# AIR PROTECTION BRANCH

## 2016 Air Quality Report

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION


Last updated: 11/1/17

# Informational Publication

This document is published annually by the Ambient Monitoring Program, in the Air Protection Branch of the Georgia Department of Natural Resources, Environmental Protection Division.

**DISCLAIMER:** Any reference to specific brand names is not an endorsement of that brand by the Georgia Environmental Protection Division.


**ENVIRONMENTAL PROTECTION DIVISION**

**Air Protection Branch**

**Ambient Monitoring Program**

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# Contents



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# Introduction

## EPD Mission

The Environmental Protection Division (EPD) protects and restores Georgia's environment. We take the lead in ensuring clean air, water, and land. With our partners, we pursue a sustainable environment that provides a foundation for a vibrant economy and healthy communities.

## Who We Are

- This report is prepared by the Ambient Monitoring Program (AMP), a program of the Air Protection Branch of the Georgia Environmental Protection Division (EPD), the State's lead environmental agency and a Division of the Georgia Department of Natural Resources.

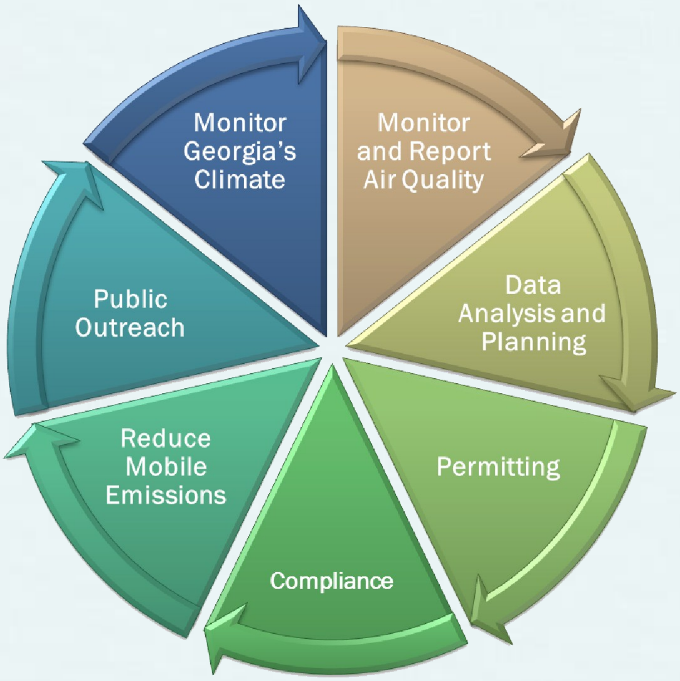
- The Air Protection Branch ensures clean air in Georgia in support of Georgia EPD's mission.

- The environmental professionals (scientists, meteorologists, and engineers) who make this report possible make sure Georgia produces air quality data that is accurate, complete, and readily available for public use.

- The Air Protection Branch has six programs:
    1. Ambient Monitoring
    2. Mobile and Area Sources
    3. Planning and Support
    4. Radioactive Materials
    5. Stationary Source Compliance
    6. Stationary Source Permitting


## What We Do

- Monitor air quality in Georgia
- Forecast air quality for public use
- Develop plans to maintain or attain the National Ambient Air Quality Standards (NAAQS)
- Issue permits to regulated stationary sources (industrial facilities and power plants)
- Enforce all state and federal requirements through compliance activities (inspections)
- Oversee required federal emission testing on cars

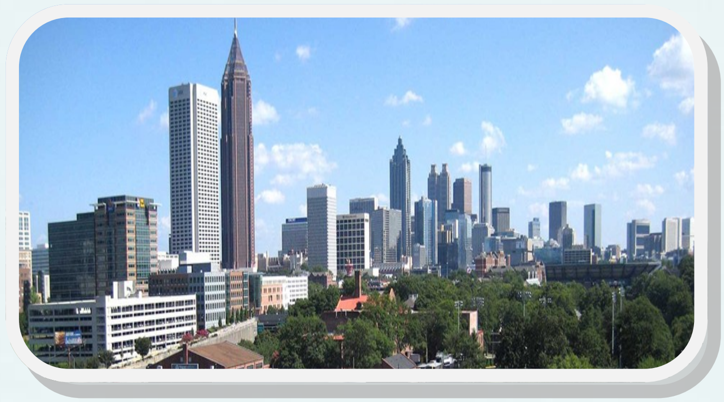


## Air Quality in Georgia: 2016

Photo courtesy of http://blog.cleanenergy.org/2010/07/09/epa-proposes-new-air-quality-rules/

The Ambient Monitoring Program of the Georgia Environmental Protection Division's Air Protection Branch has been monitoring air quality in the State of Georgia for more than forty years. During that time, the list of monitored compounds has grown to more than 200 pollutants at 42 sites in 31 counties across the state. This monitoring is performed to protect public health and environmental quality. The resulting data is used for a broad range of regulatory and research purposes, as well as to inform the public.

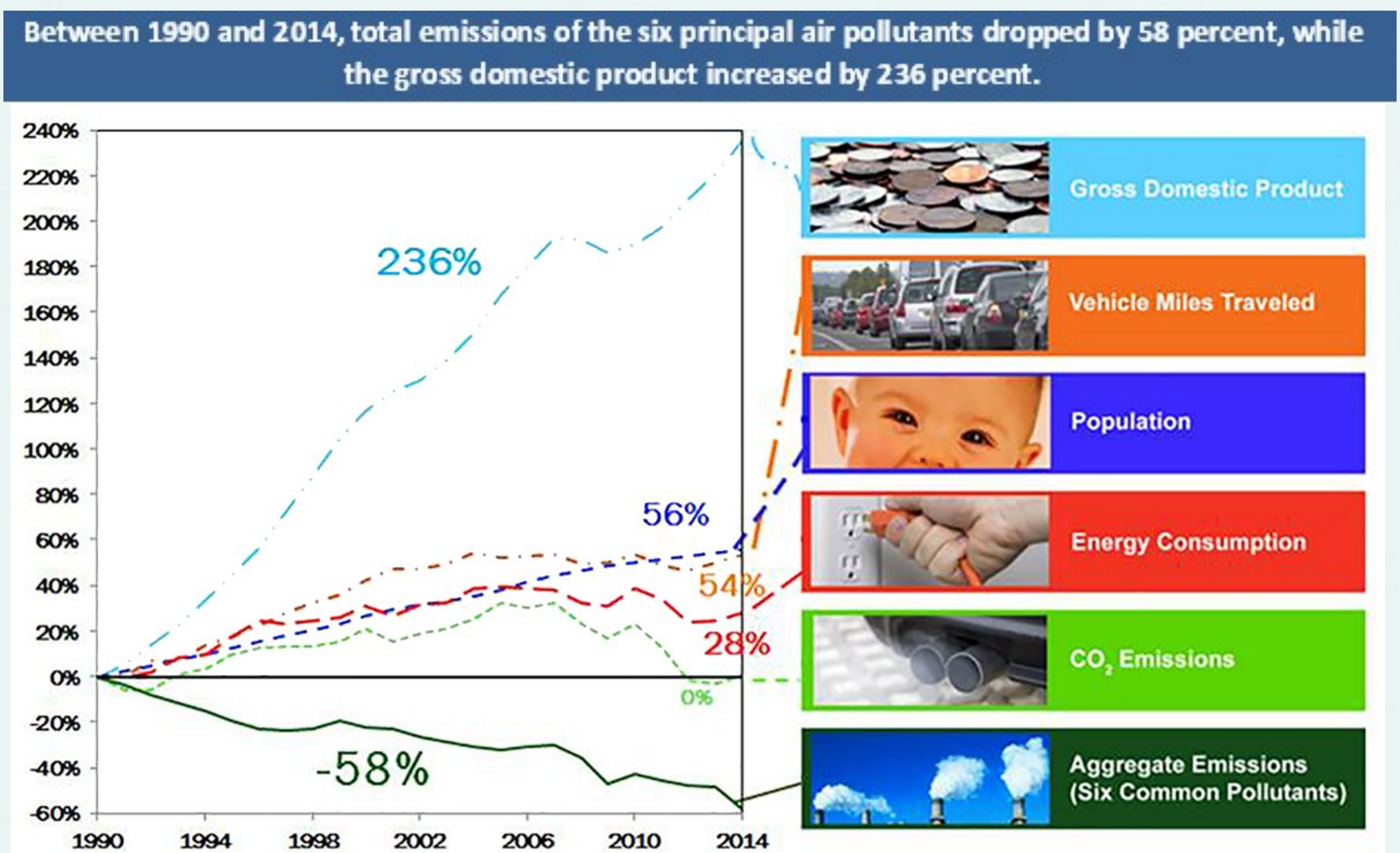
This report includes monitoring data from 2016 and shows that the air quality in Georgia has steadily improved over the last few decades.



http://www.nationsonline.org/oneworld/map/google_map_Atlanta.htm

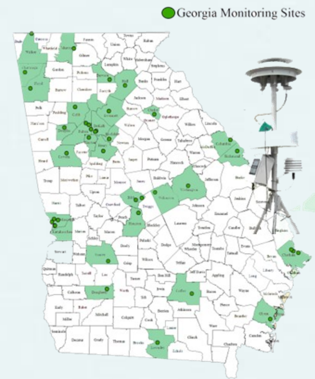
A lot has changed in 40 years of air quality monitoring.

### How are we doing as a state?



# Air Monitoring FAQs

## Where are the monitors located?




Over 100 air samplers (called monitors) are located throughout Georgia that measure for nearly 200 air pollutants. These pollutants can be gaseous such as ground-level ozone, or can be very fine particles such as particulate matter 2.5 ($PM_{2.5}$), also known as particle pollution.

## How are air samples collected?

There are two types of collection methods depending on the pollutant and the monitor:

- **Continuous** - The air pollutant is measured continuously and the data is automatically recorded at a centralized location into a database.
- **Non-Continuous** – A canister or filter is used to collect the air pollutant over a period of time (8-hr, 24-hr). A technician collects the canister or filters over a specified amount of time and takes them to an approved laboratory for analysis.

## How do we know the air quality data is accurate?

Both the continuous and non-continuous data are screened for errors by validation specialists. When the data is certified as valid, it can be reported to the public and used to compare to the National Ambient Air Quality Standards, and to previous years' data for trend information. The validated data is also used by scientists and policy makers.

- **Validated data** is used to prepare publications such as the Annual Reports and EPD's Annual Network Plan.
- **Non-Validated data** includes hourly data from continuous monitors published as the Air Quality Index (AQI) on the Georgia Air Monitoring website (http://amp.georgiaair.org) and AirNow, a national air quality database.

## What is the Air Quality Index (AQI)?

The Air Quality Index, or AQI, is a color coded indicator of what the air quality is like taking into consideration measurements of multiple pollutants including ozone, particulate matter, sulfur dioxide, nitrogen dioxide, and carbon monoxide.

| | |
|---|---|
| Good | Air quality is considered satisfactory, and air pollution poses little or no risk |
| Moderate | Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution. |
| Unhealthy for Sensitive Groups | Members of sensitive groups may experience health effects. The general public is not likely to be affected. |
| Unhealthy | Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects. |
| Very Unhealthy | Health warnings of emergency conditions. The entire population is more likely to be affected. |
| Hazardous | Health alert: everyone may experience more serious health effects |

## What is the air quality like where I am?

Real time, hourly, air quality data for your area is available on the Georgia Air Monitoring Website at http://amp.georgiaair.org. Georgia's air quality data is also uploaded to a national air quality information database called AirNow (www.airnow.gov) and available to the public in real time.

## Why don't we have monitoring everywhere?

The number of monitoring sites and their location can vary from year to year depending on the availability of long-term space allocation, regulatory needs, and funding. The cost associated with establishing and running a monitoring station is significant. It involves maintaining equipment and collecting samples to produce quality data for public use. EPD does not own land at any of its ambient air monitoring stations, we are always either a guest or a leaseholder. Each monitoring station must meet federal siting criteria set by EPA and be approved by the landowner. Before deciding to establish a new monitoring station, EPD has to consider regulatory needs, funding limitations, and finding an appropriate location where a long-term arrangement is possible. If EPD determines a change is needed, EPA has to review and approve the changes before the changes can happen.

# Air Quality FAQs

### What are National Ambient Air Quality Standards (NAAQS)?

Under the Clean Air Act, EPA is required to set National Ambient Air Quality Standards (40 CFR part 50) for air pollutants that may be harmful to public health and the environment. There are two types of National Ambient Air Quality Standards. ***Primary standards*** protect public health, including protecting populations considered "sensitive," such as children, the elderly, and asthmatics. ***Secondary standards*** protect public welfare, including protection against damage to animals, crops, vegetation, and buildings, and decreased visibility in national parks and protected areas.

The EPA has set National Ambient Air Quality Standards for six pollutants, called "criteria" air pollutants. These standards are periodically reviewed, as required by the Clean Air Act, and revised, as appropriate.

### What is 'attainment?'

With the criteria pollutants, a geographic area that meets or does better than the national ambient air quality standard (NAAQS) is called an ***attainment area***. An area that does not meet this standard is called a ***nonattainment area***. (www.epa.gov)

### Where do we get emission inventory?

The National Emissions Inventory (NEI) is a detailed estimate of air emissions that include criteria pollutants and hazardous air pollutants. It is released every three years and it is based on data provided by the State, Local and Tribal Agencies.

Examples of Air Monitors in Georgia



# Communication and Partnerships

# Georgia EPD's Ambient Air Monitoring Website

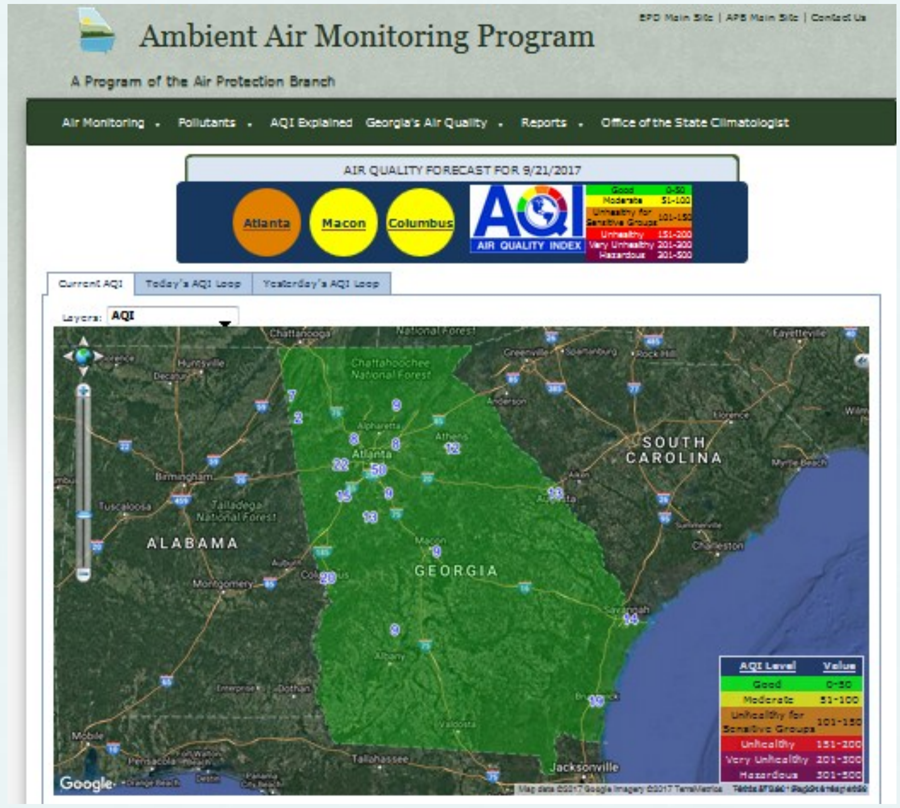
**Air Quality Forecast**

**Site Information**

**Links to Annual Reports**

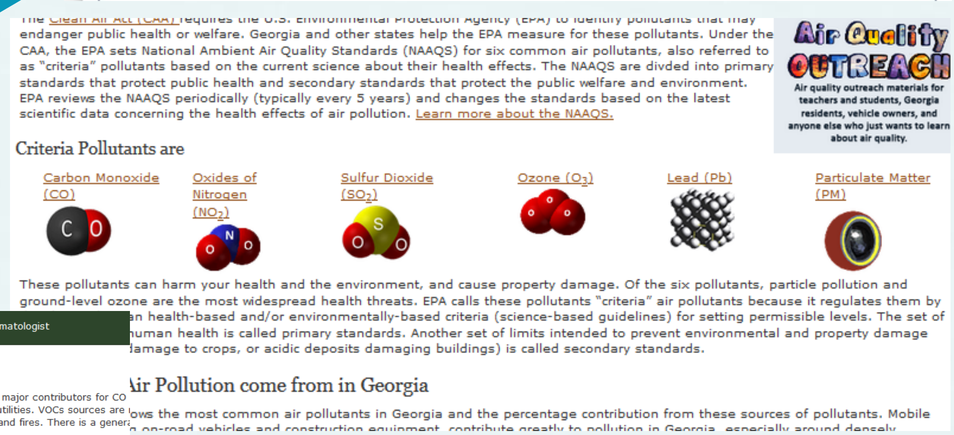
**Trends in Georgia's Air**

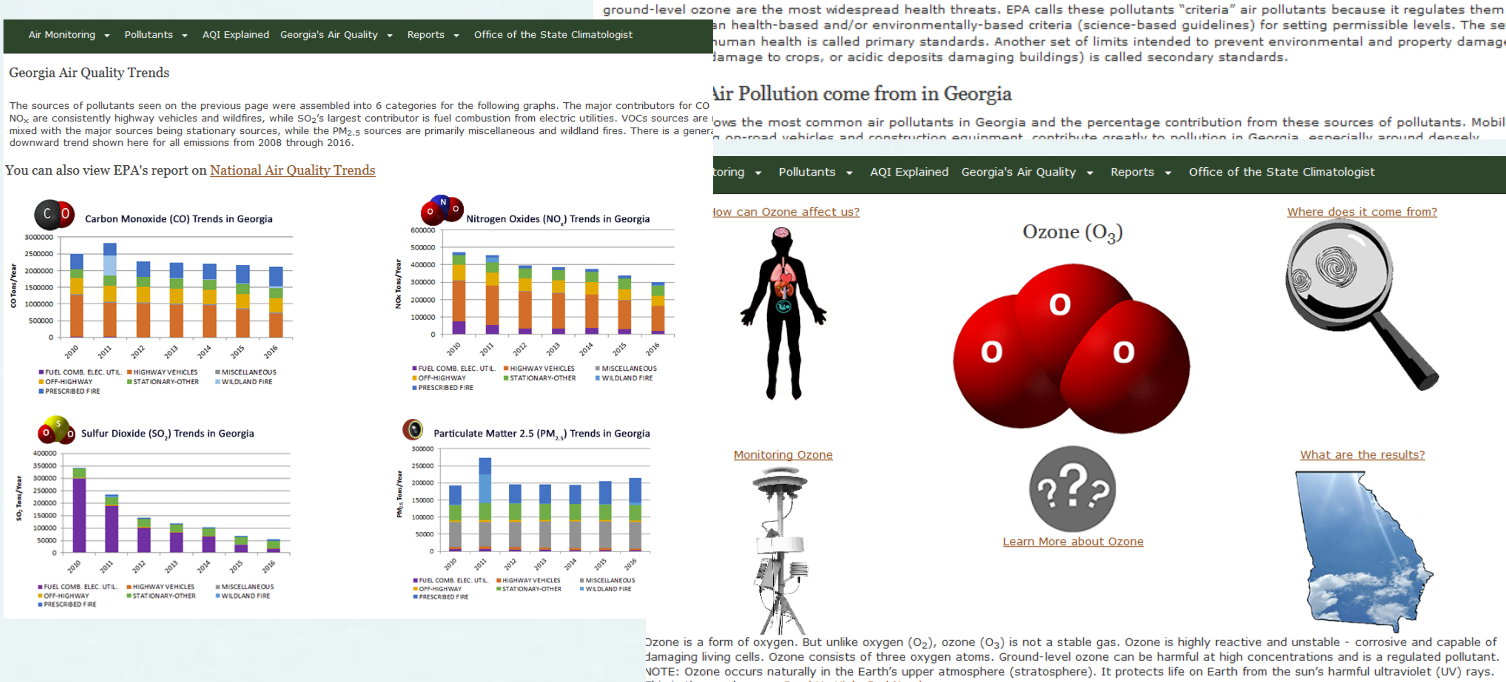
**Pollutant Information**




**And So Much More…**

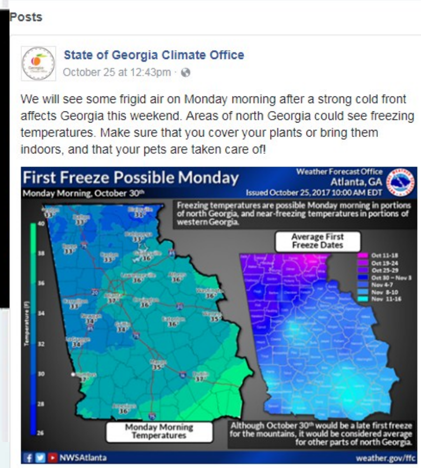
Visit us at http//amp.georgiaair.org/



# Social Media

# Georgia Climate Office


https://www.facebook.com/georgiaclimate/

https://twitter.com/gaclimateoffice

## Reaching out into the Community



Educating school children and incorporating air quality information into the classroom-learning environment is an outreach strategy for the GA EPD Ambient Monitoring Program (AMP). AMP staff visit Georgia classrooms to discuss air quality, forecasting, and monitoring. Each program presented by the AMP is designed to supplement grade-specific curricula. Learning opportunities include meteorological lessons and forecasting techniques, among other relevant topics.

In many situations, these lessons involve hands-on activities and mini-field trips to the monitoring sites. High School students simulate forecasting conditions and use scientific methods to create their own forecasts. AMP staff also participate in Career Days at both elementary and high schools to promote environmental and meteorological careers.

AMP hosts an annual Air Quality Seminar and Air Monitoring Station fieldtrip for college interns in the Centers for Disease Control and Prevention's (CDC) Environmental Health Summer Intern Program, thereby reaching top college students from all over the country.

Air Quality specialists from Korea come to learn about GA EPD's Ambient Monitoring Program.


GA EPD Ambient Air Monitoring and air quality forecasting highlighted on WABE 90.1 radio.

# Voluntary Emissions Reductions Programs– GA EPD Partners

## Encouraging fewer vehicles on the road...

GEORGIACOMMUTEOPTIONS

Get More by Driving Less

http://gacommuteoptions.com/

- Sponsored by the Atlanta Regional Commission (ARC).
- Distributes daily ozone forecasts (as well as $PM_{2.5}$ forecasts produced by EPD and Georgia Tech) during the ozone season to enable citizens in the sensitive group category, as well as industries, to alter activities on days that are forecasted to have high ozone levels.
- Forecasts for the Atlanta, Macon and Columbus metropolitan areas.
- Rewards commuters for trying an alternative to driving alone to and from work (e.g. carpooling or trying transit).

GaDER

Georgia Diesel Emissions Reduction Program

*Taking a bite out of Georgia's diesel emissions* SM

With a focus on reducing all sources of diesel emissions in Georgia, the GADER program not only encompasses the Georgia School Bus Retrofit initiative, but also assists with funding, and education assistance and outreach for voluntary measures such as idling reduction, Truck Stop Electrification, the use of cleaner fuels, and diesel emissions controls to rail yards, long haul and delivery truck fleets, construction equipment, and more.

## Helping schools afford cleaner school buses...


- Older diesel school buses are replaced early or fitted with an emissions control device to reduce emissions of oxides of nitrogen ($NO_X$).
- Selective catalytic reduction (SCR) is an emissions reduction technology used in diesel engines to convert $NO_X$ pollution into harmless atmospheric nitrogen and water. The technology is enhanced when the engines run on low sulfur diesel fuel, the dominant fuel today.
- Diesel powered commercial trucks can add particulate trap filters to capture particulate matter pollution exhausted from their engines.
- For information about the Georgia Diesel Emissions Reduction Program, go to http://www.gaderprogram.org/html/Retrofit.html.

## Encouraging the use of alternative fuels...

## Helping promote Truck Stop Electrification Stations...

- Diesel powered commercial trucks can produce emissions of oxides of nitrogen ($NO_X$) due to idling. Truck drivers are typically required to rest 8 hours for every 10 hours of travel time and their diesel engines are often idled during rest times to power air conditioning and heating systems.
- Truck stop electrification allows truck drivers to run their air conditioning, heating, electronic devices without having to run their diesel powered engines.
- Cool and warm air can be pumped into the trucks via a hose hookup at the electrified truck stops as well.

## Working to reduce locomotive  and rail yard emissions...


NORFOLK SOUTHERN

26 LOCOMOTIVES CONVERTED INTO 14 MOTHER-SLUGS SETS

3 CONVERSIONS

CSX TRANSPORTATION

6 CONVERSIONS

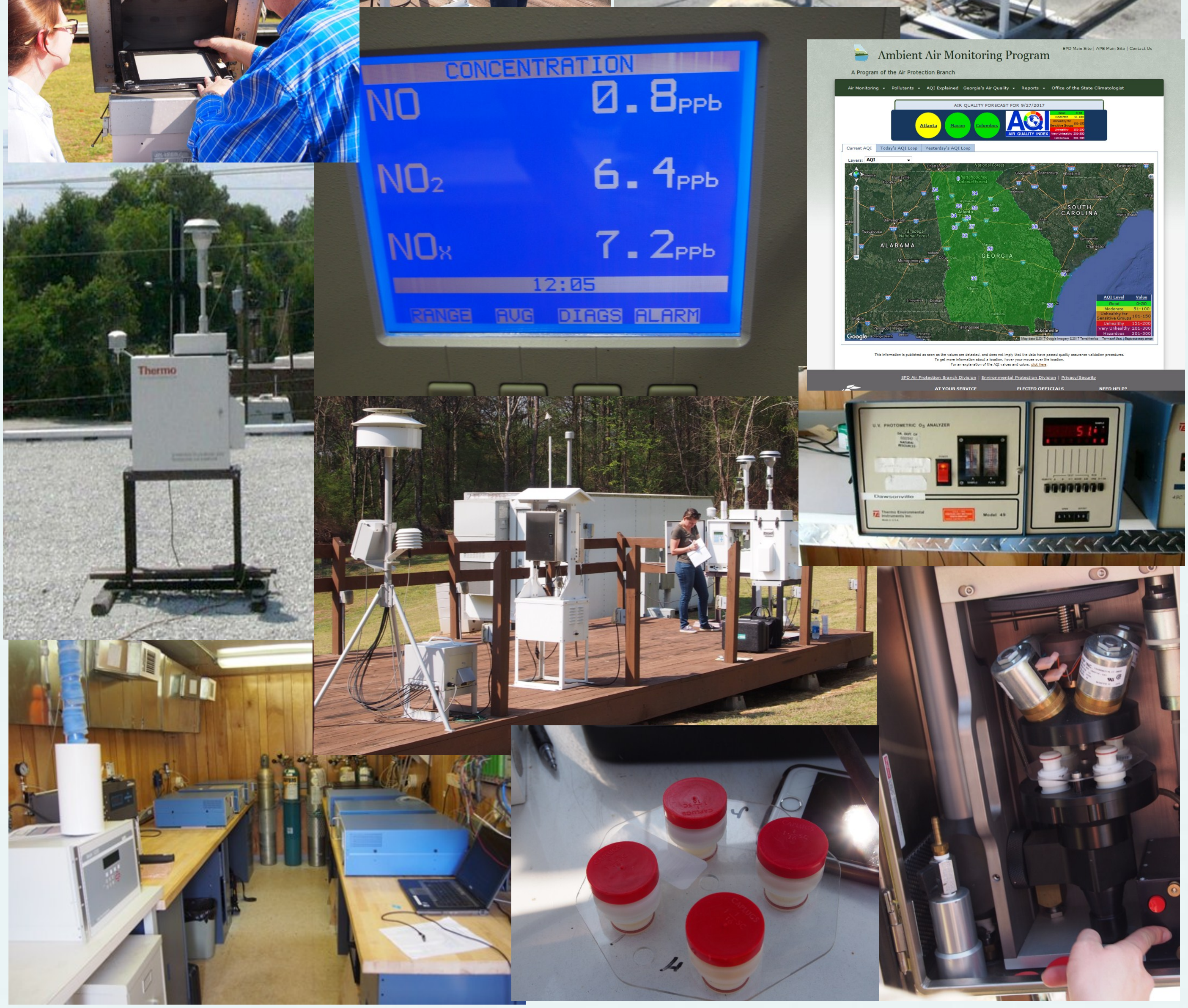
GaDER Georgia Diesel Emissions Reduction Program

ARGOS

1 LOCOMOTIVE CONVERTED INTO A TIER-4 GENSET


- Locomotives can be retrofitted with cleaner engines and technology that helps improve air quality.
- Smaller, more efficient modular diesel engines reduce emissions.
- New engines, known as "genset" and  Tier 4 engines, utilize two or more smaller engines that can combine to equal the strength of the older engines.
- Automatic engine start/stop technology reduces idling.
- In-cylinder strategies include better fuel injection timing, and better rings and oil separators.
- 'Mother' locomotives and 'Slug' sets operate in tandem. The Mother's excess electrical power is used to drive the Slug's traction motors, saving fuel and reducing air pollution.
- 22 locomotives have been converted to Mother-Slug sets in Georgia, with several more sets to be completed by the end of 2017.
- Electric plugin stations allow the diesel engine to be shut down when temperatures drop below freezing and still keep the cooling water warm.

# Air Quality in Georgia



# Pollutants of Concern and Their Sources in Georgia

The list below shows the most common air pollutants in Georgia and their source by percentage. Mobile sources, including on-road vehicles, construction equipment and aircraft, contribute greatly to pollution in Georgia, especially around densely populated cities like in the Atlanta Metro area.

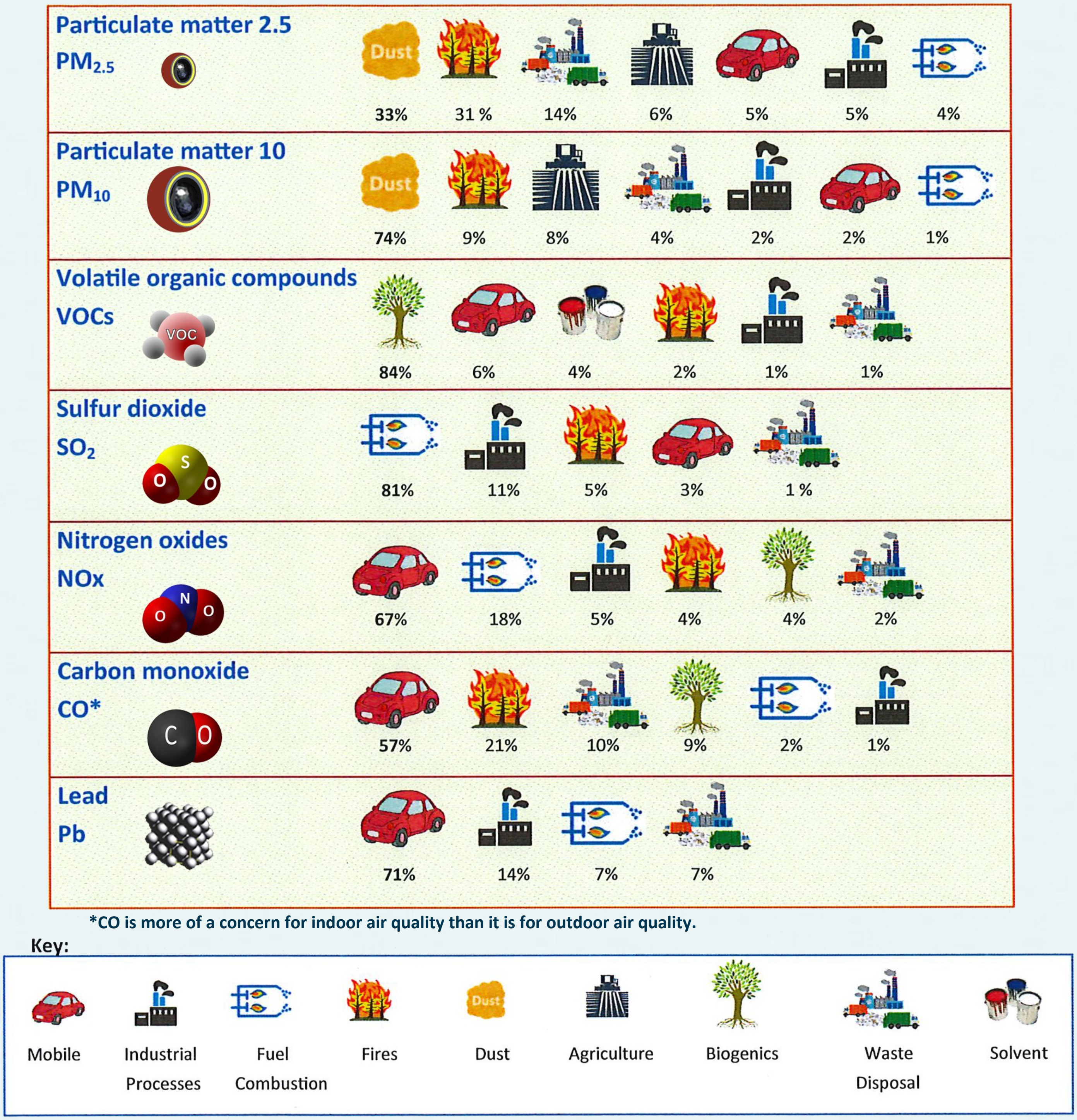


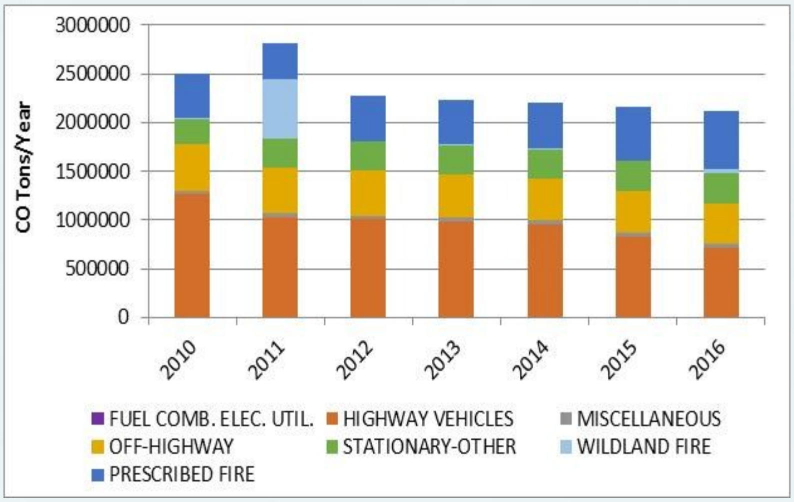

Figure 1: Pollutants of Concern and Their Sources in Georgia

Source: 2014 National Emissions Inventory

# Emissions Trends in Georgia

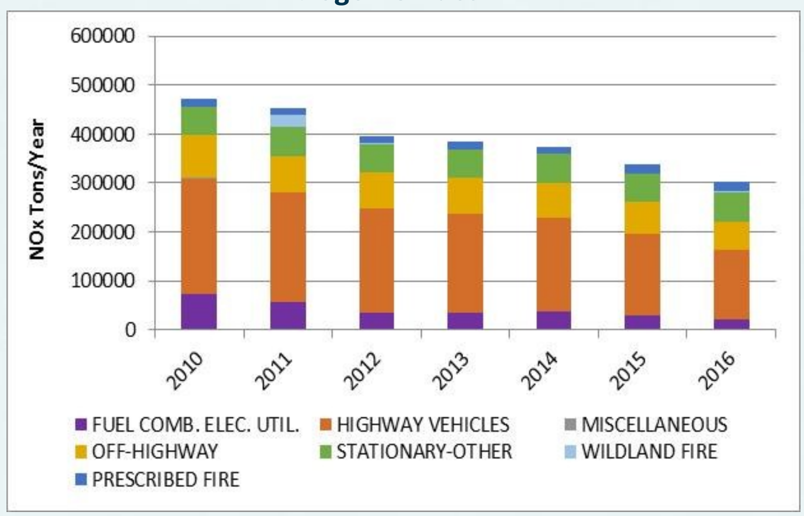
The sources of pollutants seen on the previous page were assembled into seven categories for the following graphs. The major contributors for CO and $NO_x$ are highway vehicles, while the largest contributors of $SO_2$ are electric utilities. Wildland and prescribed fires can have a large impact on $PM_{2.5}$ emissions, and VOCs come from a variety of stationary sources. There is a downward trend shown here for all emissions from 2008 through 2016. In 2011, there was a wildfire in the Okefenokee Swamp area that showed an uptick in the data for that year.

## Carbon Monoxide

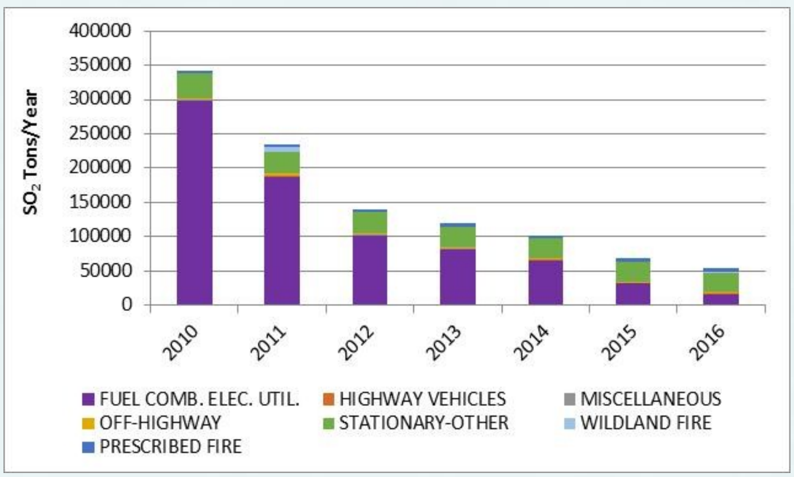



Georgia's air quality is improving...

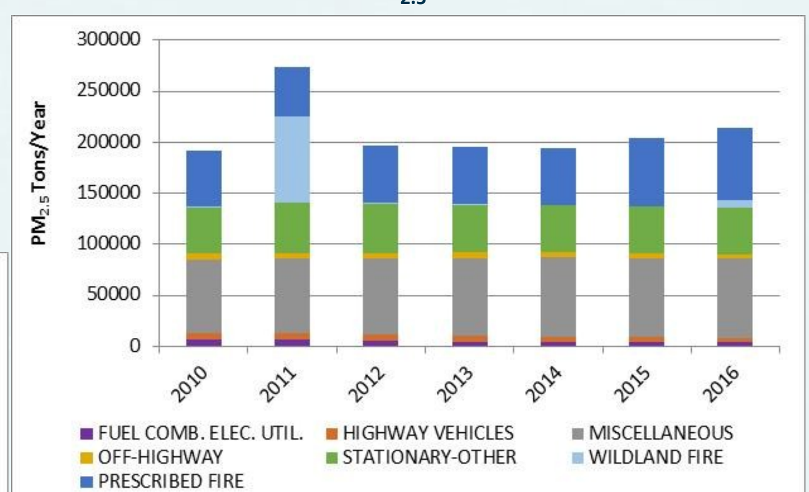
## Nitrogen Oxides




## Sulfur Dioxide




## $PM_{2.5}$




## VOCs

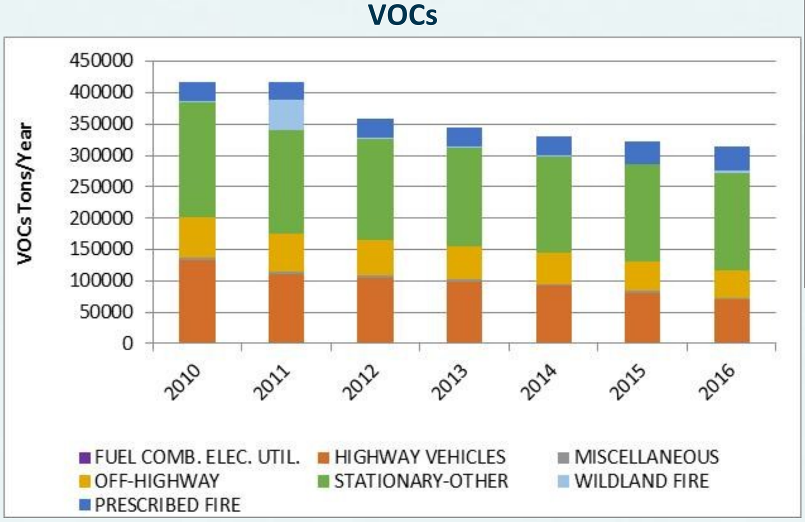



Figure 2: Emissions Trends in Georgia

# Georgia’s Ambient Air Monitoring Sites

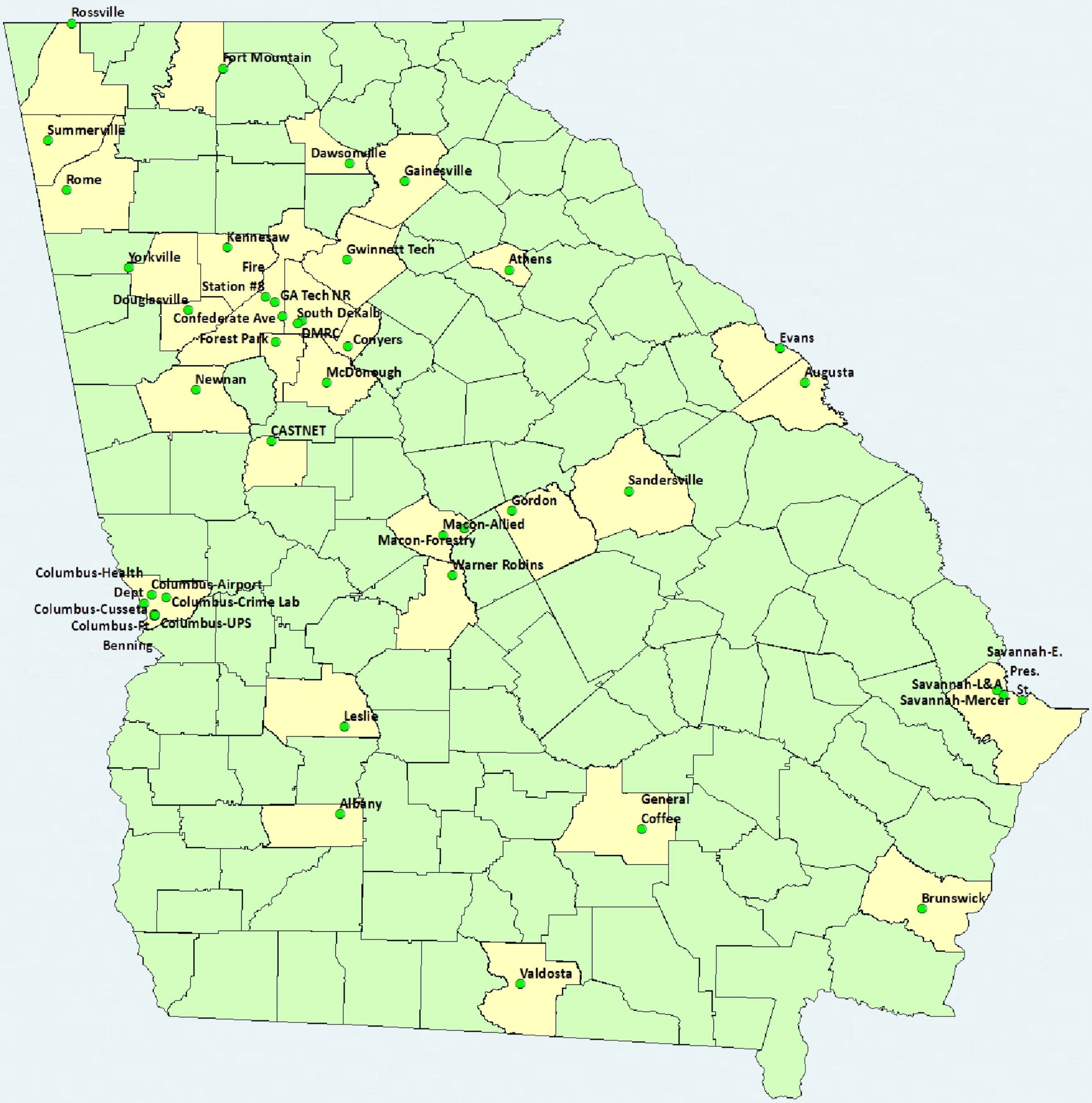


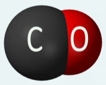

Figure 3. Georgia’s ambient air monitoring sites

For more detailed site information, see page 71.

## Criteria Pollutants (six most common regulated pollutants)

The Clean Air Act (CAA) requires the U.S. Environmental Protection Agency (EPA) to identify pollutants that may endanger public health or welfare. Under the CAA, the EPA sets **National Ambient Air Quality Standards (NAAQS)** for six common air pollutants, also referred to as “criteria” pollutants based on the current science regarding their known health effects. The NAAQS are divided into primary standards that protect public health and secondary standards that protect the public welfare and environment. EPA reviews the NAAQS periodically, based on new findings about the health effects of air pollution. For more information about the NAAQS, please refer to EPA’s website (https://www.epa.gov/criteria-air-pollutants/naaqs-table).

### NAAQS have been established for six common air pollutants called criteria pollutants:

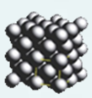



**Carbon Monoxide (CO)**

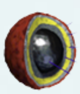

**Oxides of Nitrogen ($NO_2$)**


**Sulfur Dioxide ($SO_2$)**


**Ozone ($O_3$)**



**Lead (Pb)**



**Particulate Matter (PM)**

We monitor for these criteria pollutants and much more. Our monitoring network takes the guess work out of knowing what pollutants are in the air you breathe.

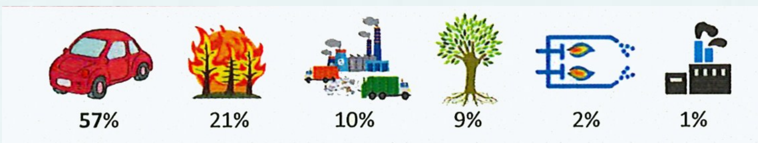
# Carbon Monoxide (CO)

## What is it?

- Carbon Monoxide is an odorless, colorless, and poisonous gas that is a by-product of incomplete burning. Learn more: https://www.epa.gov/co-pollution

## Where does it come from?

- Carbon and oxygen can combine to form two different gases. When combustion of carbon is complete, in the presence of plenty of air, the product is mainly carbon dioxide ($CO_2$). Sources of carbon include; coal, coke, charcoal. When combustion of carbon is incomplete, *i.e.* there is a limited supply of air, only half as much oxygen adds to the carbon, and instead you form carbon monoxide (CO).
- In Georgia, 57% of the carbon monoxide comes from mobile sources including cars, construction equipment, aircraft, locomotives, and on the coast commercial marine vessels.




See page 16 for icon key.

## Health Impacts

- Increased risk of lower blood flow, anemia, and reduced heart activity.
- Sensitive groups include fetuses, young infants, pregnant women, elderly people, and individuals with anemia or emphysema.

## Georgia Monitoring Information for CO

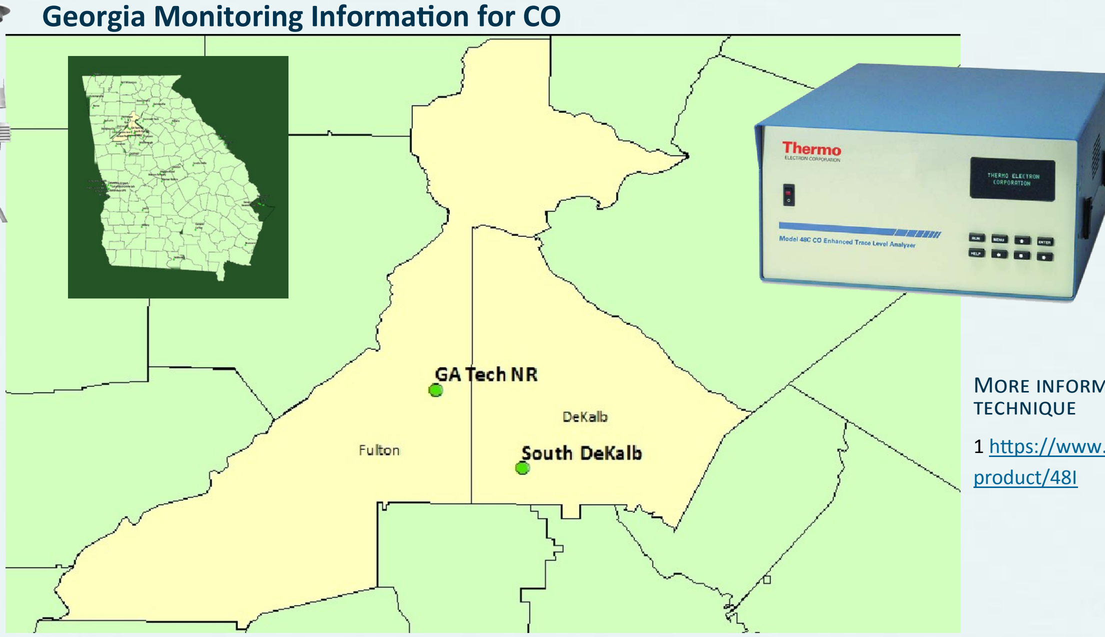



Figure 4. Georgia carbon monoxide monitoring sites

### Measurement Technique

Measured continuously with infrared light[1]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

1 https://www.thermofisher.com/order/catalog/product/48I

# National Ambient Air Quality Standards for Carbon Monoxide

**Primary NAAQS:** 8-hour average not to exceed 9 ppm more than once per year

1-hour average not to exceed 35 ppm more than once per year

**Secondary NAAQS:** None

## Attainment Designation

All of Georgia is in attainment of both the 8-hour and 1-hour standards for carbon monoxide. Figure 5 and Figure 6 show how Georgia's CO compares to the two NAAQS.

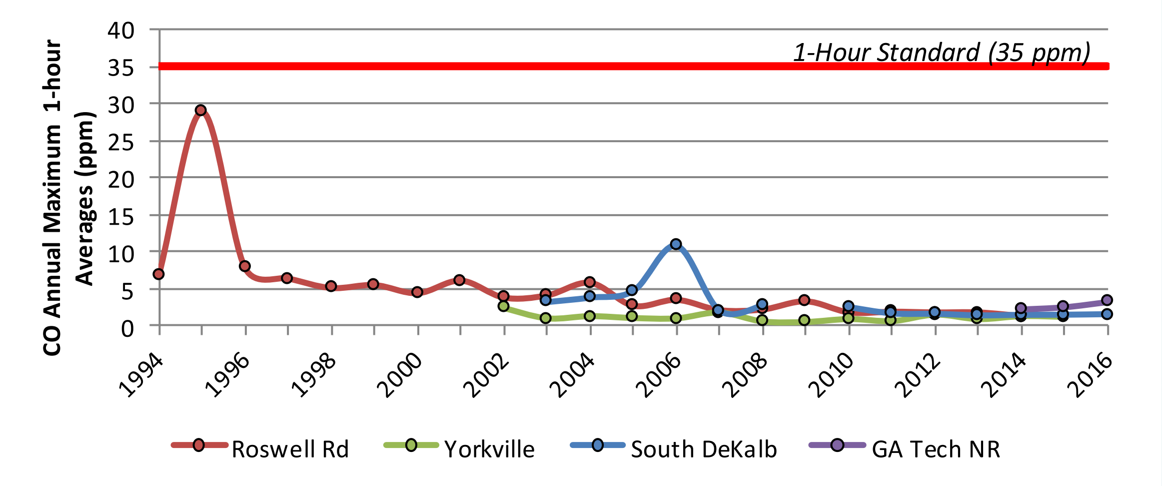



Figure 5. Carbon monoxide annual maximum 1-hour average compared to the 1-hour standard

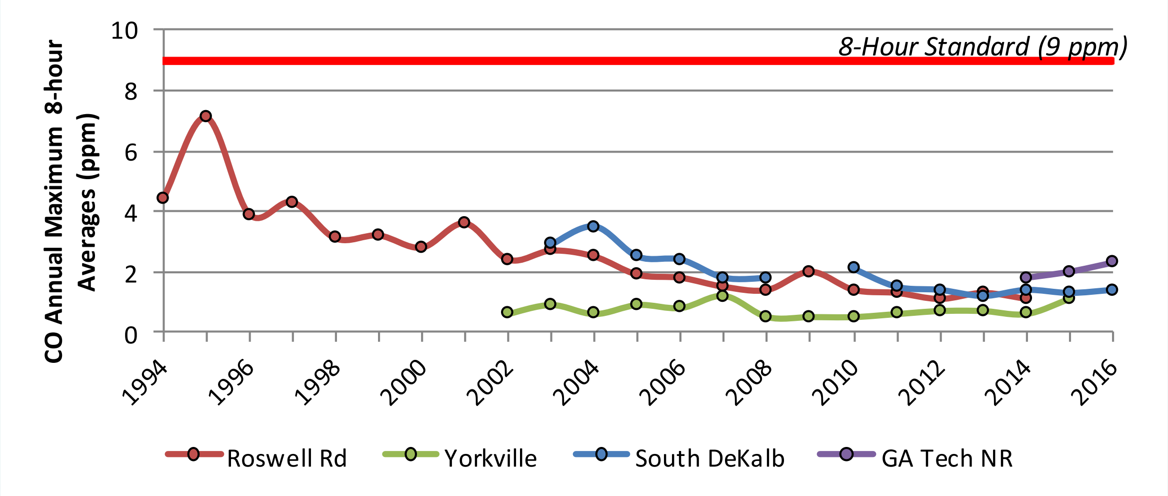
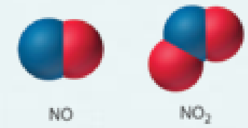



Figure 6. Carbon monoxide annual 8-hour average compared to the 8-hour standard

# Oxides of Nitrogen ($NO$, $NO_2$, $NO_x$ and $NO_Y$)

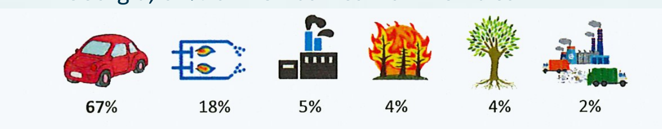



## What is it?

- Oxides of nitrogen are a mixture of gases that are composed of nitrogen and oxygen and primarily produced during combustion. Learn more: https://www.epa.gov/no2-pollution

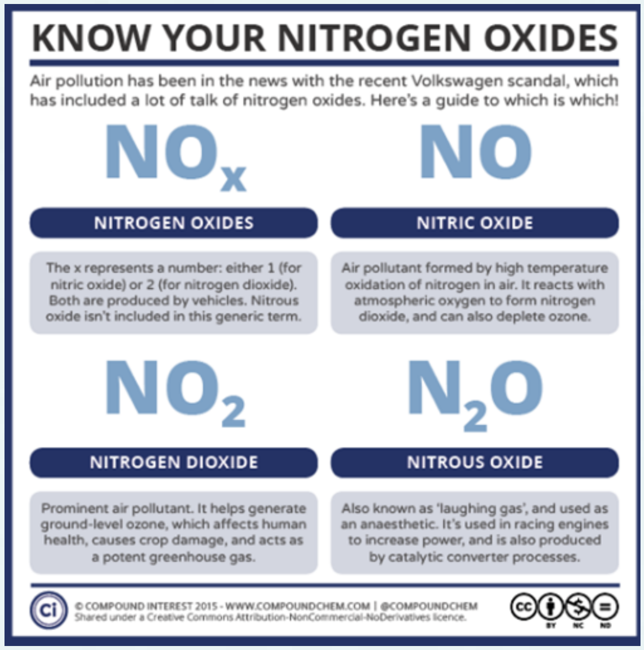
## Where does it come from?

- Nitrogen oxides ($NO_x$) are usually products of combustion from mobile sources such as vehicle engines and construction equipment engines. They also come from large industrial boilers, turbines, and kilns, as well as fires. In Georgia, 67% of NOx comes from vehicles.




See page 16 for icon key.

- $NO_2$ is formed from the oxidation of nitric oxide (NO).
- $NO_Y$ consists of all atmospheric reactive nitrogen oxide compounds.



KNOW YOUR NITROGEN OXIDES

Air pollution has been in the news with the recent Volkswagen scandal, which has included a lot of talk of nitrogen oxides. Here's a guide to which is which!

$NO_x$ — NITROGEN OXIDES

The x represents a number: either 1 (for nitric oxide) or 2 (for nitrogen dioxide). Both are produced by vehicles. Nitrous oxide isn't included in this generic term.

NO — NITRIC OXIDE

Air pollutant formed by high temperature oxidation of nitrogen in air. It reacts with atmospheric oxygen to form nitrogen dioxide, and can also deplete ozone.

$NO_2$ — NITROGEN DIOXIDE

Prominent air pollutant. It helps generate ground-level ozone, which affects human health, causes crop damage, and acts as a potent greenhouse gas.

$N_2O$ — NITROUS OXIDE

Also known as 'laughing gas', and used as an anaesthetic. It's used in racing engines to increase power, and is also produced by catalytic converter processes.

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Source: http://www.compoundchem.com/2015/09/30/vehicle-emissions/

## Health Impacts

- Increases risk of respiratory infections, respiratory diseases and asthma

## Georgia Monitoring Information for Oxides of Nitrogen

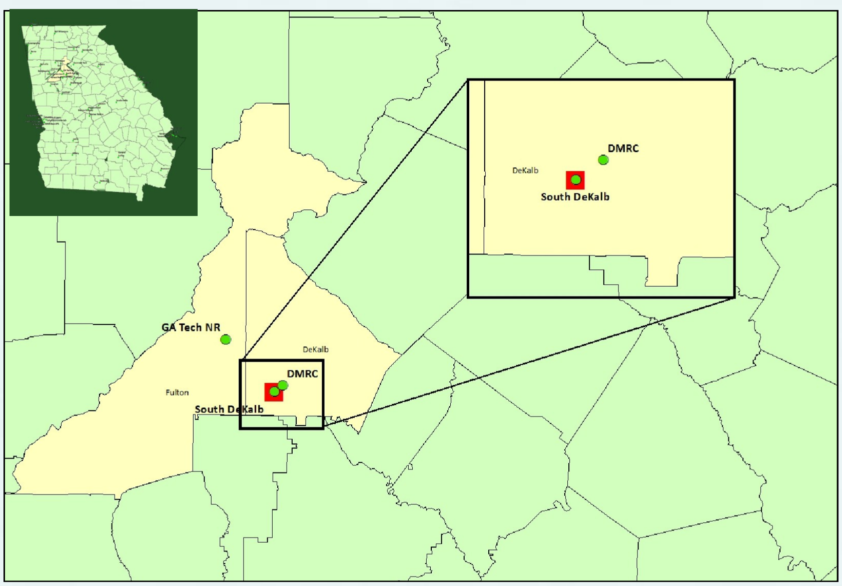



Figure 7. Georgia's $NO/NO_2/NO_x$ monitoring sites (green circles) and $NO_Y$ site (red square)

### Measurement Technique

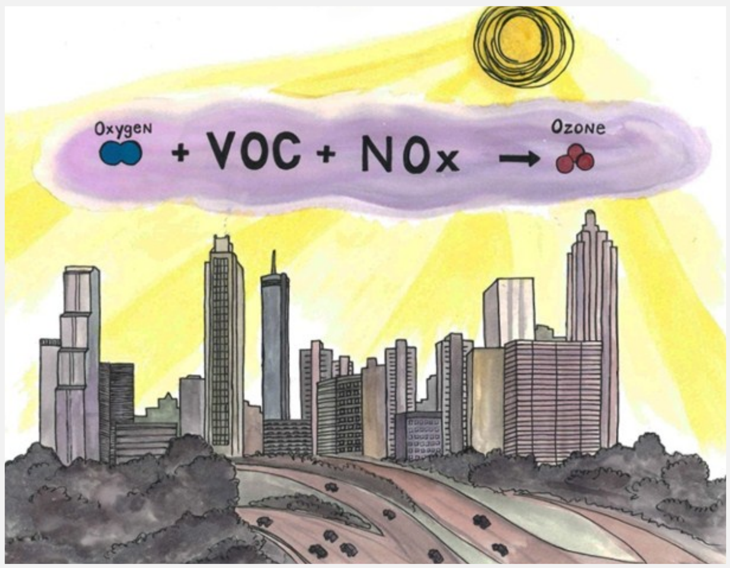
Measured continuously with chemiluminescent method[2]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

2 https://www.thermofisher.com/order/catalog/product/42I

## $NO_x$ Daily Cycle

$NO_x$ reacts with volatile organic compounds in the presence of sunlight to form ground level ozone ($O_3$) pollution which causes $NO_x$ levels to drop in the middle of a sunny day and increase at night on a daily basis.




(Courtesy of Jamie Smith)

Because this pattern typically reoccurs each day within a 24-hour period, this is known as a diurnal cycle.

The following graph shows a comparison of the daily average of hourly $NO_2$ data at the near-road sites, DMRC and Georgia Tech, compared to the South DeKalb $NO_2$ site.

- The two near-road sites (shown in green and red) display the highest daily averages.
- The cyclical diurnal pattern of lower concentrations mid-day and higher concentrations in evening is shown below.

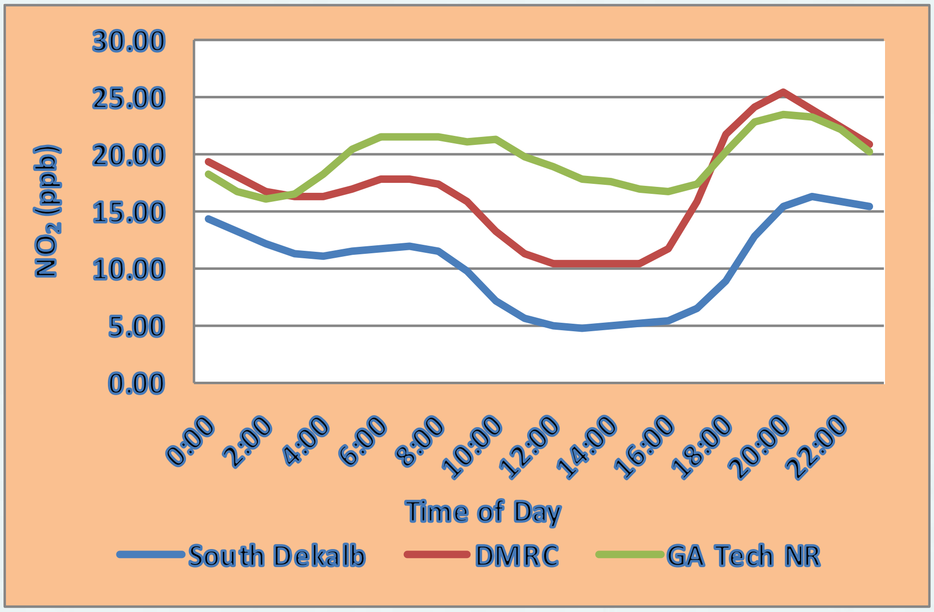


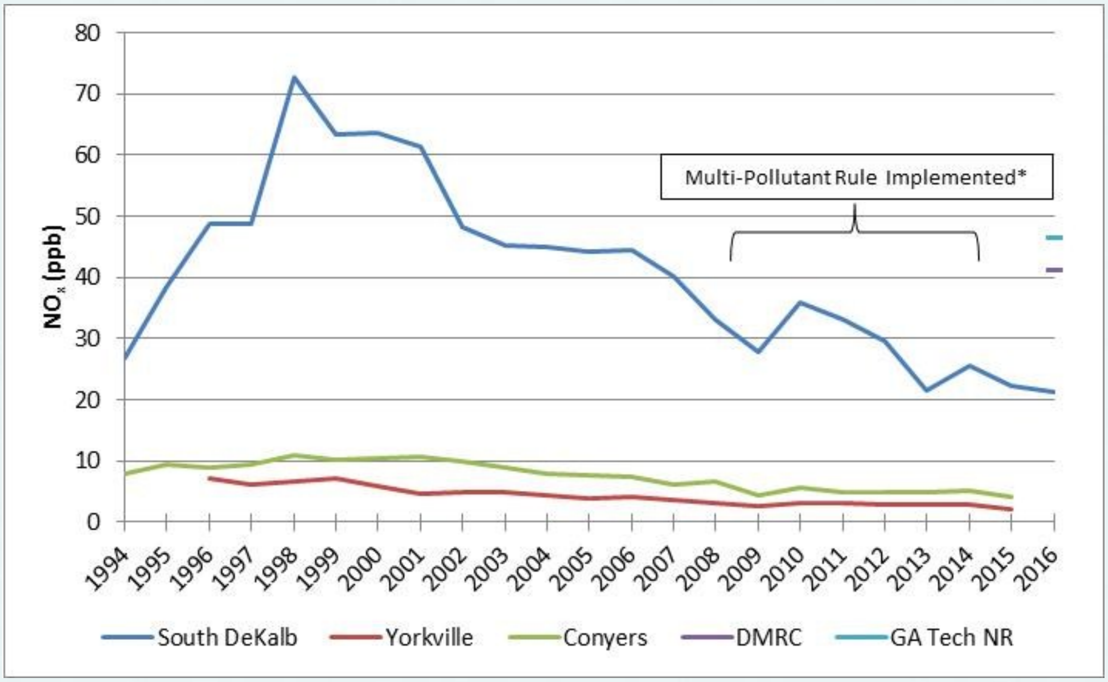

Figure 8. Diurnal Pattern of $NO_2$

## Reducing $NO_x$ Emissions in Georgia

Ozone formation in the southeastern United States is driven by emissions of nitrogen oxides ($NO_x$) in large urban areas with high vehicle traffic. Therefore, Georgia has focused efforts on reducing the emissions of $NO_x$, particularly in the Atlanta ozone nonattainment area.

- Our vehicle emissions inspection program, also known as Georgia's Clean Air Force, which covers the counties of Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, and Rockdale, helps reduce $NO_x$, the main precursor to ozone.


- A series of Georgia air quality rules were implemented in 1999 through 2014 specifically targeting $NO_x$ emissions from combustion sources such as industrial boilers and electric steam generating units at power plants, especially large coal-fired units. Figure 9 shows how $NO_X$ pollution in Georgia declined as $NO_x$ controls were implemented at large stationary sources from 1999 through 2014. The Georgia multi-pollutant rule, implemented 2008-2014, required additional $NO_x$ reductions at power plants in addition to reductions in mercury and sulfur dioxide emissions. During the same time, national manufacturing standards required greater efficiency and performance from engines in vehicles, construction equipment, and generators which also helped reduce $NO_X$ emissions nationwide, including Georgia.




*Multi-pollutant Rule is discussed on page 27.

Figure 9. Implementation of $NO_x$ Controls

## National Ambient Air Quality Standards for Nitrogen Dioxide

| | |
|---|---|
| **Primary NAAQS:** | **Annual mean must not exceed 53 ppb**<br>**3-year average of the 98th percentile of daily maximum one-hour averages must not exceed 100 ppb** |
| **Secondary NAAQS:** | **Annual mean must not exceed 53 ppb** |

### Attainment Designation

- $NO_2$ monitoring is required in urban areas with populations exceeding one million. The Atlanta-Sandy Springs-Roswell Metropolitan Statistical Area (MSA) is the only urban area in Georgia required to perform $NO_2$ monitoring.
- Figure 10 shows Georgia's annual average $NO_2$ concentrations from 2000 to 2016. Annual average concentrations are well below the standard of 53 ppb.
- EPD operates two near-road monitoring sites (Georgia Tech and DMRC) to study the effects of traffic pollution.
- Figure 11 indicates that Georgia's 1-hour design values are well below the 100 ppb national standard.

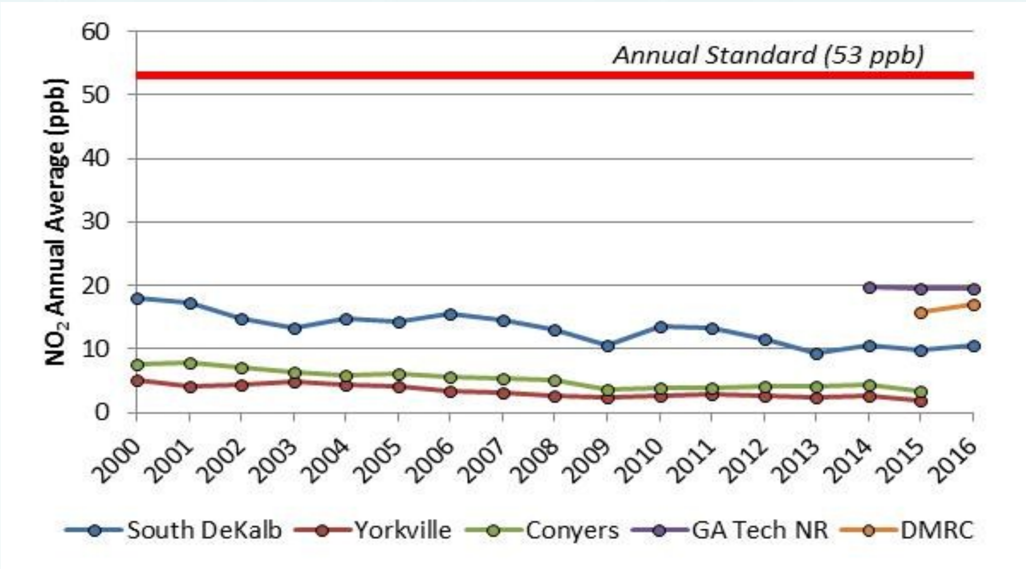



Figure 10. Nitrogen dioxide annual averages compared to the annual standard

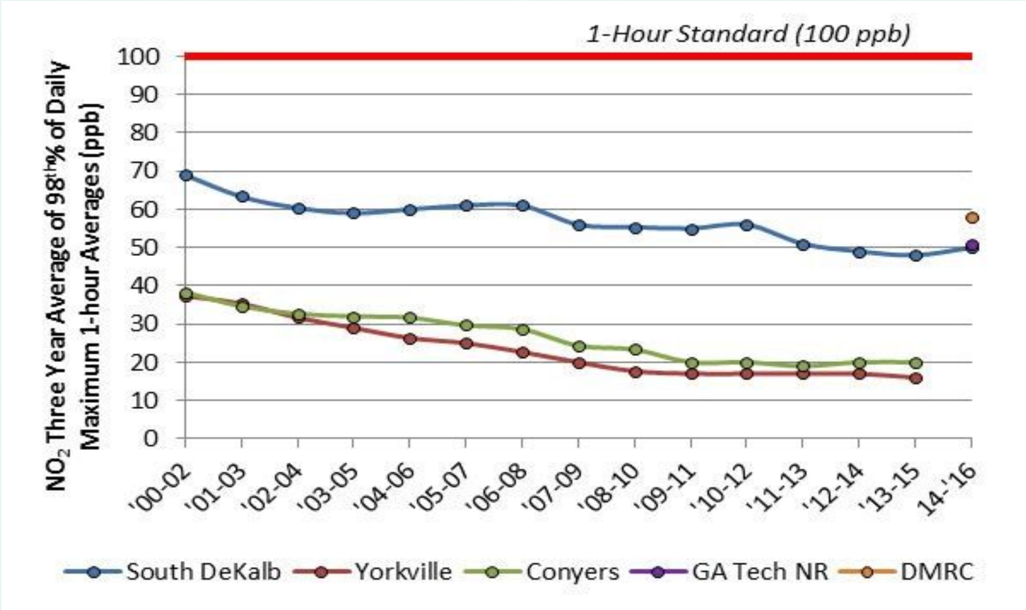
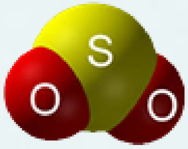



Figure 11. Nitrogen dioxide 1-hour design values compared to the 1-hour standard

# Sulfur Dioxide ($SO_2$)




## What is it?

- Sulfur dioxide ($SO_2$) is a colorless reactive gas that is formed by burning sulfur-containing material, such as coal or diesel fuel, or by processing sulfur-containing clays. Learn more: https://www.epa.gov/so2-pollution

## Where does it come from?

- 81% of $SO_2$ emissions in Georgia come from electric generation and large industrial boilers.


See page 16 for icon key.

- $SO_2$ can be oxidized in the atmosphere into sulfuric acid, and form acid rain.
- Sulfur is oxidized to form $SO_2$ during combustion. $SO_2$ then can react with other pollutants to form aerosols, which are solid or liquid particles in a gas. $SO_2$ can also form sulfate particles, that contribute to the formation of fine particulate matter ($PM_{2.5}$).
- In liquid form, $SO_2$ may be found in clouds, fog, rain, aerosol particles, and in surface liquid films on these particles.

## Environmental Impacts

Both $SO_2$ and $NO_2$ can form acid rain that lead to acidic deposition[3].

## Health Impacts

- $SO_2$ can impair respiratory function, increase respiratory disease, and reduce lung's ability to clear foreign particles especially in sensitive groups like children, the elderly, and individuals with asthma, hyperactive airways, and cardiovascular disease.
- Short-term peak exposures can cause significant constriction of air passages in sensitive asthmatics, wheezing, shortness of breath, and coughing in these sensitive groups, and affect ability to perform exercise.

## Georgia Monitoring Information for Sulfur Dioxide ($SO_2$)

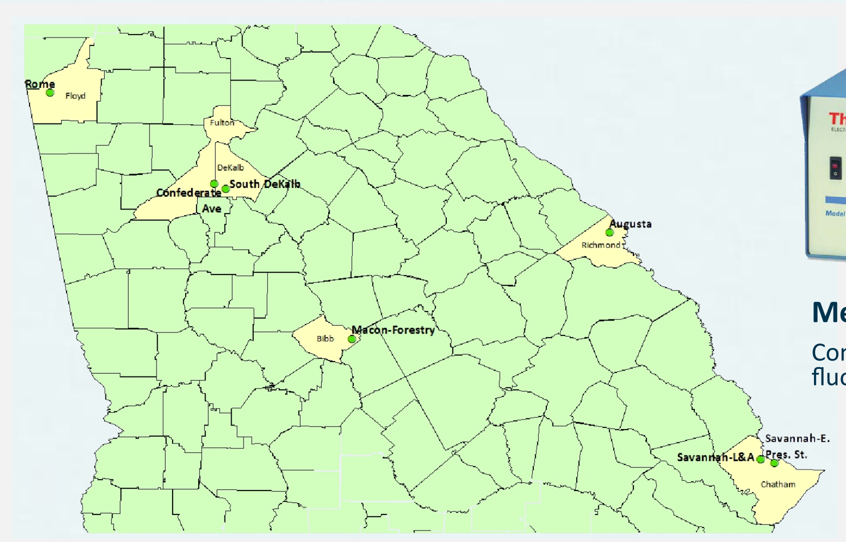



Figure 12. Georgia's sulfur dioxide monitoring sites


### Measurement Technique

Continuous ultraviolet fluorescence[4]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

[4] https://www.thermofisher.com/order/catalog/product/43I

[3] Acid deposition causes damage to forests, man-made structures, and streams and lakes, which can be deadly for aquatic wildlife.

# Reducing $SO_2$ in Georgia

## Georgia's Multi-Pollutant Rule

- In 2007, Georgia implemented State Rule 391-3-1-.02(2)(sss), which affects the 13-county Atlanta nonattainment area plus surrounding counties.
- This multi-pollutant control measure for electric steam generating units at electric utilities required coal fired power plants to install controls to reduce three criteria pollutants, PM, $NO_x$, and $SO_2$, and had rolling start dates between 2008 and 2014.
- The controls are called Selective Catalytic Reduction (SCR) for $NO_x$ and Flue Gas Desulfurization (FGD) for $SO_2$ and PM.
- Figure 13 shows the decrease in $SO_2$ concentrations as these controls have been implemented across the state.

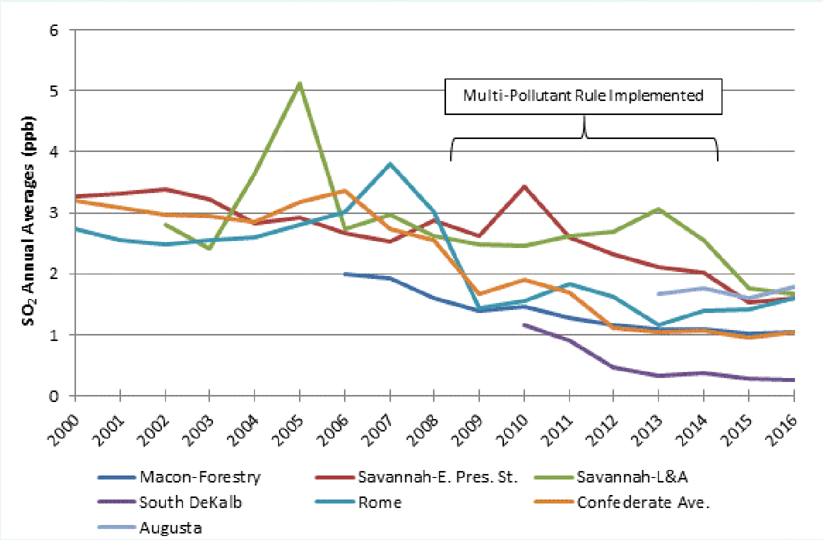



Figure 13. Implementation of $SO_2$ Controls

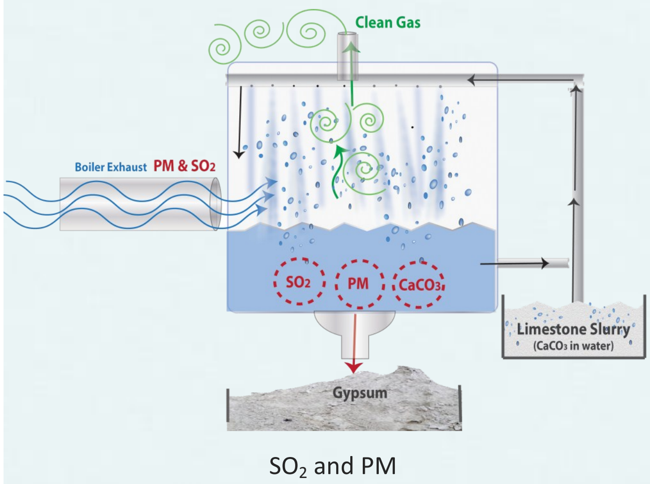



Figure 14. Schematic design of the absorber of an FGD

Statewide $SO_2$ Concentration Comparison from 2005 to 2014

- Figure 15 compares the concentrations of sulfur dioxide from 2005-2007 and 2011-2014 in Georgia on a scale of 0 to 1 in Dobson units (DU)[5].
- These maps were created by NASA using satellite data and depict multi-year averages of sulfur dioxide concentrations over the eastern United States.
- According to analyses of satellite data, in the eastern U.S., levels of sulfur dioxide have dropped by about 80 percent between 2005 and 2014.

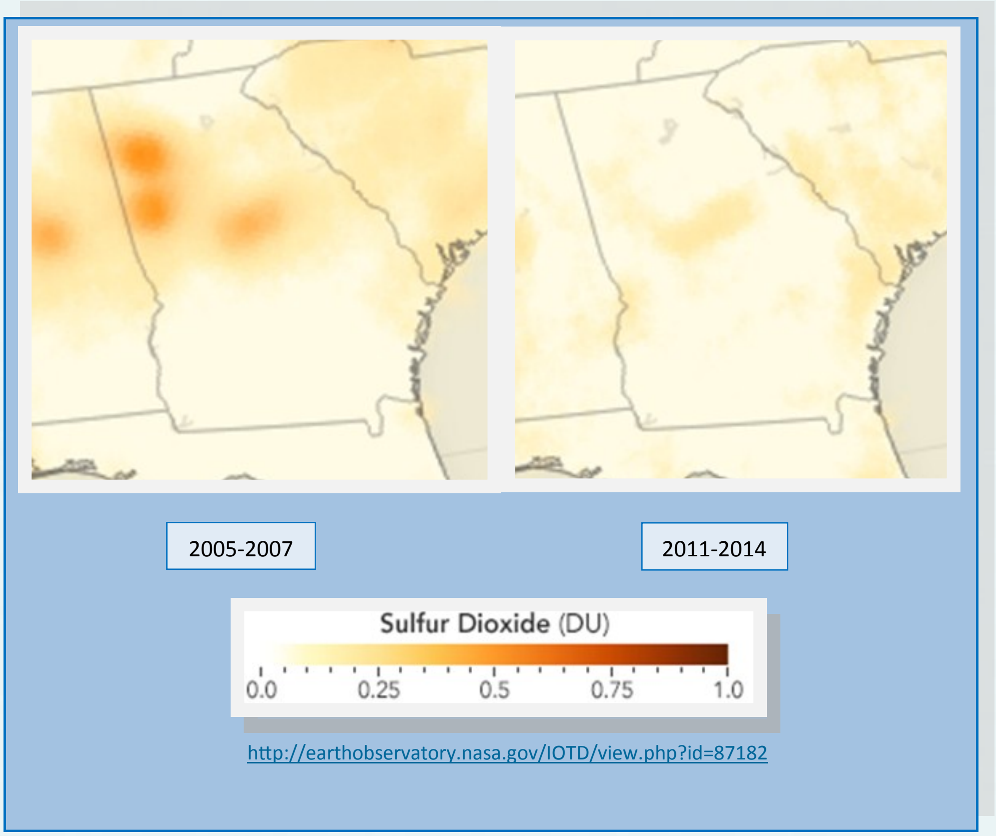



Figure 15.

[5]A Dobson unit (DU) is a measurement of density of a gas in a column of the Earth's atmosphere.

## National Ambient Air Quality Standards for Sulfur Dioxide

| | |
|---|---|
| **Primary NAAQS:** | **3-year average of 99th percentile of the daily maximum 1-hour concentration not to exceed 75 ppb** |
| **Secondary NAAQS:** | **3-hour concentrations not to exceed 0.5 ppm (500 ppb) more than once per year** |

### Attainment Designation

- EPA strengthened the $SO_2$ primary National Ambient Air Quality Standard (NAAQS) in 2010 and has developed a 4-phase process for designations. Please refer to EPA's information on the $SO_2$ data requirement rules for more details[5].
- All the $SO_2$ design[6] values, for 2014-2016 in Georgia, were below the 1-hour standard, with the highest design value occurring at the Augusta site (60 ppb).

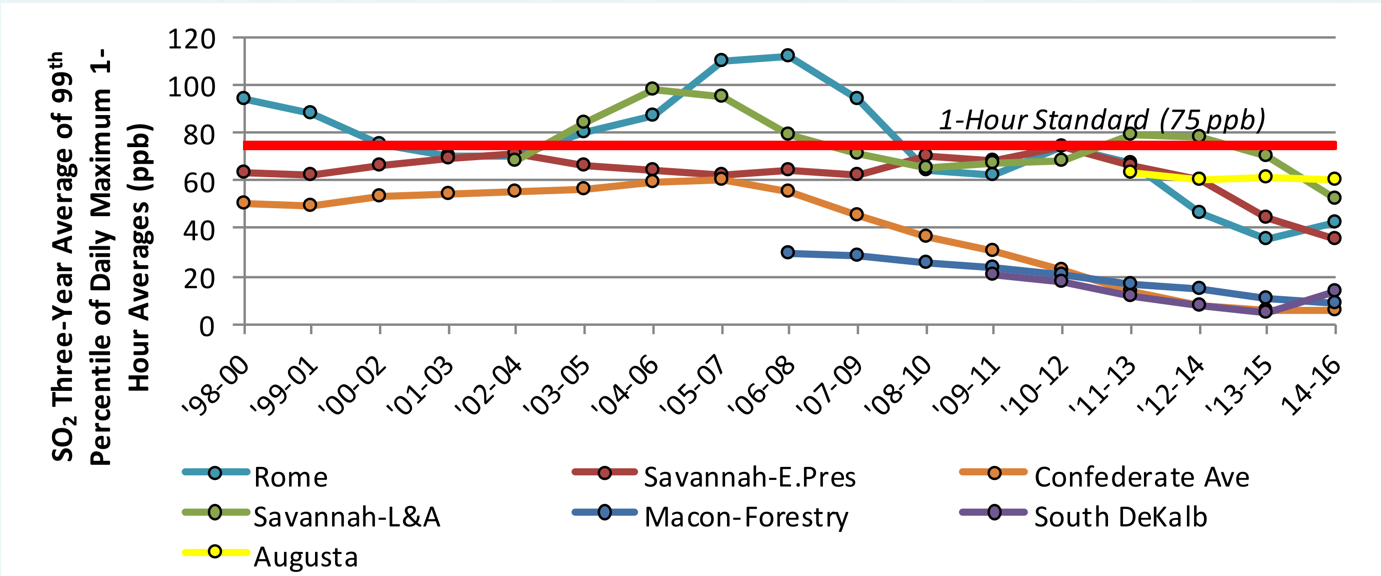
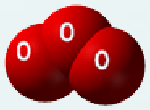



Figure 16. $SO_2$ three-year averages of the 99th percentile of annual daily max 1-hour averages

[5] https://www.epa.gov/so2-pollution/final-data-requirements-rule-2010-1-hour-sulfur-dioxide-so2-primary-national-ambient

[6] Three-year average of the 99th percentile of annual daily maximum 1-hour averages

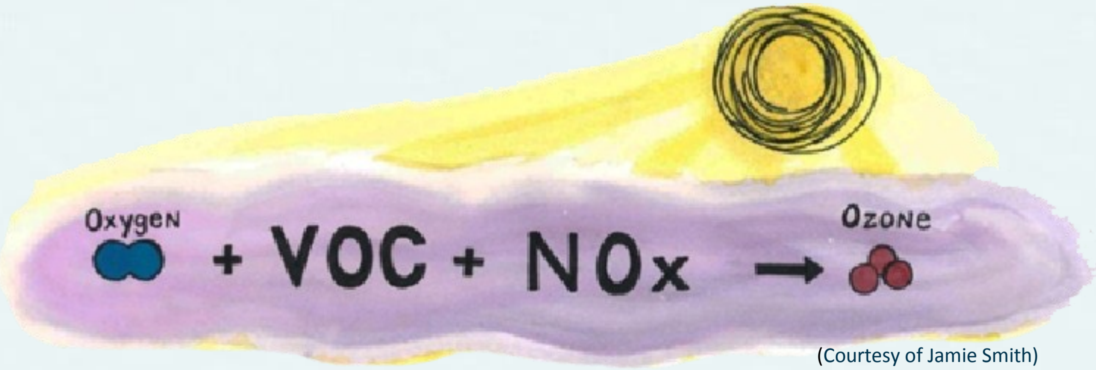
# Ozone ($O_3$) 

## What is it?

Ozone is a form of oxygen. But unlike oxygen ($O_2$), ozone ($O_3$) is not a stable gas. Ozone is highly reactive and unstable - corrosive and capable of damaging living cells. Ground-level ozone can be harmful at high concentrations and is a regulated pollutant. NOTE: Ozone occurs naturally in the Earth's upper atmosphere (stratosphere) where it protects life on Earth from the sun's harmful ultraviolet (UV) rays. This is the good ozone. "Good Up High, Bad Nearby."
Learn more: https://www.epa.gov/ozone-pollution

## Where does it come from?

Ground-level ozone is not emitted directly into the air, but is created by chemical reactions between nitrogen oxides ($NO_x$) and volatile organic compounds (VOC) in the presence of sunlight. Major sources of $NO_x$ include emissions from industrial facilities, electric utilities and motor vehicle exhaust. In Georgia, the major sources of VOC are natural sources such as trees and vegetation. Other VOC sources include gasoline vapors and chemical solvents.



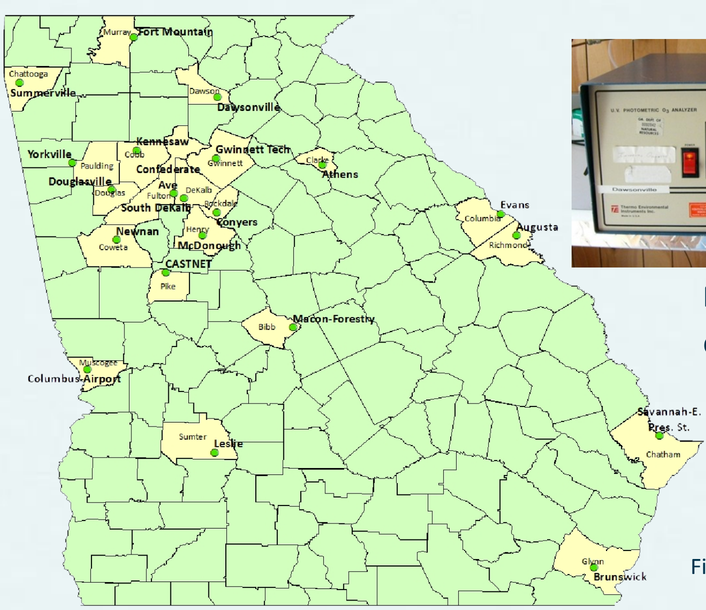

(Courtesy of Jamie Smith)

Figure 17. Ozone formation process

## Health Impacts

- Ozone can irritate the mucous membranes of the nose, throat, and airways which can lead to coughing and chest pain.
- It can increase risk of respiratory infections in people with asthma and respiratory disease.
- Ozone reduces the ability to perform physical exercise by impairing normal lung function.
- Repeated exposure may cause permanent scarring of lung tissue.

## Georgia Monitoring Information for Ozone




### Measurement Technique

Continuous ultraviolet photometric method[7]

More information about measurement technique

[7] https://www.thermofisher.com/order/catalog/product/49I

Figure 18. Georgia's ozone monitoring sites

## EPA's CASTNET Site

- As part of the Clean Air Status and Trends Network (CASTNET), EPA established a monitoring site in Pike County, Georgia in 1988.
- The CASTNET site is part of a national air quality monitoring network put in place to assess long-term trends in atmospheric deposition and ecological effects of air pollutants.
- The CASTNET site is one of 95 regional sites across rural areas of the United States and Canada measuring nitrogen, sulfur, and ozone concentrations, and deposition of sulfur and nitrogen.
- Like the South DeKalb ozone monitor, the CASTNET ozone monitor also collects data year-round. https://www.epa.gov/castnet

## More Information about Ground Level Ozone

- Ground level ozone formation occurs through a complex series of photochemical reactions that take place in the presence of sunlight, causing a diurnal pattern (high ozone during the day, low ozone at night, see Figure 19).

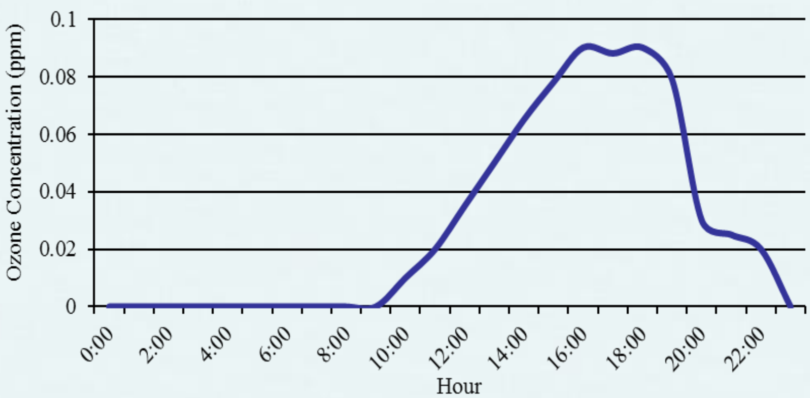
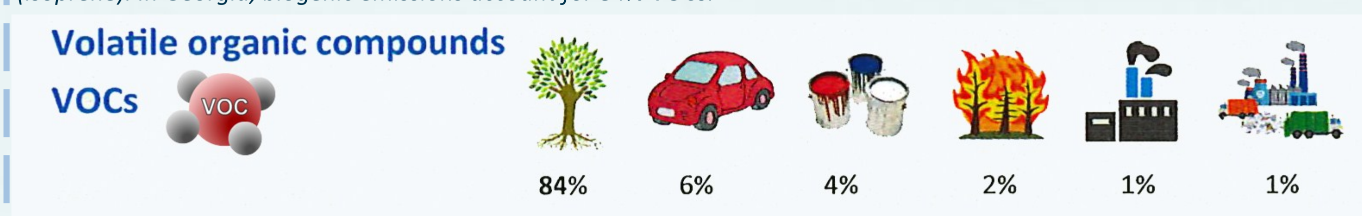



Figure 19. Typical urban 1-hour ozone diurnal pattern

- The photochemical reactions require a reaction between oxides of nitrogen ($NO_x$) and volatile organic compounds (VOCs).
- Since there will always be strong sunshine in the summer, and the naturally-occurring (or biogenic) levels of VOCs in Georgia are high, the most effective way to control ozone production in Georgia is to reduce emissions of $NO_x$ in the summer.

*Examples of the most common reactive VOCs that contribute to ozone formation are: hydrocarbons found in automobile exhaust (benzene, propane, toluene); vapors from cleaning solvents (toluene); and biogenic emissions from plants and trees (isoprene). In Georgia, biogenic emissions account for 84% VOCs.*




- With the exception of the South DeKalb and CASTNET sites, ozone in Georgia, unlike other pollutants previously discussed, is monitored March through October, complying with federal monitoring regulations (in 40CFR Part 58).
- Ozone is prevalent in urban areas in the summer but can appear in other areas due to weather patterns that can move air or many hundreds of miles.

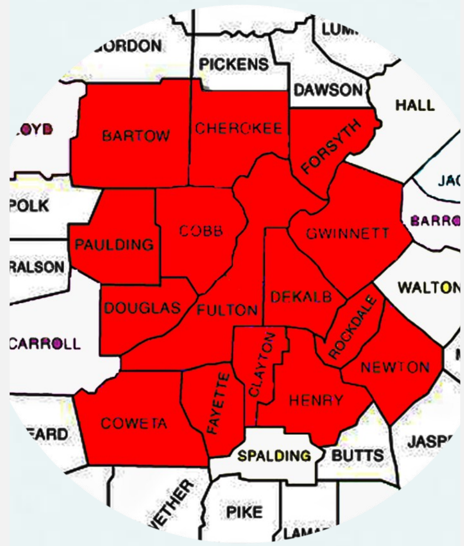
# National Ambient Air Quality Standards for Ozone

**Primary NAAQS:** 3-year average of 4th highest daily maximum 8-hr concentration not to exceed 0.070 ppm

**Secondary NAAQS:** Same as the Primary Standards

## Attainment Designation

- Ozone monitoring has been in place in the Atlanta area since the 1970's.
- Currently the Atlanta-Sandy Springs-Roswell MSA ozone network includes ten monitors located in ten counties.
- On March 27, 2008 the ozone primary standard level was lowered to 0.075 ppm for the 8-hour averaging time, fourth maximum value, averaged over three years (Federal Register, Vol. 73, No. 60, page 16436).
- With the implementation of this ozone standard, the boundary of the Atlanta nonattainment area was defined as a 15-county area (Figure 20).




- With the 2013-2015 ozone data, the entire state of Georgia (including Atlanta) met the 2008 ozone standard of 0.075 ppm for ozone.
- Georgia was redesignated to attainment on May 22, 2017.
- On October 1, 2015, EPA lowered the ozone standard to 0.070 ppm[8].
- A violation of the standard is determined by using an 8-hour average of the fourth maximum daily value, averaged over three years. There has been a gradual reduction in the number of days exceeding the ozone standards (Figure 21).

Figure 20. Georgia's 8-hour ozone nonattainment area (NAA) map for the 2008 standard

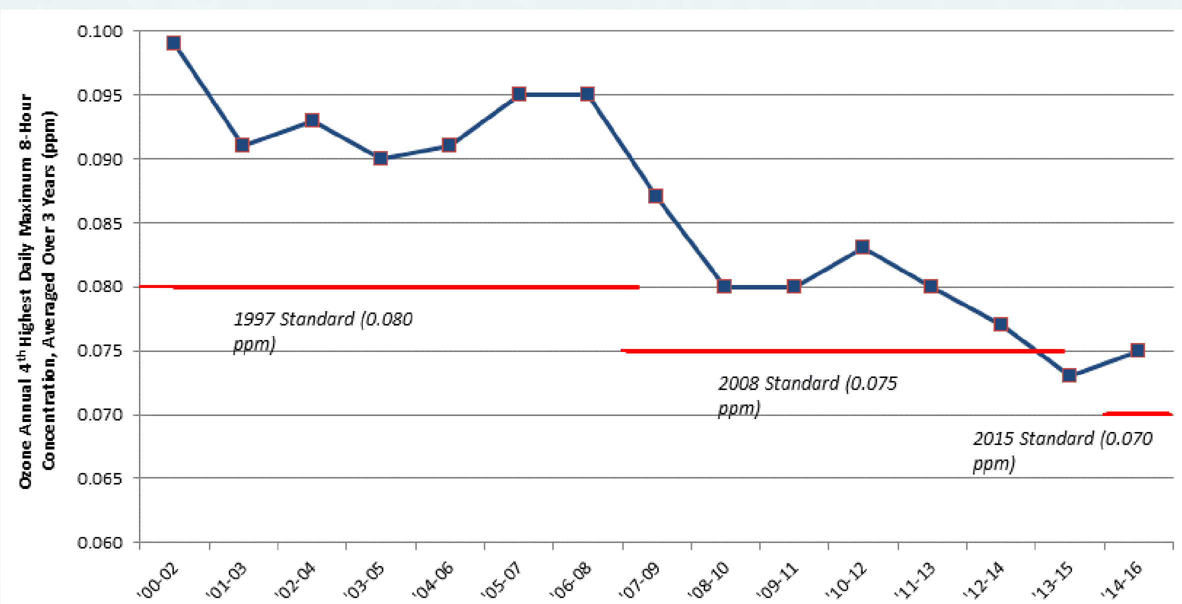


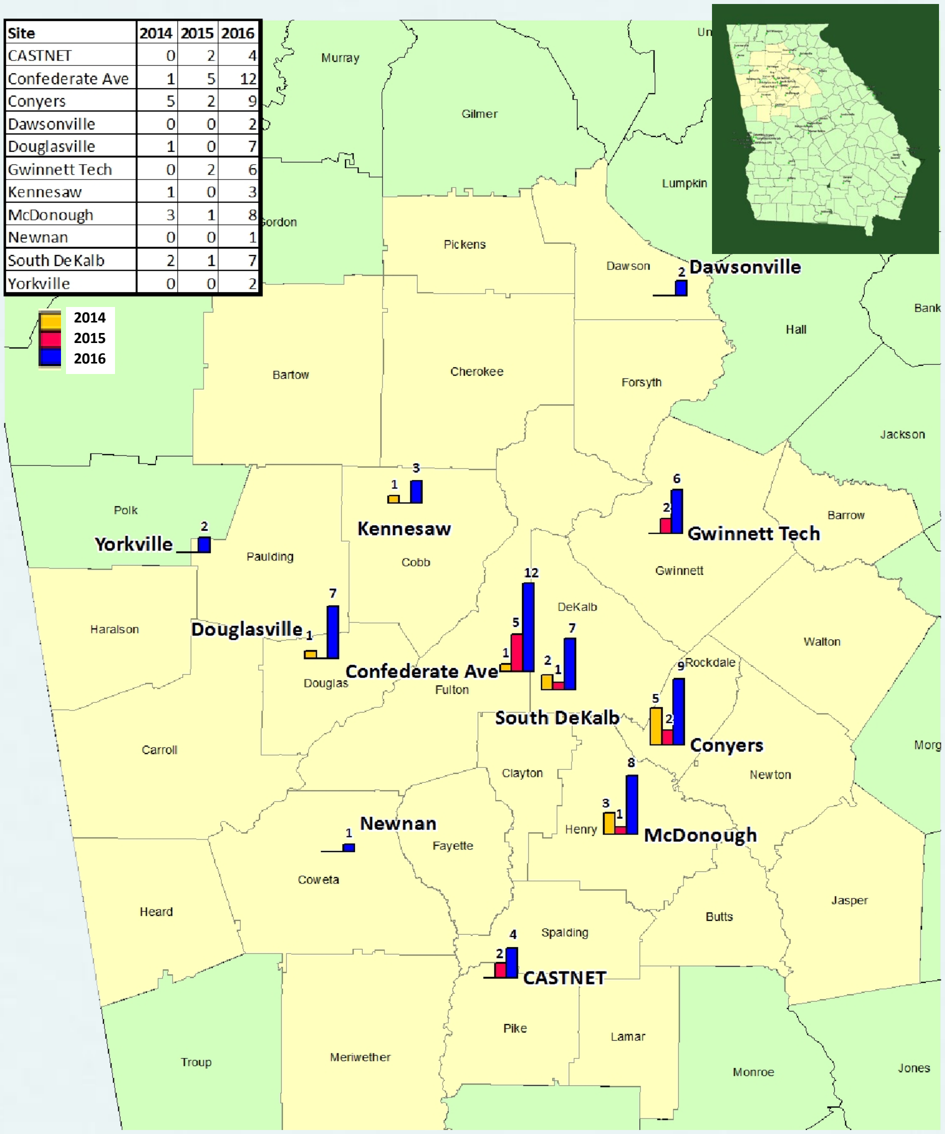

Figure 21. Ozone design values for Atlanta-Sandy Springs-Roswell MSA

[8] https://www.epa.gov/ozone-pollution/2015-revision-2008-ozone-national-ambient-air-quality-standards-naaqs-supporting

#### 8-hour ozone exceedances in Atlanta-Sandy Springs-Roswell MSA

In 2016, the Atlanta-Sandy Springs-Roswell MSA area had a total of 29 days that exceeded the current (0.070 ppm) 8-hour standard. 2016 was one of the hottest and driest summers on record for Georgia.

The term 'exceedance' is defined as a daily maximum 8-hour average greater than the standard. The Atlanta-Sandy Springs-Roswell MSA ozone monitors which exceeded the 8-hour ozone standard (0.070 ppm) in 2016 are mapped in Figure 22.



| Site | 2014 | 2015 | 2016 |
|---|---|---|---|
| CASTNET | 0 | 2 | 4 |
| Confederate Ave | 1 | 5 | 12 |
| Conyers | 5 | 2 | 9 |
| Dawsonville | 0 | 0 | 2 |
| Douglasville | 1 | 0 | 7 |
| Gwinnett Tech | 0 | 2 | 6 |
| Kennesaw | 1 | 0 | 3 |
| McDonough | 3 | 1 | 8 |
| Newnan | 0 | 0 | 1 |
| South DeKalb | 2 | 1 | 7 |
| Yorkville | 0 | 0 | 2 |



Figure 22.

#### National 8-hour ozone concentrations

Figure 23 was taken from EPA's "Our Nation's Air- Status and Trends through 2015" (https://gispub.epa.gov/air/trendsreport/2016/). It shows the fourth maximum reading for the 8-hour ozone readings across the United States. Georgia's fourth maximum ozone readings in 2015 were in the 0.055-0.07 ppm (light blue) and 0.07-0.085 ppm (green) ranges.

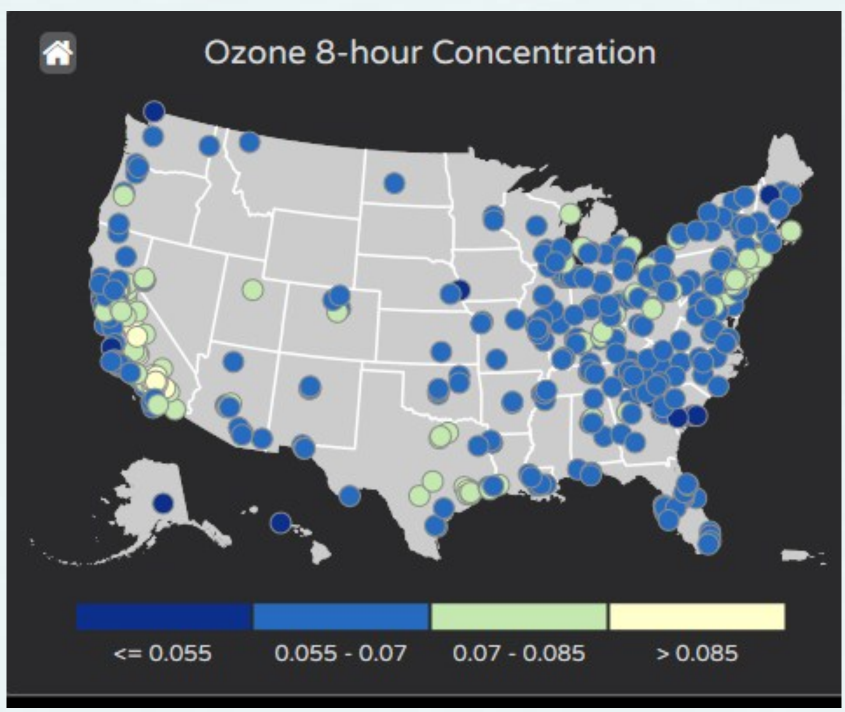




Figure 23.

# Lead (Pb)

## What is it?

Lead is a naturally occurring element found in small amounts in the earth's crust. While it has some beneficial uses, it can be toxic to humans and animals causing detrimental health effects. Learn more: https://www.epa.gov/lead

## Where does it come from?

- In the past, the Clean Air Act required extensive lead monitoring to detect the high levels of airborne lead that resulted from the use of leaded gasoline. With the phase-out of leaded gasoline, lead concentrations decreased drastically by the late 1980s**.** Figure 24 shows the drop in annual averages from 1990 through 2016.
- A major source of lead is acid battery plants. Lead can also come from the dust of vehicle traffic, construction activities, and agricultural activities and deposit on leaves and plants.

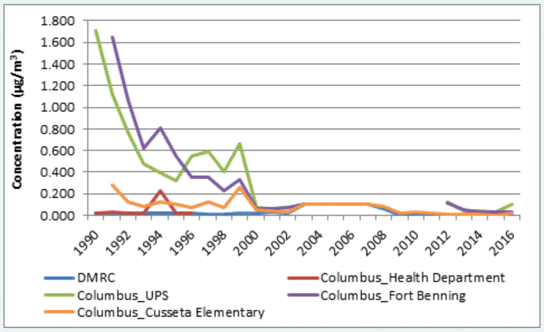



Figure 24.

## Health Impacts

- Exposure mainly through inhalation and ingestion of lead in food, water, soil, or dust.
- Puts children at particular risk exposure since they commonly put hands, toys, and other items in their mouths, which may come in contact with lead-containing dust and dirt.
- Bioaccumulates in blood, bones, and tissues.
- Can damage kidneys, liver, and nervous system.
- Excessive and repeated exposure leads to neurological impairments that can cause seizures, mental retardation, and behavioral disorders especially in children, infants, and fetuses.
- Lead toxicity is rarely attributed to a single exposure or digestive event, it is the product of chronic exposure over time.
- May be a factor in high blood pressure and subsequent heart disease.

## Georgia Monitoring Information for Lead

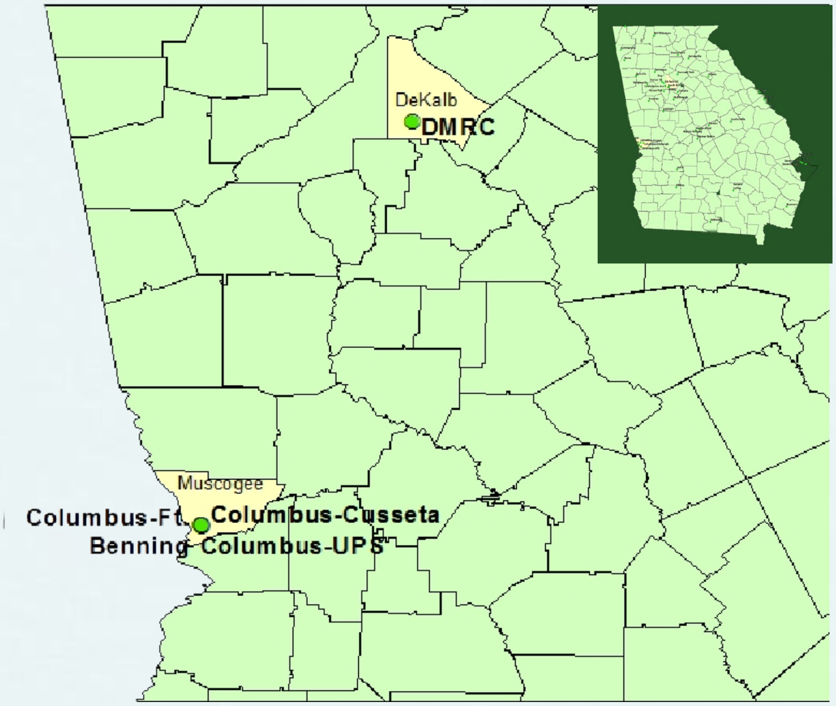



Figure 25. Georgia's lead monitoring sites

## Measurement Technique

24-hour total suspended particulate (100 microns or less) on 8"x10" pre-weighed fiberglass filter[9]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

[9] https://tisch-env.com/high-volume-air-samplers/

# National Ambient Air Quality Standards for Lead

**Primary NAAQS:** Rolling 3-month average, not to exceed 0.15 ug/m$^3$

**Secondary NAAQS:** Same as the Primary Standards

## Attainment Designation

- Figure 26 shows how Georgia's lead data compares to the rolling three-month average standard for 2012 through 2016.
- The last of the three months used for each average is indicated on the graph.
- The two monitors in the Columbus GA-AL MSA are located near a lead battery manufacturer, and have shown higher readings compared to the other monitors in the Columbus GA-AL MSA or the Atlanta-Sandy Springs-Roswell MSA.
- In November 2016, there was a violation of the lead standard in Columbus due to a malfunction on a silo control and is reflected in the graph below.

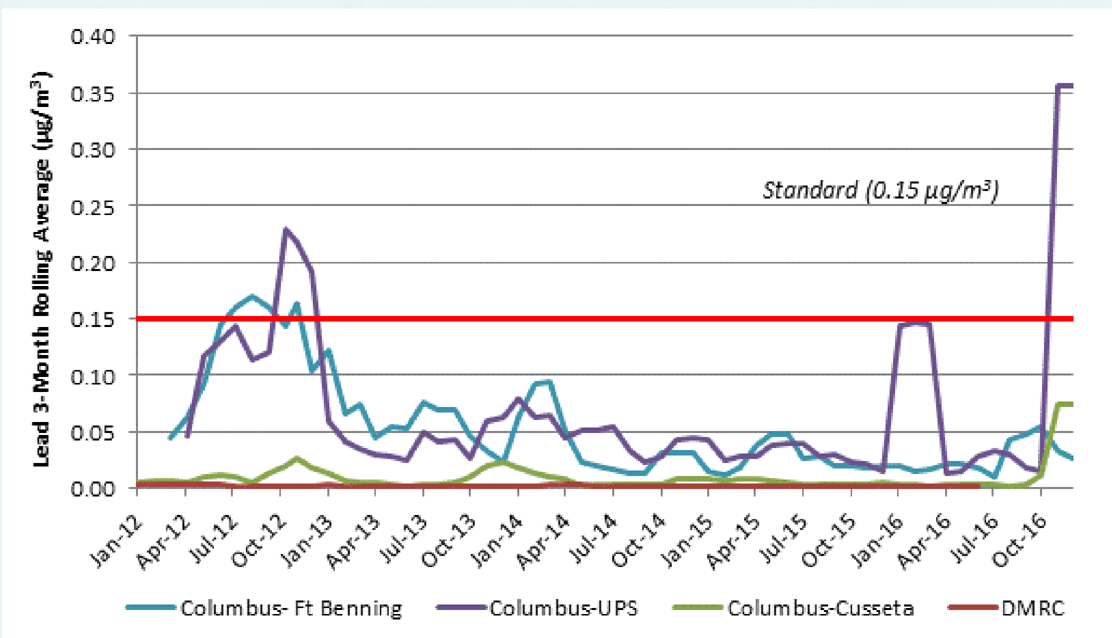



Figure 26. Georgia's three-month rolling averages, 2012-2016

# Particulate Matter $PM_{10}$ and $PM_{2.5}$

Learn more: https://www.epa.gov/pm-pollution

- Particulate matter includes a broad range of material that consists of solid particles, fine liquid droplets, or condensed liquids absorbed onto solid particles.
- Airborne particulates are not a single pollutant as discussed for the other criteria pollutants, but rather a mixture of many different air pollutants.
- There are two ways that particulate matter is formed, known as primary and secondary.
- Primary sources that emit particles directly include combustion, incineration, construction, mining, metals smelting, metal processing, and grinding sources.
- Other primary sources include diesel engine exhaust, road dust, wind blown soil, forest fires, open burning of vegetation for land clearing or waste removal, ocean spray, and volcanic activity.
- A great deal of particulate matter is in form of gaseous air pollutants that readily react with oxygen and each other. While many of those reactions produce other gases, they frequently produce particles. Particles formed through this process are known as secondary particulate matter such as sulfate particles, nitrate particles, and calcium nitrate or sodium nitrate particulates.
- Alternative diesel fuels are available that emit less particulate matter, as well as other pollutants.
- Ultra-low sulfur diesel fuel is one fuel that emits less sulfur dioxide, a source of particulate matter formation.
- Biodiesel fuel emits less particulate matter, carbon monoxide, hydrocarbons, and air toxics.
- Also, emulsified diesel emits less nitrogen oxides and particulate matter.
- Particulate pollution may be categorized by size since there are different health impacts associated with the different sizes of particulate matter.
- We currently monitor for three sizes of particles: **$PM_{10}$** (up to 10 microns in diameter), **$PM_{2.5}$** (up to 2.5 microns in diameter) and **$PM_{coarse}$** ($PM_{10}$ minus $PM_{2.5}$). To illustrate the size differences, Figure 27 shows how approximately ten $PM_{10}$ particles can fit on a cross section of a human hair, and approximately thirty $PM_{2.5}$ particles would fit on a cross section of a hair.
- These particles and droplets are invisible to the naked eye, and composition and sources can vary greatly by region.
- Regional relative humidity can affect the level of water present within the particles and affect how much dissolved gases or reactive species enter the lungs when particles are inhaled.

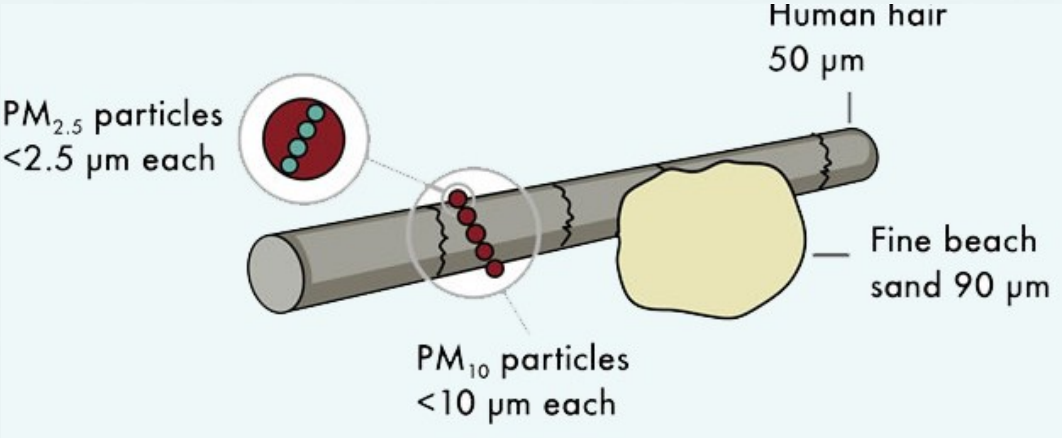



Figure 27. Comparison of particulate matter size to human hair

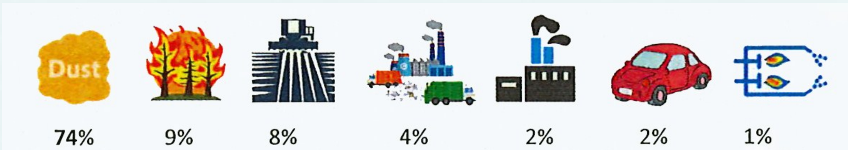
# $PM_{10}$

## What is it?

$PM_{10}$ are dust particles that are up to 10 micrometers in diameter.

## Where does it come from?

Sources include crushing or grinding operations and dust stirred up by vehicles on roads.




See page 16 for icon key.

## Health Impacts

- Penetrate deeply into the lungs.
- Breathing and respiratory problems, aggravation of existing respiratory and cardiovascular disease, alterations in the body's defense system against inhaled materials and organisms, and damage to lung tissue.
- Individuals with chronic lung or cardiovascular disease, individuals with influenza, asthmatics, elderly people, and children are most effected.

## Georgia Monitoring Information for $PM_{10}$

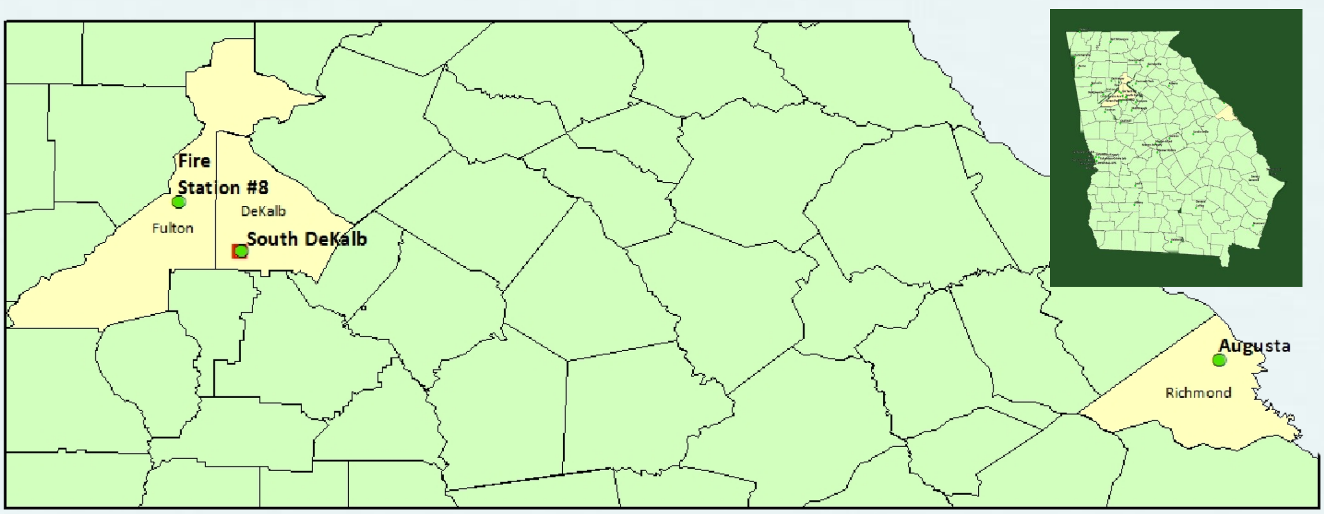



Figure 28. Georgia's $PM_{10}$ and $PM_{coarse}$ (red square) monitoring sites

## Measurement Techniques

- Two types of EPA-approved reference or equivalent monitors used to determine attainment with the $PM_{10}$ standard:

⇒ Integrated low-volume monitor that collects a 24-hour sample through an impaction inlet device that only allows particles with 10 microns or less in size to reach the filter media.[10]

⇒ Continuous beta ray attenuation monitor, with an inlet designed to cut out particles larger than 10 microns in size.[11]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUES

[10] https://tisch-env.com/low-volume-air-sampler/

[11] http://metone.com/air-quality-particulate-monitors/regulatory/bam-1020/

# National Ambient Air Quality Standards for Particulate Matter $PM_{10}$

**Primary NAAQS:** Number of days with a maximum of 24-hour concentration of 150 µg/m$^3$ must not exceed more than once per year on average over 3 years

**Secondary NAAQS:** Same as the Primary Standards

## Attainment Designation

- Figure 29 shows how Georgia compares to the 24-hour standard for $PM_{10}$, which is 150 µg/m$^3$.
- The standard allows one exceedance per year, averaged over a 3-year period; therefore, this chart shows the second highest 24-hour average for each site. All three samplers collected data well below the standard.

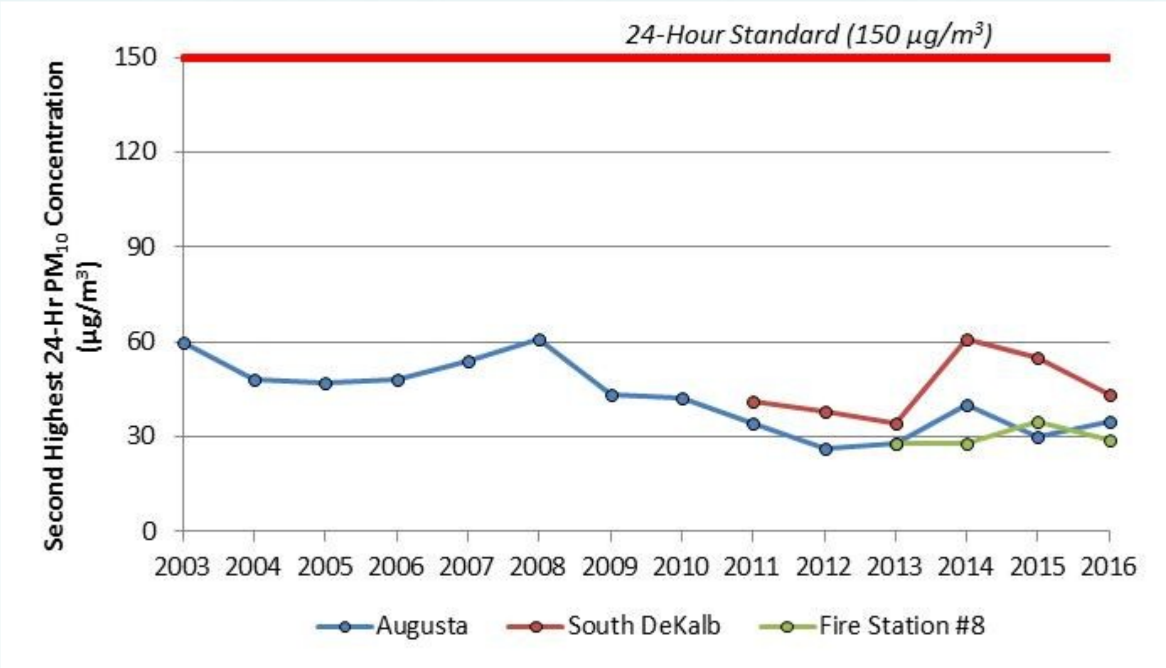



Figure 29. $PM_{10}$ annual second maximum 24-hour concentrations

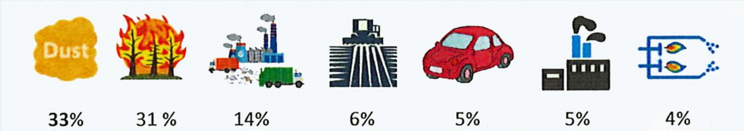
# $PM_{2.5}$

## What is it?

- $PM_{2.5}$ are particles that are 2.5 micrometers in diameter or smaller, and can only be seen with an electron microscope. Most particles form in the atmosphere as a result of complex reactions of chemicals such as sulfur dioxide and nitrogen oxides.

## Where does it come from?

- Fine particles are produced from dust and all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes.




See page 16 for icon key.

## Health Impacts

- Can penetrate deep into lung tissue and even enter the bloodstream. This may cause significant respiratory or cardiovascular problems that can shorten an individual's lifespan.
- High risk groups include children, the elderly, and people with cardiovascular or lung diseases such as emphysema and asthma.

## Georgia Monitoring Information for $PM_{2.5}$

### Measurement Techniques

- Two types of methods: integrated and continuous.
- The integrated samplers are the official reference method (FRM) used for determining which areas in Georgia are attainment (meeting the national standard). Integrated samplers collect samples on Teflon filters for 24 hours, using a 2.5 microns particle size sorting device.[12]
- The continuous method consists of two types of instruments.
  - ⇒ The beta attenuation method (BAM) is designed for the inlet to cut out particles larger than 2.5 microns in size. EPD has two sites where BAM samplers are running as Federal Equivalent Method (FEM) samplers that can be used for attainment determinations as well: South DeKalb and Albany.[13]
  - ⇒ The tapered element oscillating microbalance (TEOM) method is used to support the development of air quality models and forecasts, including the Air Quality Index (AQI), and provide the public with information about pollutant concentrations in real time. As set up at EPD's sites, these samplers cannot be used for making attainment determinations.[14]
- Continuous $PM_{2.5}$ data is reported every hour on Georgia's Ambient Air Monitoring web page located at http://amp.georgiaair.org/. The immediate availability of this data allows the public to make informed decisions regarding their outdoor activities.


MORE INFORMATION ABOUT MEASUREMENT TECHNIQUES

[12] https://www.thermofisher.com/order/catalog/product/2025I

[13] http://www.metone.com/products/air-quality-monitors/

[14] https://www.thermofisher.com/order/catalog/

Figure 30 shows the location of Georgia's $PM_{2.5}$ FRM monitors and Figure 31 shows the location of $PM_{2.5}$ continuous and speciation monitors.

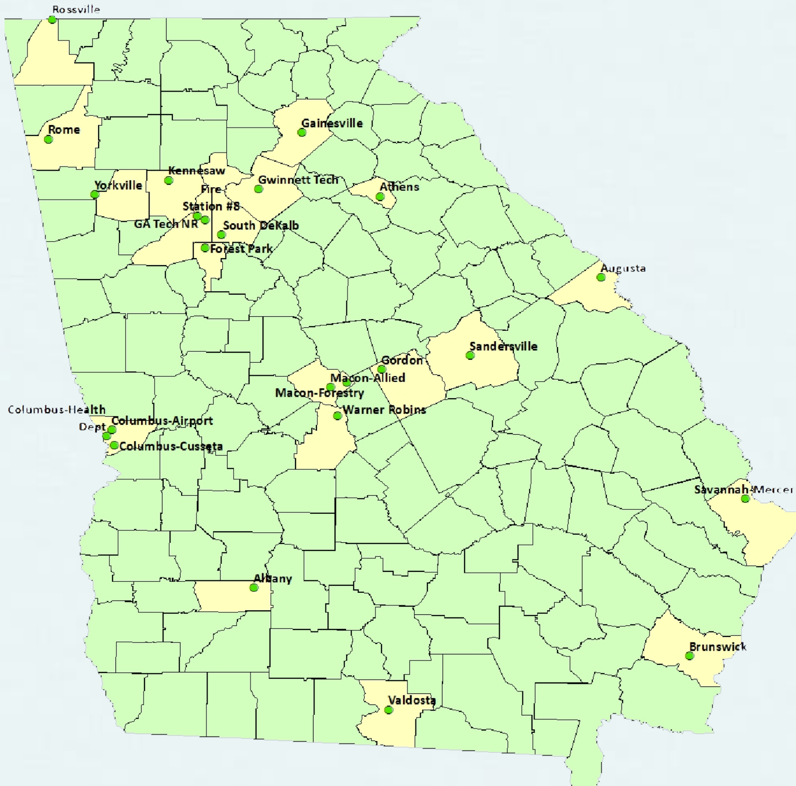



Figure 30. Georgia's $PM_{2.5}$ FRM monitoring sites

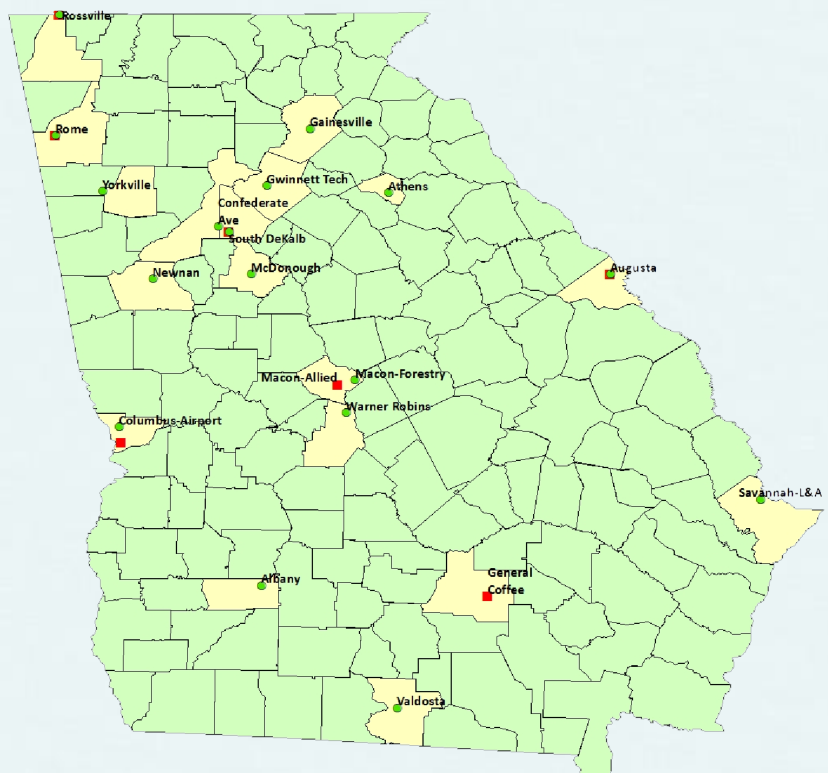


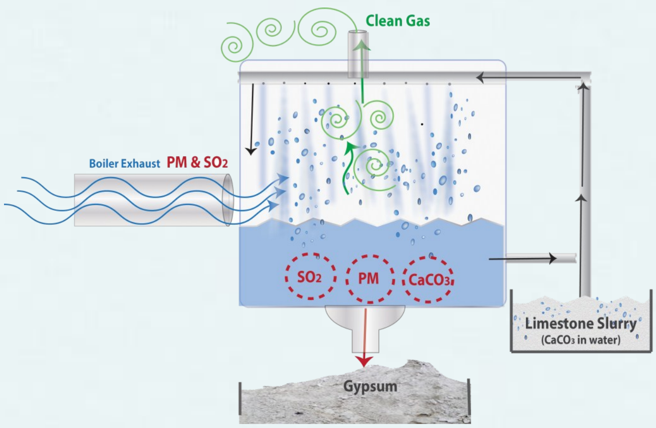

Figure 31. Georgia's $PM_{2.5}$ continuous (green circles) and $PM_{2.5}$ speciation (red squares) monitoring sites

# Reducing $PM_{2.5}$ Emissions in Georgia

## PM Controls

### Georgia's Multi-Pollutant Rule

- In 2007, Georgia implemented State Rule 391-3-1-.02(2)(sss), which affects the 13-county Atlanta nonattainment areas plus surrounding counties.
- This multi-pollutant control measure that affected electric steam generating units at electric utilities required coal fired power plants to install controls to reduce three criteria pollutants, PM, $NO_x$, and $SO_2$, and had rolling start dates between 2008 and 2014.
- The controls that were added are called Selective Catalytic Reduction (SCR) for $NO_x$ and Flue Gas Desulfurization (FGD) for $SO_2$ and PM.
- Figure 32 shows the decrease in $PM_{2.5}$ concentrations as these controls were implemented across the state.




$SO_2$ and PM

Schematic design of the absorber of an FGD

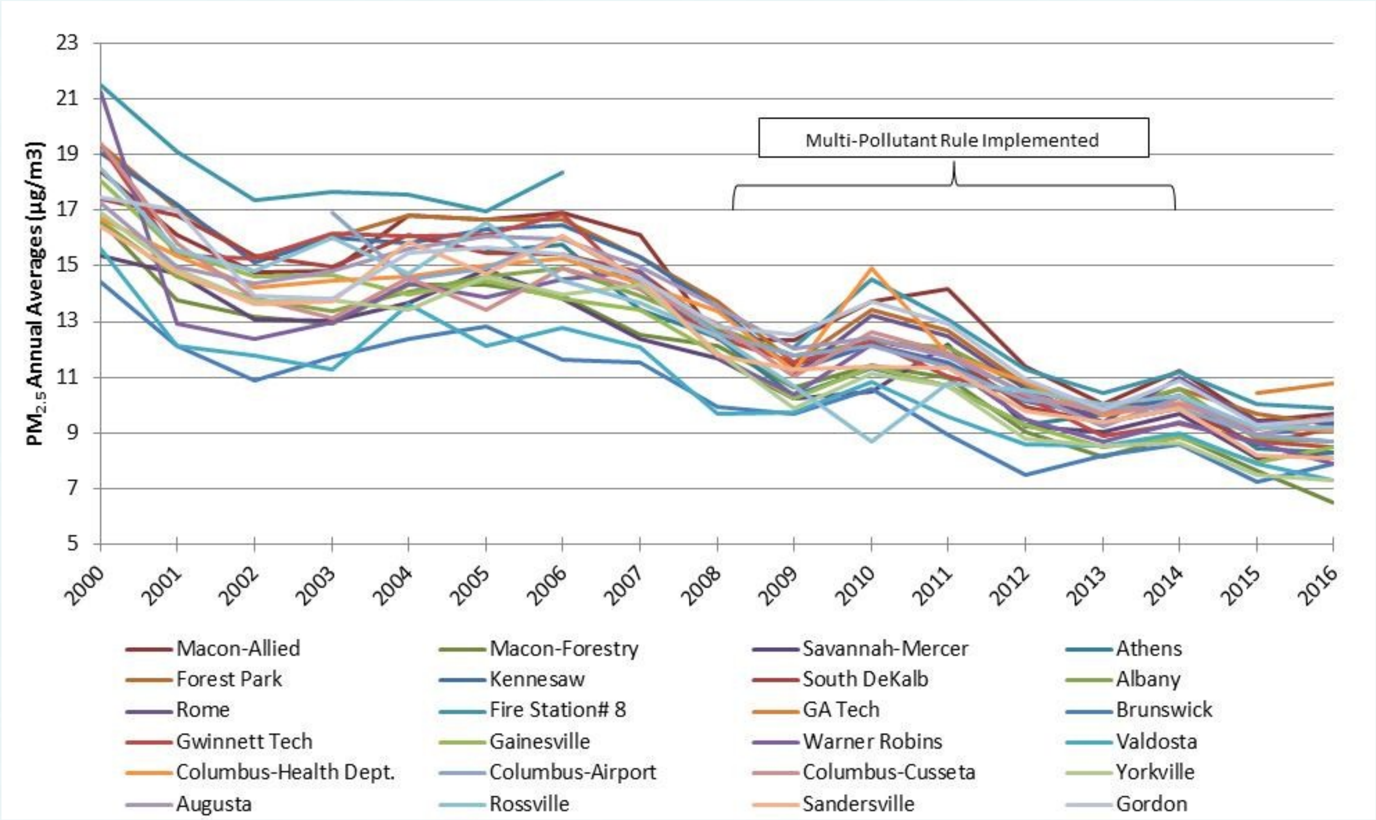



Figure 32: Implementation of PM Controls

## National Ambient Air Quality Standards for Particulate Matter $PM_{2.5}$

**Primary NAAQS:** 3-year average of the annual weighted mean not to exceed 12.0 µg/m$^3$

3-year average of the 98th percentile of 24-hour concentration not to exceed 35 µg/m$^3$

**Secondary NAAQS:** 3-year average of the annual weighted mean not to exceed 15.0 µg/m$^3$

3-year average of the 98th percentile of 24-hour concentration not to exceed 35 µg/m$^3$

### Attainment Designation

- For an area to be in attainment of the annual ambient air $PM_{2.5}$ standard, the three-year average of the annual average concentrations has to be less than or equal to 12.0 µg/m$^3$.
- In addition, the 24-hour primary and secondary standard requires that the three-year average of the 98th percentile of the 24-hour concentrations be less than or equal to 35 micrograms per cubic meter.
- Currently all areas of Georgia are designated unclassifiable/attainment for the 2012 annual $PM_{2.5}$ standard because they are meeting the national standard.

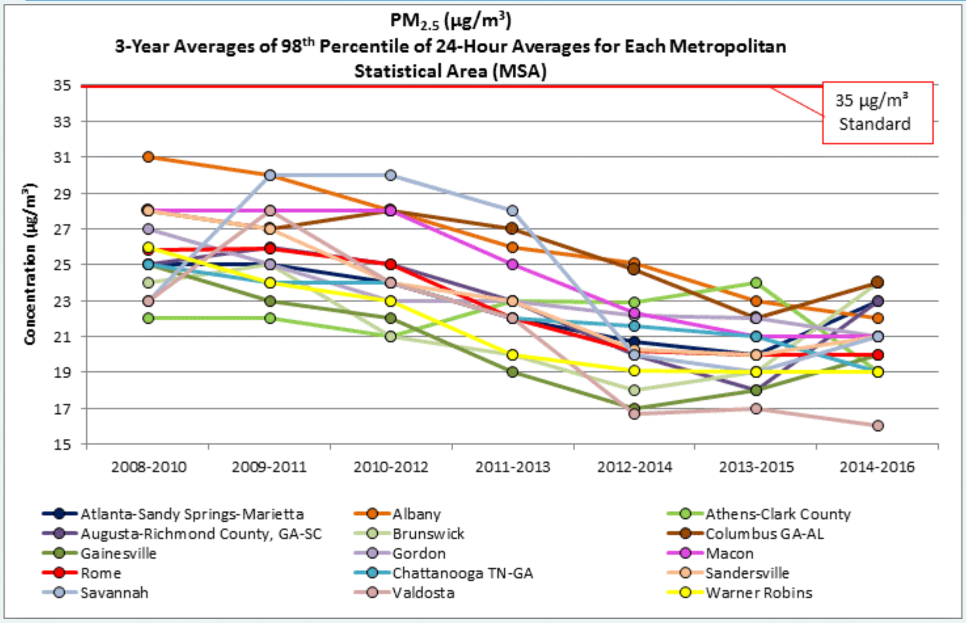



Figure 33. Comparison of the three-year averages of the 98th percentile of $PM_{2.5}$ 24-hour data

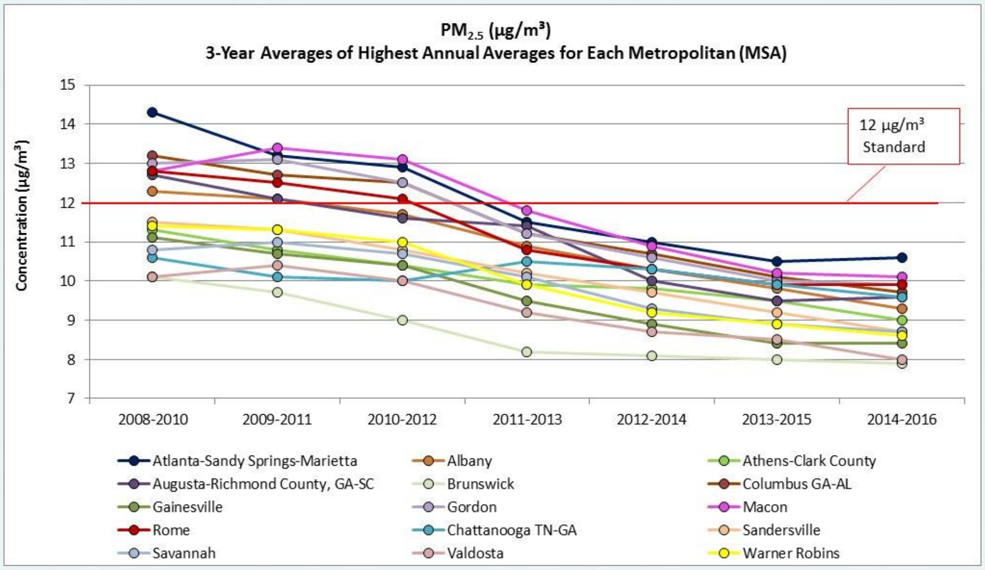


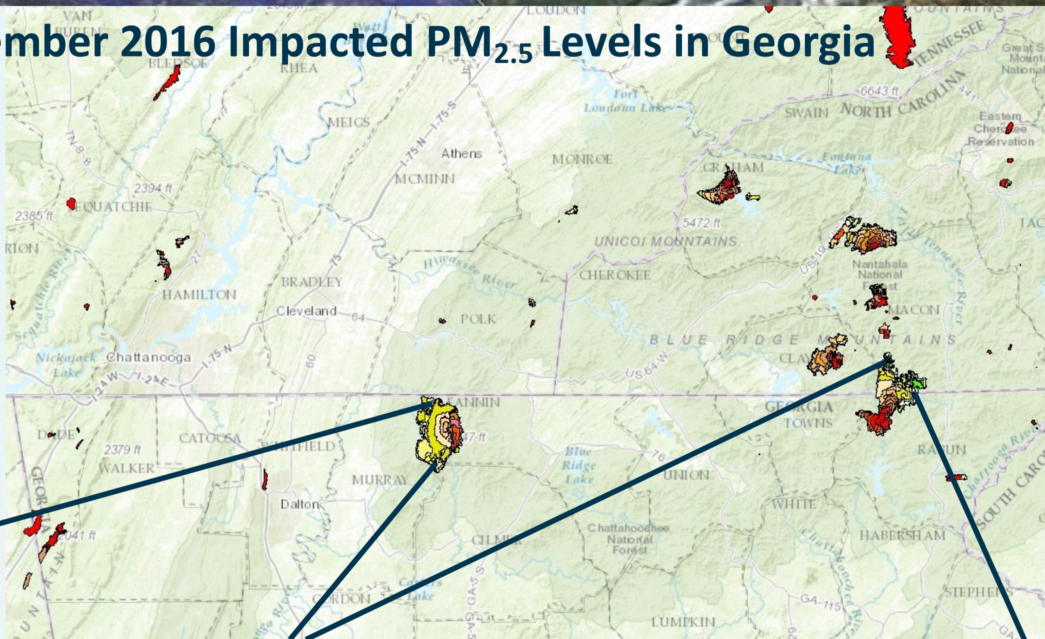

Figure 34. Comparison of the $PM_{2.5}$ three-year annual averages to the annual standard


# How Wildfires of November 2016 Impacted $PM_{2.5}$ Levels in Georgia

During the month of November, the Southeast experienced several days of wildfires that affected $PM_{2.5}$ levels across the region.

The following maps depict the location of fires in north GA, and nearby in TN, SC, NC, and AL.

The two maps below show a closer view of the two bigger fires that impacted GA. The colors give a visual of the date progression.



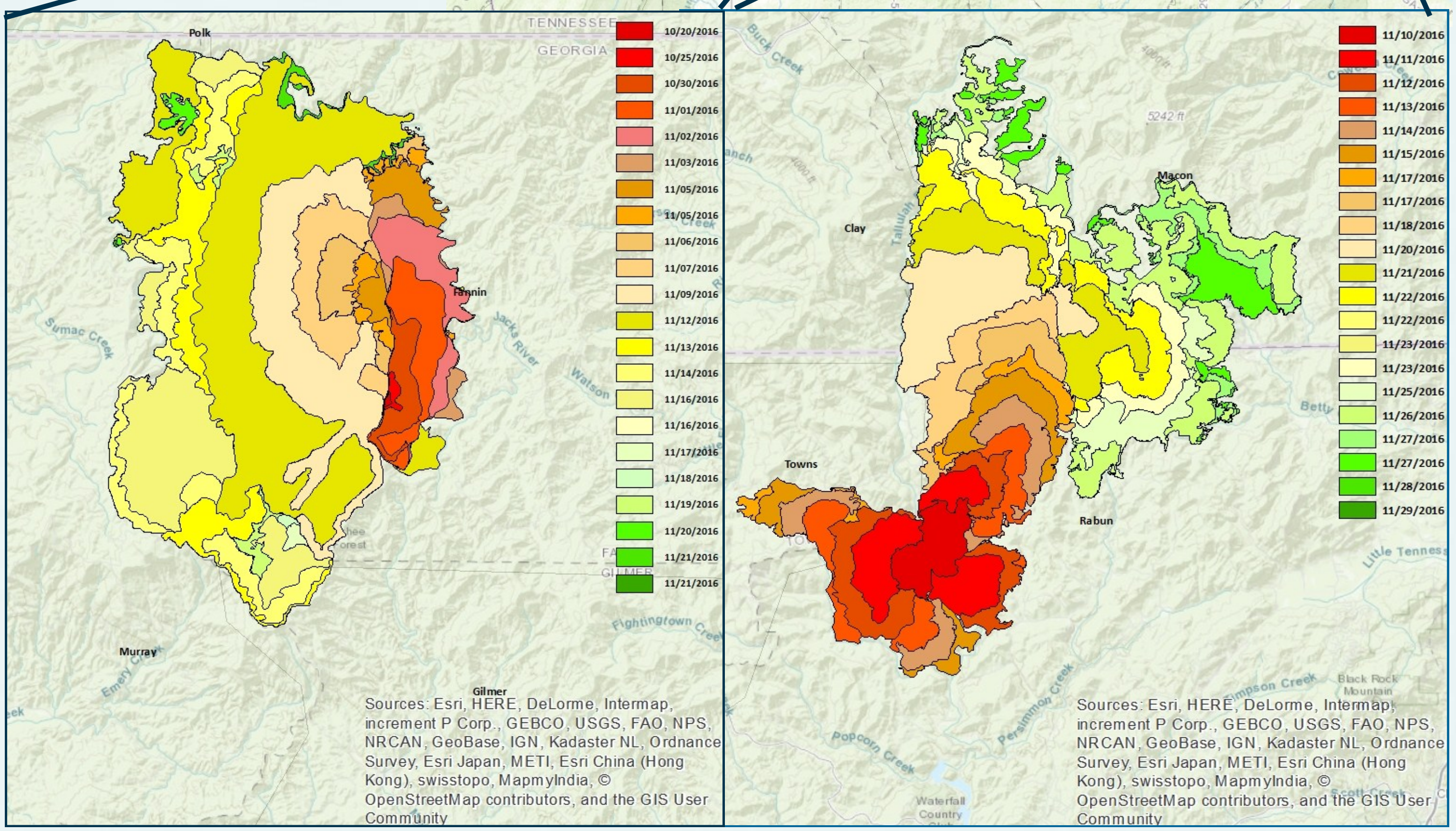




Figure 35. Location of wildfires

In the following graphs, the $PM_{2.5}$ ambient monitoring data is shown in more detail for November 2016. The first graph shows the daily Air Quality Index (AQI) for the $PM_{2.5}$ data for each metropolitan area (MSA). Several monitors were affected from November 9th through November 17th, and had $PM_{2.5}$ concentrations that were considered “Unhealthy”. The second graph reflects the 24-hour averages of the regulatory FRM $PM_{2.5}$ data for November 2016. The red line depicts the daily standard of 35 µg/m$^3$. While the $PM_{2.5}$ data was affected by the wildfires and there were 24-hour averages above the daily standard, Georgia continued to be below both of the $PM_{2.5}$ National Ambient Air Quality Standards for 2016.

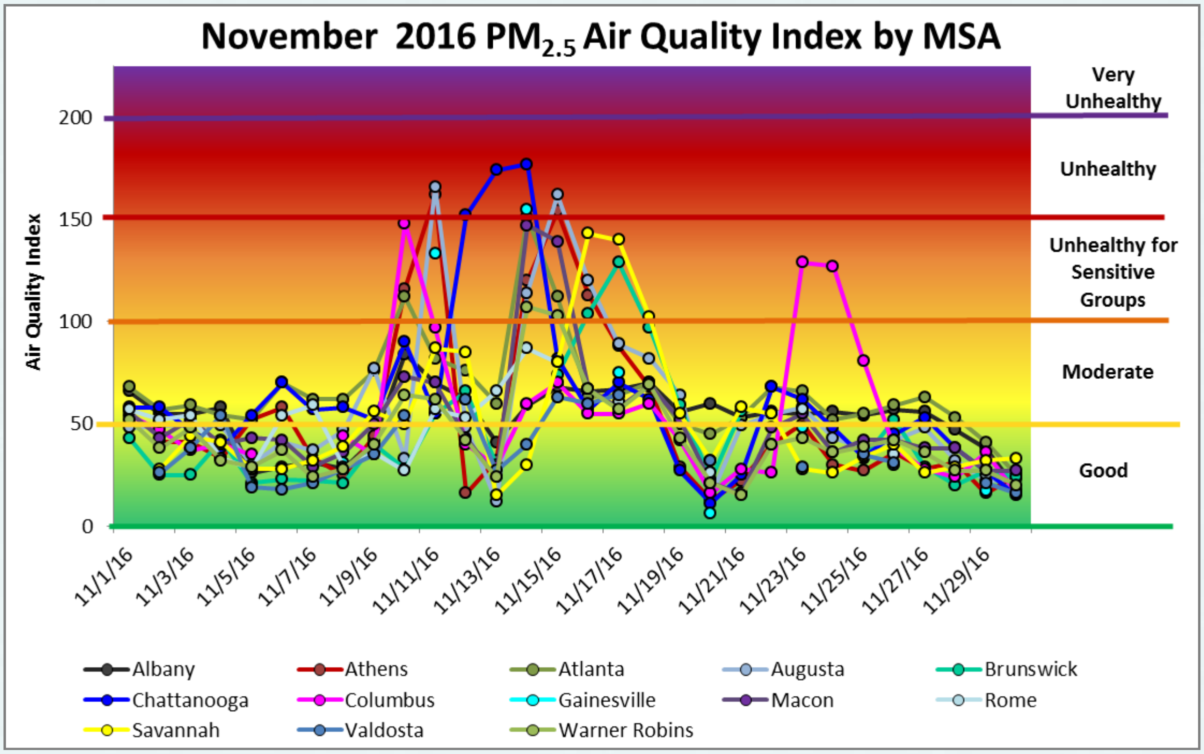



Figure 36. Hourly $PM_{2.5}$ samples for November 2016

This graph shows the daily Air Quality Index (AQI) for $PM_{2.5}$ data for each metropolitan area (MSA). Several $PM_{2.5}$ concentrations were considered “Unhealthy” in November 2016.

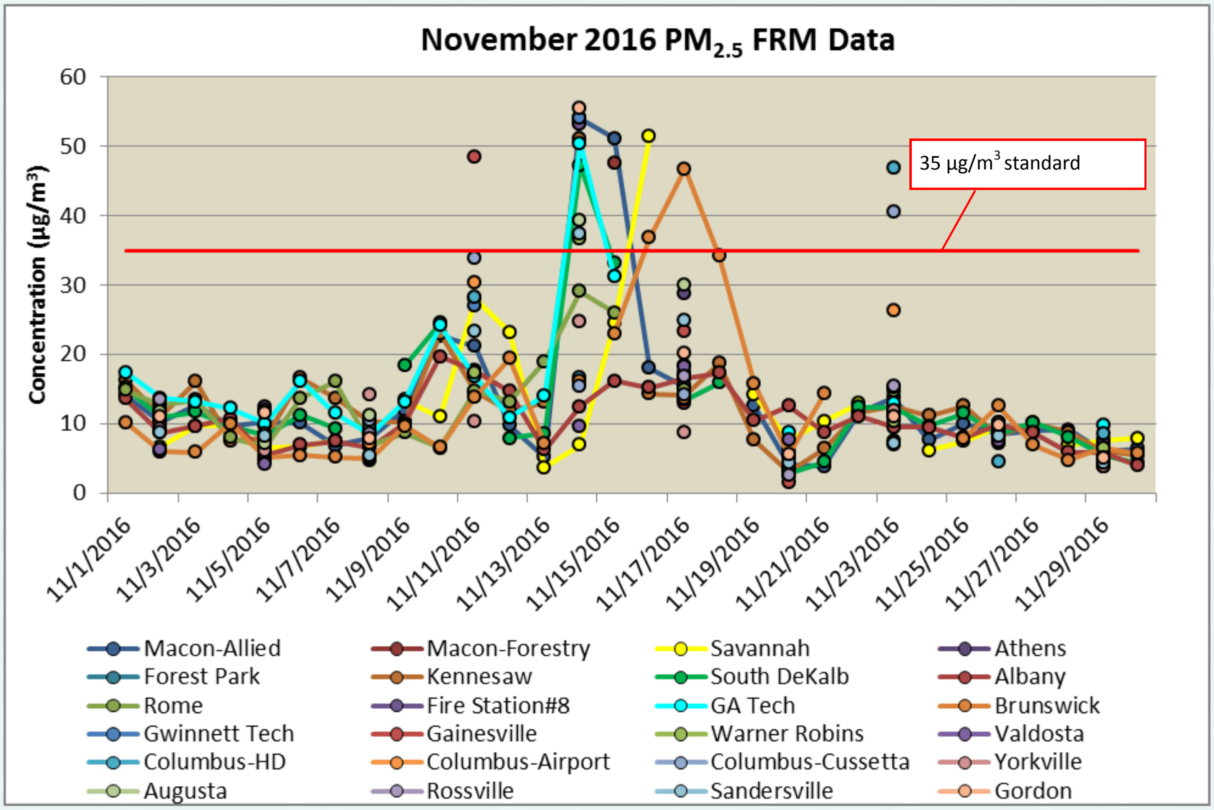



Figure 37. 24-hour $PM_{2.5}$ samples for November 2016

This graph reflects the 24-hour averages of the regulatory FRM $PM_{2.5}$ data for November 2016. Not all 24-hour samplers run daily.

## $PM_{2.5}$ Speciation

Particle speciation measurements are performed to support the regulatory, analytical, and public health purposes of the program. These measurements help scientists and regulators track the progress and effectiveness of newly implemented pollution controls. The data also improves scientific understanding of the relationship between particle composition, visibility impairment, and adverse human health effects.

Each individual particle, regardless of its source, has a distinct chemical composition which depends on local sources and a variety of other factors. Each has varying health effects based on its size and chemical composition.

Georgia currently monitors fifty-three species in particulate matter. Of these, sulfate and organic carbon are detected in the highest concentrations, with magnitudes of up to five to nine times greater than the other major species.

Refer to Figure 31 for a map of Georgia's $PM_{2.5}$ Speciation monitors.

Figure 38 compares the percent composition of $PM_{2.5}$ for each site based on 2015 annual averages. At the time this report was compiled, all of the 2016 $PM_{2.5}$ speciation data was not available from EPA.

- Organic carbon makes up 41-51% of $PM_{2.5}$ for all sites with Augusta having the largest percentage.
- Sulfate is the second largest portion of $PM_{2.5}$ for all sites except Augusta and ranges from 12-24%.
- Nitrate, crustal, elemental carbon, and ammonium ion make up no more than 11% of $PM_{2.5}$ for all sites.
- The chemical elements typical of the Earth's crust are grouped together as "crustal".

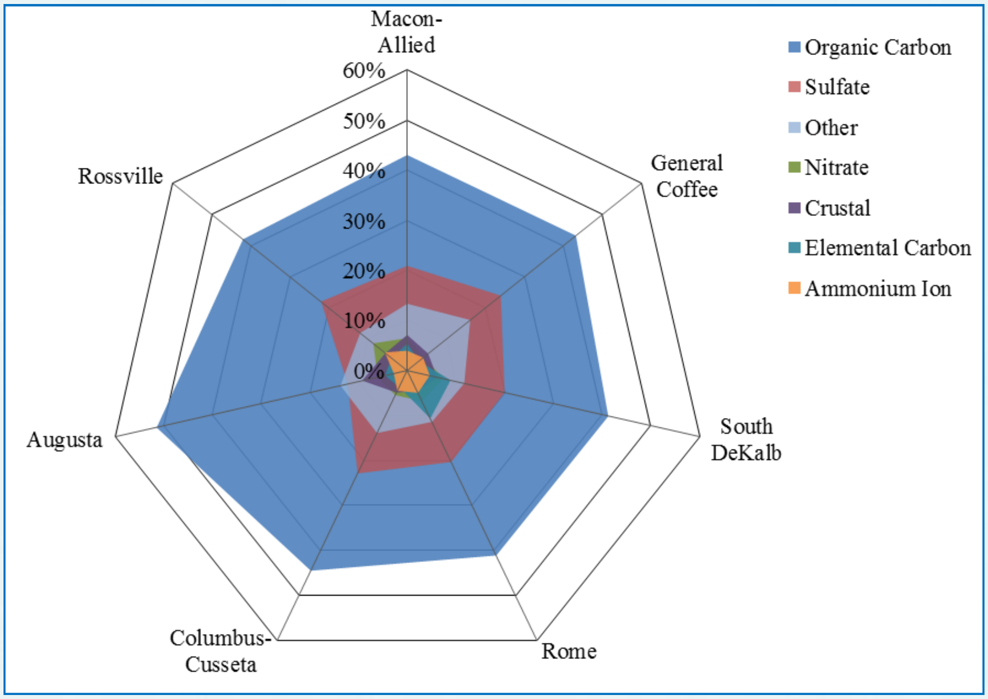



Figure 38.

## Measurement Techniques[15,16]

- Filter media with laboratory techniques using gravimetric (microweighing) analysis
- X-ray fluorescence and particle-induced X-ray emission for trace elements; Ion chromatography for anions and selected cations
- Controlled combustion for carbon
- Gas chromatography/mass spectroscopy (GC/MS) for semi-volatile organic particles

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUES

[15] http://www.urgcorp.com/index.php/systems/manual-sampling-systems/urg-3000n-carbon-sampler

[16] http://www.metone.com/?wpfb_dl=228

## PREDOMINANT SPECIES FOUND IN $PM_{2.5}$

Figure 39 presents each site with all species making up the composition at each location.

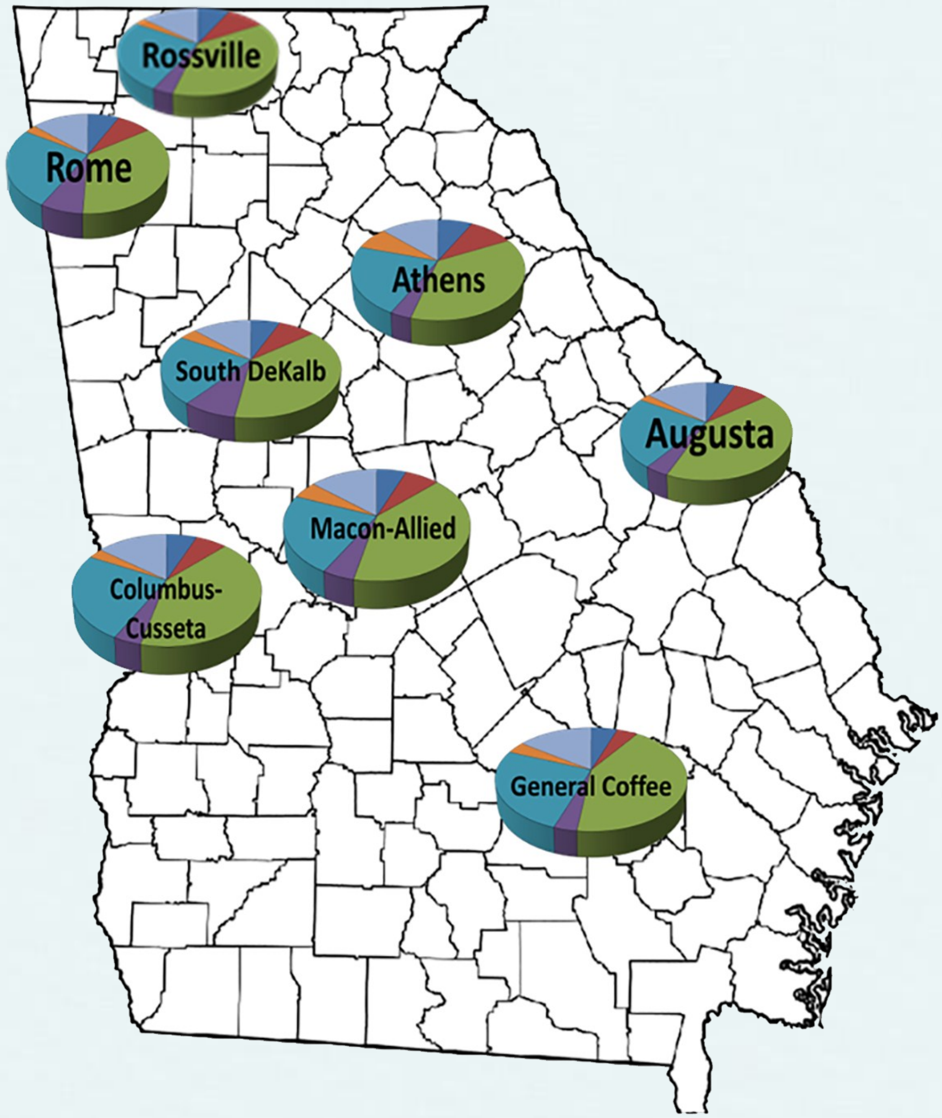



Figure 39. Annual averages of $PM_{2.5}$ composition data in Georgia

**Ammonium Ion:** commonly released by fertilizer production, livestock production, coke production, and some large refrigeration systems. Ironically, it can be emitted by $NO_x$ control systems installed on large fossil fuel combustion systems, which use ammonia or urea as a reactant.

**Sulfate Products:** formed during the oxidation of $SO_2$ in the atmosphere.

**Nitrate Products:** formed through a complex series of reactions that convert $NO_x$ to nitrates - vehicle emissions and fossil fuel burning.

**Crustal Products:** components that are the result from the weathering of Earth's crust—ocean salt and volcanic discharges— aluminum, calcium, iron, titanium, and silicon—released by metals production, and can be resuspended in the atmosphere by mechanisms that stir up fine dust, such as mining, agricultural processes, and vehicle traffic.

**Elemental Carbon:** carbon in the form of soot- diesel engine emissions, wood-burning fireplaces, and forest fires.

**Organic Carbon:** may be released directly, but are also formed through a series of chemical reactions in the air, mostly as a result of the burning of fossil fuels and wood.

# The Air Quality Index

The Air Quality Index (AQI) is a national air standard rating system developed by the U.S. Environmental Protection Agency. The AQI is used statewide to provide the public, on a daily basis, with an analysis of air pollution levels and possible related health risks.

Generally, an index scale of 0 to 500 is used to assess the quality of air, and these numbers are synchronized with a corresponding descriptor word such as: Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, and Very Unhealthy. To protect public health the EPA has set an AQI value of 100 to correspond to the NAAQS for the following criteria pollutants: Ozone ($O_3$), Sulfur Dioxide ($SO_2$), Carbon Monoxide (CO), Particulate Matter 10 ($PM_{10}$), Particulate Matter 2.5 ($PM_{2.5}$), and Nitrogen Dioxide ($NO_2$).

The AQI for a reporting region equates to the highest rating recorded for any pollutant within that region. Therefore, the larger the AQI value, the greater level of air pollution present, and the greater expectation of potential health concerns. However, this system only addresses air pollution in terms of acute health effects over time periods of 24 hours or less and does not provide an indication of chronic pollution exposure over months or years. Figure 40 shows how the recorded concentrations correspond to the AQI values, descriptors and health advisories. Each day the AQI values are available to the public through Georgia EPD's Ambient Air Monitoring website at http://amp.georgiaair.org/.

| Maximum Pollutant Concentration | | | | | | | AQI Value | Descriptor | EPA Health Advisory |
|---|---|---|---|---|---|---|---|---|---|
| $PM_{2.5}$ | $PM_{10}$ | $SO_2$ | $O_3$ | $O_3$ | CO | $NO_2$ | | | |
| (24hr) µg/m$^3$ | (24hr) µg/m$^3$ | (1hr)* ppm | (8hr)^ ppm | (1hr) ppm | (8hr) ppm | (1hr) ppm | | | |
| 0.0–12.0 | 0– 54 | 0– 0.035 | 0.000–0.059 | None | 0.0–4.4 | 0–0.053 | 0 to 50 | **Good (green)** | Air quality is considered satisfactory, and air pollution poses little or no risk. |
| 12.1–35.4 | 55–154 | 0.036–0.075 | 0.060–0.075 | None | 4.5–9.4 | 0.054-0.100 | 51 to 100 | **Moderate (yellow)** | 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 the condition of the air may experience respiratory symptoms. |
| 35.5–55.4 | 155 – 254 | 0.076 – 0.185 | 0.076 – 0.095 | 0.125 – 0.164 | 9.5–12.4 | 0.101-0.360 | 101 to 150 | **Unhealthy for Sensitive Groups** | Members of sensitive groups (people with lung or heart disease) are at greater risk from exposure to particle pollution. Those with lung disease are at risk from exposure to ozone. The general public is not likely to be affected in this range. |
| 55.5–150.4 | 255–354 | 0.186–0.304* | 0.096–0.115 | 0.165–0.204 | 12.5–15.4 | 0.361-0.649 | 151 to 200 | **Unhealthy (red)** | Everyone may begin to experience health effects in this range. Members of sensitive groups may experience more serious health effects. |
| 150.5–250.4 | 355–424 | 0.305–0.604* | 0.116–0.374 | 0.205–0.404 | 15.5–30.4 | 0.650–1.249 | 201 to 300 | **Very Unhealthy (purple)** | AQI values in this range trigger a health alert. Everyone may experience more serious health effects. When the AQI is in this range because of ozone, most people should restrict their outdoor exertion to morning or late evening hours to avoid high ozone exposures. |
| 250.5–350.4 | 425–504 | 0.605–0.804* | None^ | 0.405 – 0.504 | 30.5–40.4 | 1.250–1.649 | 301 to 400 | **Hazardous (maroon)** | AQI values over 300 trigger health warnings of emergency conditions. The entire population is more likely to be affected. |
| 350.5–500 | 505–604 | 0.805–1.004* | None^ | 0.505–0.604 | 40.5–50.4 | 1.650–2.049 | 401 to 500 | | |

Figure 40. The AQI, *AQI values of 200 or greater are calculated with 24-hr $SO_2$ concentrations, ^AQI values of 301 or greater are calculated with 1-hr $O_3$ concentrations. ***AQI numbers above 100 may not be equivalent to a violation of the standard*

# 2016 AQI Values Summary for Georgia

| Air Quality Index Summary by CBSA | | | | | | |
|---|---|---|---|---|---|---|
| Number of Days | | | | | | |
| Pollutants Monitored in 2016 | Good (0-50) | Moderate (51-100) | Unhealthy for Sensitive Groups (101-150)** | Unhealthy (151-200)** | Very Unheathy (201-300)** | Hazardous (>300)** |
| **Albany** | | | | | | |
| $PM_{2.5}$ | 263 | 100 | - | - | - | - |
| **Americus** | | | | | | |
| $O_3$ | 219 | 26 | 1 | - | - | - |
| **Athens-Clark County** | | | | | | |
| $O_3$, $PM_{2.5}$ | 295 | 61 | 4 | 2 | - | - |
| **Atlanta-Sandy Springs-Roswell** | | | | | | |
| $O_3$, $NO_2$, $PM_{2.5}$, CO, $SO_2$, $PM_{10}$ | 105 | 229 | 28 | 4 | - | - |
| **Augusta-Richmond County, GA-SC** | | | | | | |
| $O_3$, $PM_{2.5}$, $PM_{10}$ | 255 | 104 | 5 | 2 | - | - |
| **Brunswick** | | | | | | |
| $O_3$, $PM_{2.5}$ | 317 | 27 | 2 | - | - | - |
| **Chattanooga, TN-GA** | | | | | | |
| $O_3$, $PM_{2.5}$ | 227 | 127 | 2 | 3 | - | - |
| **Columbus, GA-AL** | | | | | | |
| $O_3$, $PM_{2.5}$ | 264 | 95 | 5 | - | - | - |
| **Dalton** | | | | | | |
| $O_3$ | 223 | 40 | 1 | - | - | - |
| **General Coffee** | | | | | | |
| $PM_{2.5}$ | 21 | 2 | - | - | - | - |
| **Gainesville** | | | | | | |
| $PM_{2.5}$ | 103 | 14 | 1 | 1 | - | - |
| **Macon** | | | | | | |
| $O_3$, $SO_2$, $PM_{2.5}$ | 267 | 94 | 5 | - | - | - |
| **Rome** | | | | | | |
| $SO_2$, $PM_{2.5}$ | 287 | 78 | 1 | - | - | - |
| **Savannah** | | | | | | |
| $O_3$, $SO_2$, $PM_{2.5}$ | 304 | 59 | 3 | - | - | - |
| **Summerville** | | | | | | |
| $O_3$ | 221 | 25 | - | - | - | - |
| **Valdosta** | | | | | | |
| $PM_{2.5}$ | 276 | 51 | - | - | - | - |
| **Warner Robins** | | | | | | |
| $PM_{2.5}$ | 306 | 44 | 2 | - | - | - |

Table 1. 2016 AQI summary data, most days had an AQI value in the ‘Good’ (0-50) category for all the sites.

## Atlanta-Sandy Springs-Roswell MSA

Figure 41 shows in more detail the AQI values for the Atlanta-Sandy Springs-Roswell MSA. There were 32 days with an AQI value above 100 in 2016. Ozone is a major driver of an elevated AQI and can be higher in the summer months due to increased sunlight. Higher ozone and $PM_{2.5}$ concentrations are the primary sources of AQI values in the "Unhealthy for Sensitive Groups" category in the Atlanta-Sandy Springs-Roswell MSA.

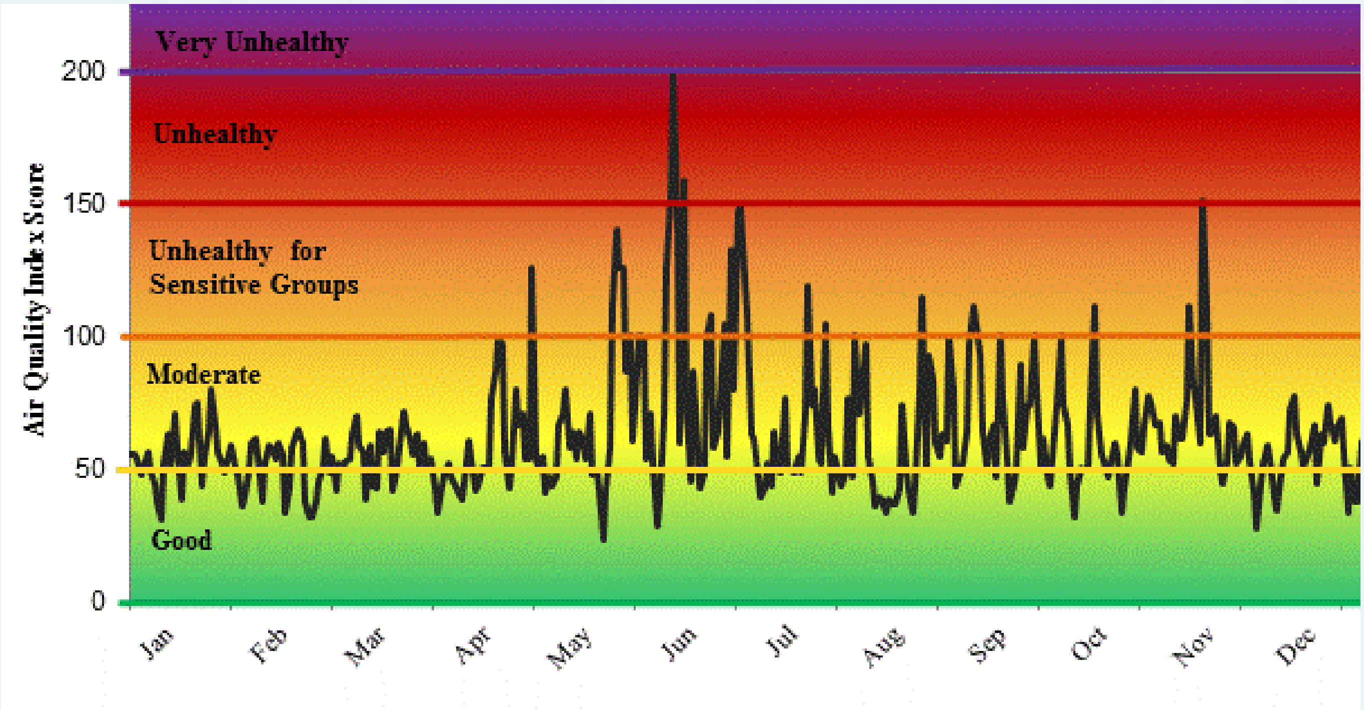



Figure 41. 2016 AQI Values for the Atlanta-Sandy Springs-Roswell MSA

# PHOTOCHEMICAL ASSESSMENT MONITORING STATIONS (PAMS)

To better understand ozone formation, EPD monitors oxides of nitrogen, volatile organic compounds (VOCs), carbonyl compounds, and meteorological parameters at the PAMS site.

Isoprene, the tracer for VOCs emissions from vegetation, is by far the largest contributor to ozone formation at the PAMS site. It is naturally released in large quantities by conifer trees, which are very abundant in the Southeastern United States.

## Georgia Monitoring Information

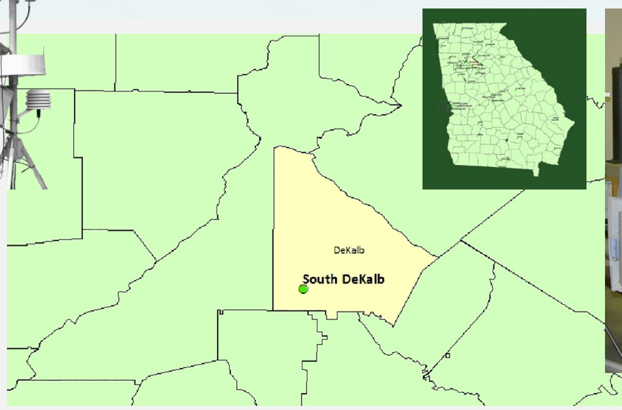



Figure 42. Georgia's PAMS monitoring site

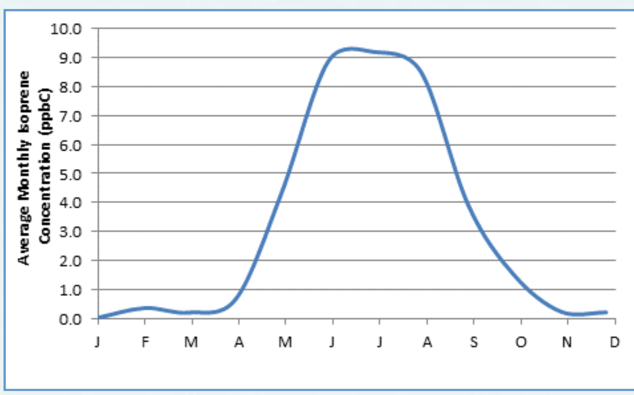
MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

[17]https://www.perkinelmer.com/lab-solutions/resources/docs/APP_Analysis-of-VOCs-in-Air-Using-EPA-Method-TO-17-011909_01.pdf

### Measurement Techniques

- Throughout the year, 24-hour integrated volatile organic compounds samples are taken with a canister every sixth day and analyzed in the EPD laboratory for 56 hydrocarbon compounds using a gas chromatograph with mass spectroscopy detection (GC/MS).
- Additionally, from June through August, hydrocarbon samples are analyzed hourly at the South DeKalb PAMS site using a gas chromatography unit with a Flame Ionization Detector (FID). [17]

The amount of isoprene emissions from conifers varies seasonally, with emissions increasing as length of daylight and temperature increases (Figure 43).



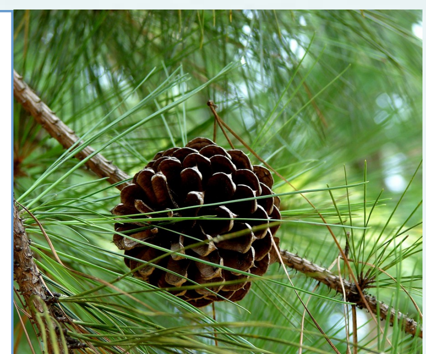



Figure 43. Average yearly profile of isoprene

Toluene (generally the most abundant anthropogenic species in urban air) reaches the air from a variety of sources such as combustion of fossil fuels and evaporative emissions, motor vehicle fuel and is also used as a common solvent in many products such as paint. It is relatively constant throughout the year, suggesting a steady level of emissions year-round (Figure 44).

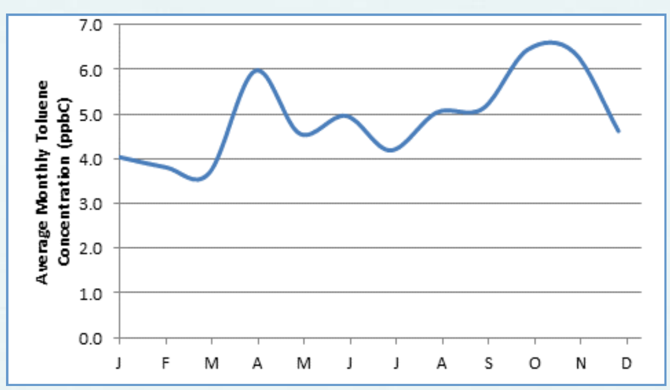



Figure 44. Toluene average annual occurrence

## Carbonyl Compounds

Carbonyl compounds define a large group of organic compounds, which include acetaldehyde, acrolein, and formaldehyde. These compounds can lead to ozone formation.

Sources of carbonyl compounds include vehicle exhaust, cigarette smoke, paper production, stationary internal combustion engines and turbines, solvents, polymers, plastics, and the combustion of wood.

Depending on the amount inhaled, exposure to these compounds can cause irritation to the eyes, ears, nose, and throat, dizziness, and damage to the lungs.

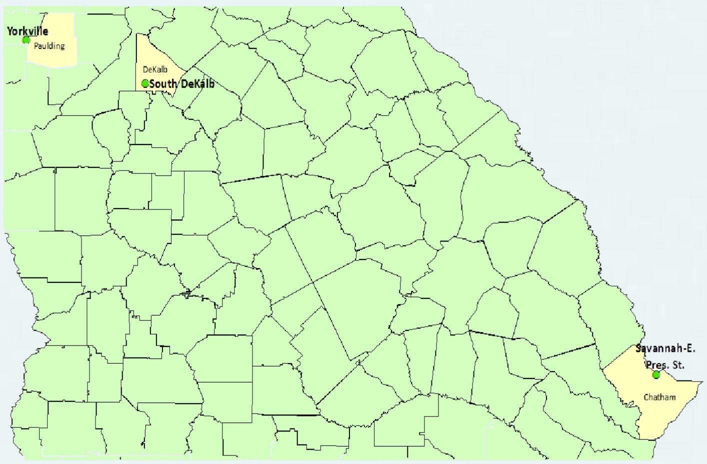



Figure 45. Georgia's carbonyls monitoring sites

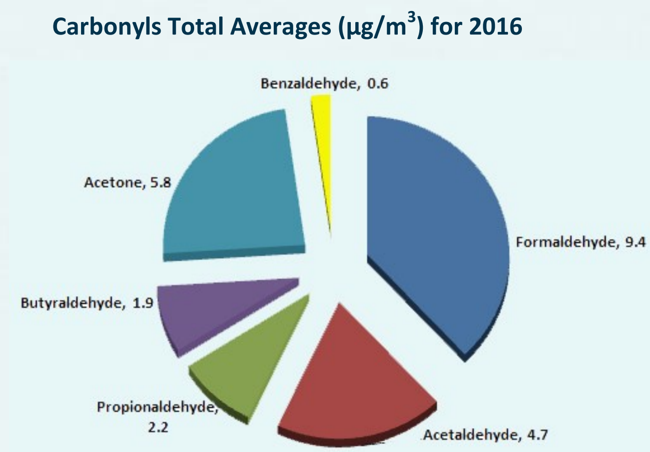



Figure 46. Total Average 24-hour carbonyl concentrations by species

### Measurement Techniques

The carbonyls are sampled with two types of methods.

- One method includes an absorbent cartridge filled with dinitrophenylhydrazine (DNPH), using High Performance Liquid Chromatography analysis. [18]
- Another collection method is the canister sampler that is used for sampling volatile organic compounds at the Air Toxics sites. Acrolein is analyzed using this method. The graph to the right shows this data.

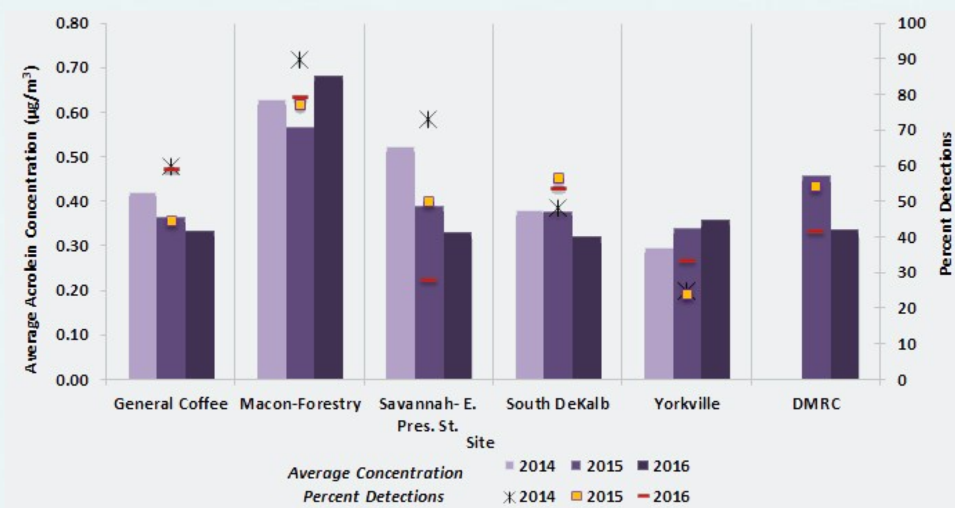



Figure 47. Acrolein concentrations and percent detections, 2014- 2016

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUES

[18] http://www.atec-online.com/

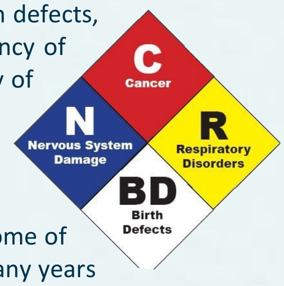
# AIR TOXICS MONITORING

*In order for EPD to expand the understanding of the quality of Georgia's air regarding ambient concentrations of hazardous air pollutants, EPD began state-sponsored air toxics monitoring activities.*

Air Toxics are those 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.

Air toxic pollutants, or hazardous air pollutants (HAPs), are a group of air pollutants that have a wide variety of sources—mobile sources (such as vehicles), stationary industrial sources, small area sources, indoor sources (such as cleaning materials), and other environmental sources (such as volcanoes and wildfires). The lifetime, transportation, and make-up of these pollutants are affected by both weather (rain and wind) and landscape (mountains and valleys). In addition, some HAPs that are no longer used, but were commonly used in the past, can still be found in the environment today.

Negative effects on human health range from headaches, nausea, and dizziness to cancer, birth defects, problems breathing, and other serious illnesses. These effects can vary depending on frequency of exposure, length of exposure time, health of the person that is exposed, along with the toxicity of the compound.




People can be exposed to HAPs by breathing contaminated air, consuming food or water contaminated by air pollutants, or touching contaminated water or soil.

Some of the substances tend to have only one critical effect, while others may have several. Some of the effects may occur after a short exposure and others appear after long-term exposure, or many years after being exposed.

These air pollutants also affect the environment. Wildlife experience symptoms similar to those in humans and pollutants accumulate in the food chain. Many air pollutants can also be absorbed into waterways and have toxic effects on aquatic wildlife.

From the list of 187 HAPs compounds identified by EPA, toxic compounds monitored include metals, volatile organic compounds, semi-volatile organic compounds, and carbonyl compounds.

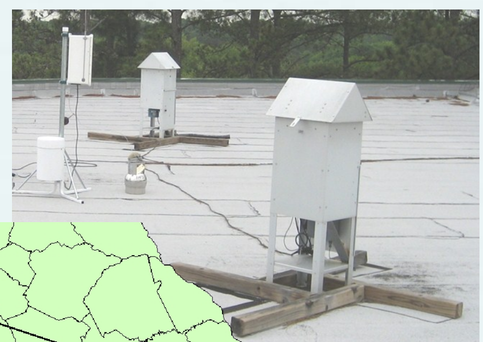
## Monitoring Techniques

Three types of samplers are used at all locations: the HIVOL, PUF, and canister. [19]

- The HIVOL sampler collects quartz fiber filters that are subjected to a chemical digestion process and are analyzed on an inductively coupled plasma spectrometer.
- PUF (polyurethane foam) sampler is used for sampling semi-volatile organic compounds (SVOCs)—A multi-layer cartridge is prepared which collects both the particulate fraction and the volatile fraction of this group of compounds, analyzed using a gas chromatograph.
- The canister sampler for VOCs is analyzed using a gas chromatograph with mass spectroscopy detection (GC/MS).

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUES

[19]https://tisch-env.com/high-volume-air-samplers/



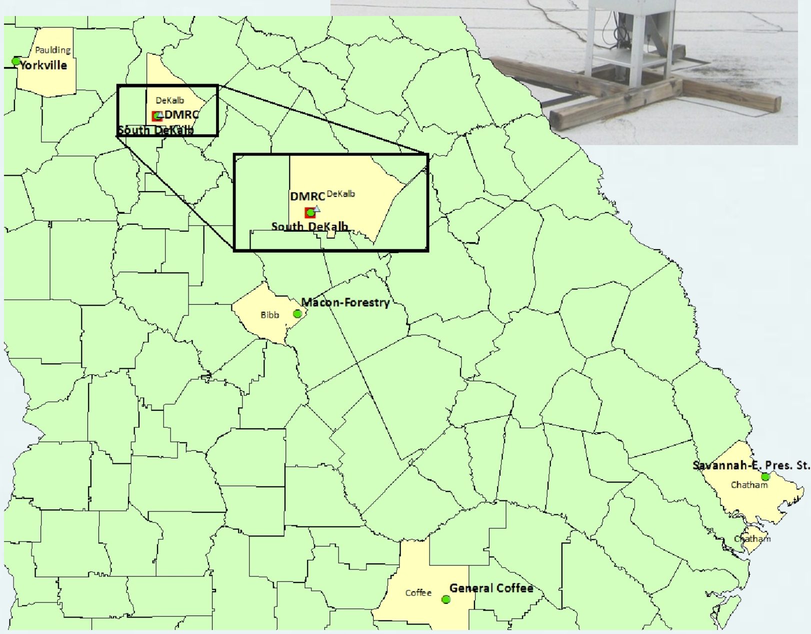
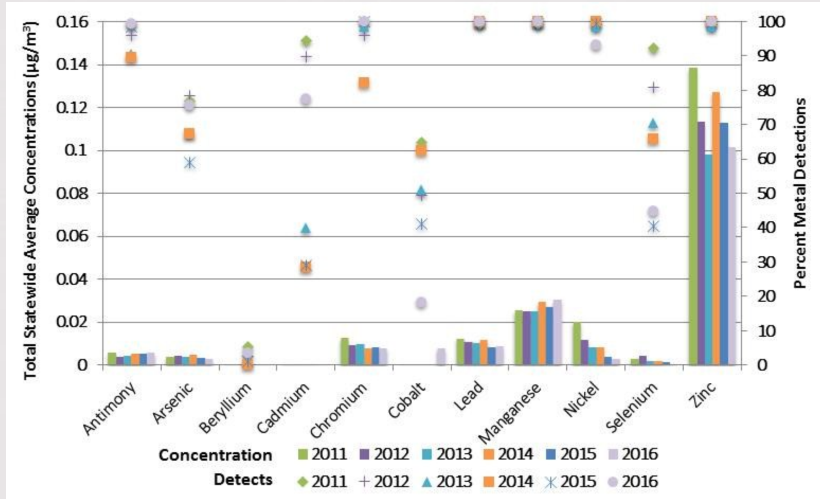



Figure 48. Air Toxics monitoring sites

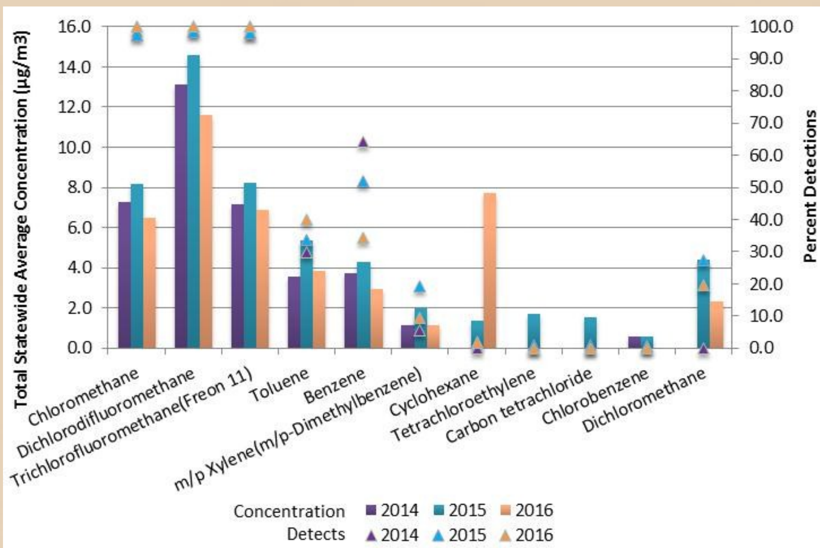
## METALS

**Sources include:**

- gasoline and diesel exhaust
- batteries
- soil and water
- burning coal
- emissions from iron and steel production
- lead smelters
- operation of iron and steel production plants
- by-product of mining and smelting sulfide ores
- used in industrial processes
- tires
- radioactive metal in radiotherapy
- photocells and solar panels




## VOLATILE ORGANIC COMPOUNDS




**Sources include:**

- various industrial, stationary and mobile sources

## SEMI-VOLATILE ORGANIC COMPOUNDS

**Sources include:**

- burning of coal, oil, gas, and garbage
- found in dyes, cigarette smoke, coal tar, plastics, and pesticides

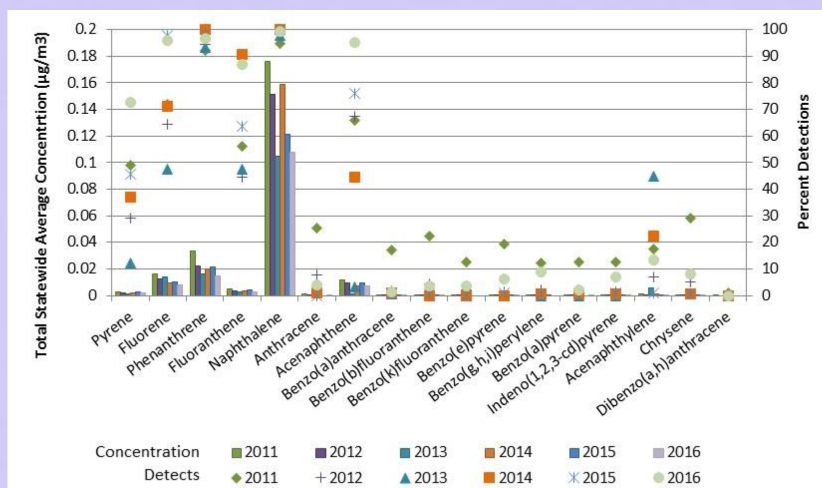



Figure 49. Air Toxics data

## NATTS

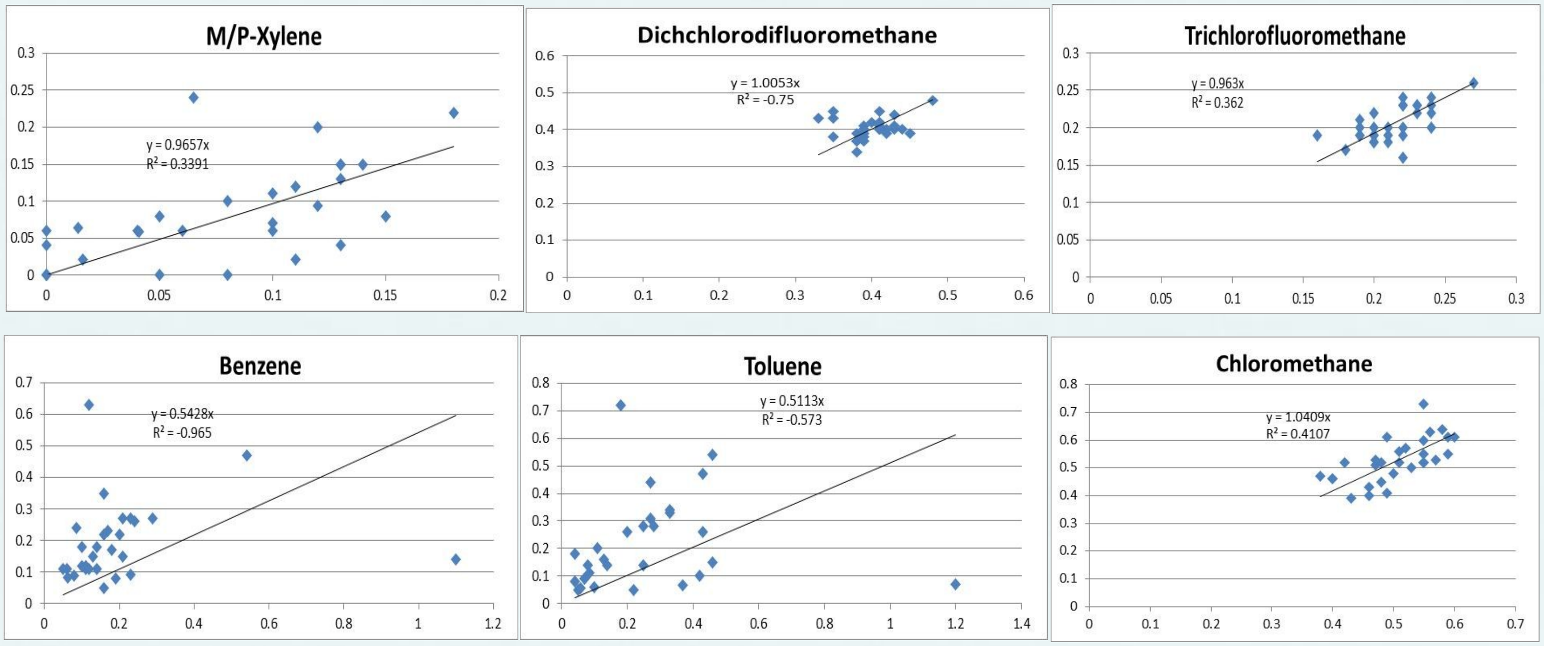
The National Air Toxics Trends Station (NATTS) network was established in 2003 at the South DeKalb site and is intended for long-term operation for the purpose of discerning national trends.

- The NATTS Network consists of 27 sites nationwide, 20 urban and 7 rural.
- The South DeKalb site monitors the same compounds as other air toxics sites, as well as black carbon, and carbonyls.
- As part of the NATTs network, metals are monitored on a $PM_{10}$ sampler at the South DeKalb site. The sample is analyzed using inductively coupled plasma mass spectrometry (ICP-MS).

## Near-Road VOCs

The DMRC site is set up as part of the Near-Road Monitoring Network and is located within 40 meters of I-285, a heavily traveled interstate. The South DeKalb site is approximately a mile away from the DMRC site and is located 580 meters from the same interstate.


The following scatterplots and correlations were created to compare select VOCs that had several pollutant detections at both the South DeKalb and DMRC sites.




| VOC | Correlation Coefficient (r) |
|---|---|
| Toluene | 0.13398 |
| M/P Xylene | 0.61461 |
| Chloromethane | 0.65920 |
| Trichlorofluoromethane | 0.65416 |
| Dicholrodifluoromethane | 0.23494 |
| Benzene | 0.15009 |

Figure 50. Comparison of select VOCs at the South DeKalb and DMRC sites

A few of the VOCs at the South DeKalb and DMRC sites have relatively low correlations. This suggests that some VOCs found in vehicle exhaust dissipate quickly in the air.

## Black Carbon

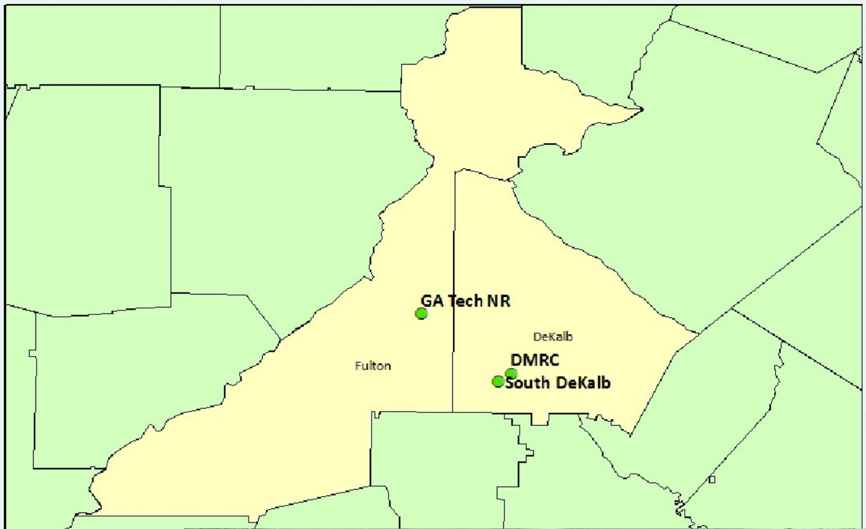
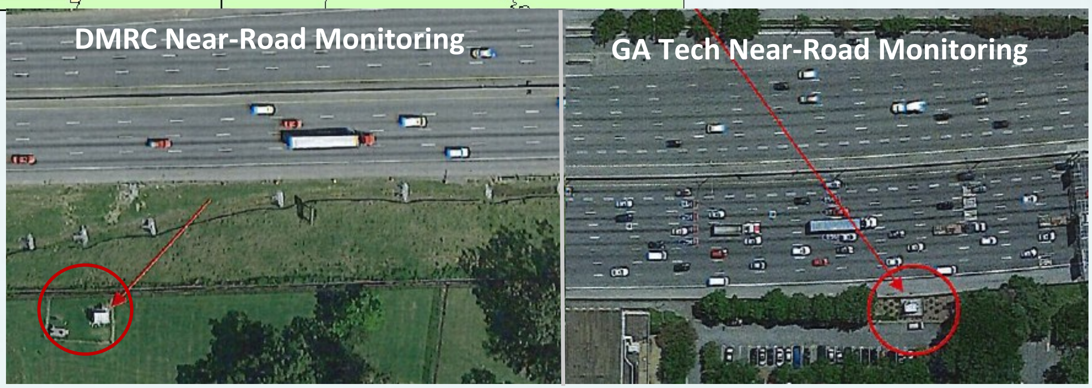
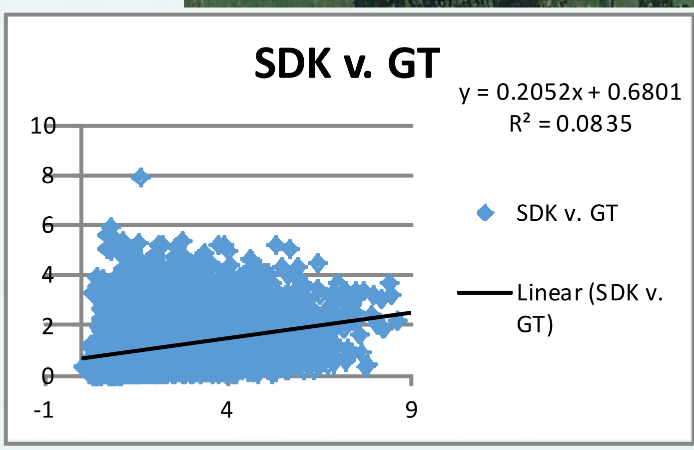
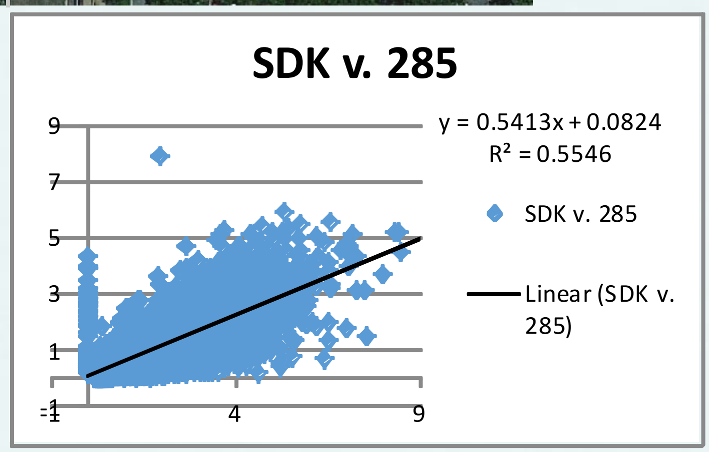



Figure 51. Black carbon monitoring sites




The black carbon scatterplots show a relatively high correlation ($R^2$=0.5546) between the South DeKalb and DMRC sites. The scatterplots that include GA Tech have less correlation, ($R^2$=0.0835 and 0.1739) which could be an indication of less truck diesel traffic (black carbon) in the downtown corridor versus the I-285 perimeter.

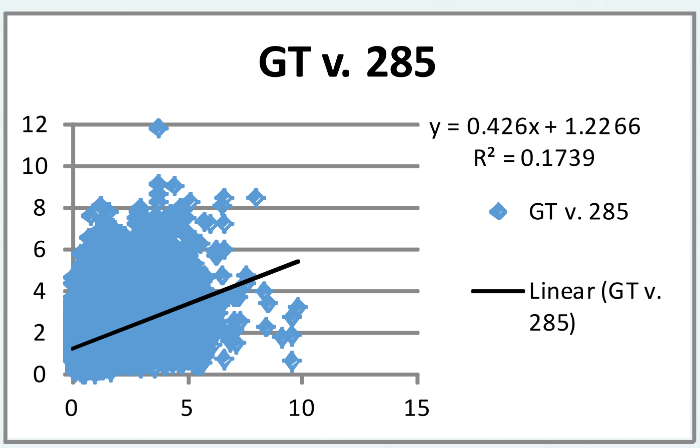


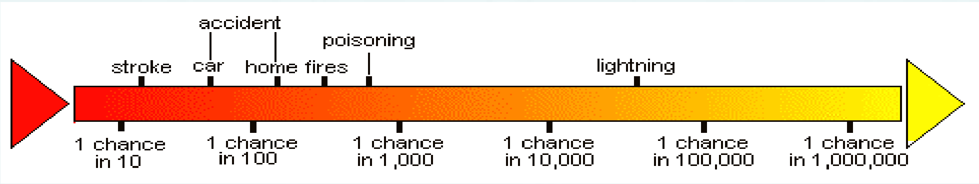

Figure 52. Comparison of black carbon at the South DeKalb, Georgia Tech, and DMRC sites

# RISK ASSESSMENT

The following risk assessment reflects data collected at the Air Toxics Network (ATN) and the National Air Toxics Trends Station (NATTS). Some of the chemicals monitored in the ATN are also monitored at Photochemical Assessment Monitoring Stations (PAMS); therefore, those chemicals were evaluated and compared to concentrations measured at nearby ATN sites for this report.

To put into perspective the risks from environmental hazards, the continuum below presents risk statistics for some familiar events. Risk analysts describe cancer risks numerically in scientific notation, for example 1 x 10[-5], 1 x $10^{-5}$ or 1.00E-05, which means that there is one chance in 100,000 of an event occurring. It is important to note that these risk statistics are population averages, while risk analysts usually estimate risk to the maximum exposed individual. Additionally, it should be noted that these risk values are considered additional risk. That is, risk above the normal background risk from exposure in everyday life.

### Putting Risks in Perspective




## Methods

The initial evaluation consisted of a comparison of the monitored results to "health based" screening values. These values were calculated using procedures recommended in EPA's latest guidance on risk assessment for air toxics, 'A Preliminary Risk-Based Screening Approach for Air Toxics Monitoring Data Sets' (https://archive.org/details/APreliminaryRisk-basedScreeningApproachForAirToxicsMonitoringDataSets). Briefly, EPA's prioritized chronic dose-response (toxicity) values for both non-cancer (reference concentrations, RfC) and cancer (inhalation unit risks, IUR) effects were used to generate screening air concentrations. To screen for non-cancer effects, the reference concentration was used as a starting point. However, to account for possible exposure to multiple contaminants acting on the same target organ or body system, the screening air concentration was obtained by dividing the RfC by a factor of 10. Screening values for the cancer endpoint were determined by calculating air concentrations equivalent to a risk level of one in one million. Most screening values utilized in this assessment are listed in Appendix A of the above mentioned guidance document and updated "Table 1. Prioritized Chronic Dose-Response Values for Screening Risk Assessments (5/09/2014)" (https://www.epa.gov/sites/production/files/2014-05/documents/table1.pdf). The screening values are derived from the dose-response values: cancer-based air screening values=1E-06/IUR and non-cancer based air screening values=RfC x 0.1 x 1000. For a limited number of chemicals, other resources such as toxicity values from the Regional Screening Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017) were used to calculate conservative screening values protective of a worse-case residential exposure scenario. Assumptions were made that accounted for the potential for continuous exposure to air toxics for 24 hours per day for 70 years. The conservative screening process was utilized so that the chance of underestimating the potential for health impacts would be minimized, as chemicals were excluded from further quantitative analysis. The following figure shows the formulas used to calculate cancer risk and non-cancer hazard for chemicals that were carried beyond the screening process into the quantitative assessment.

**Formula for Calculating Risk Using IUR for Carcinogens:**

$$Risk = IUR * Conc$$

**Formula for Calculating Hazard Quotient Using RfC for Noncarcinogens:**

$$HQ = \frac{Conc}{RfC}$$

**Equation Parameters:**

Risk: Theoretical lifetime cancer risk (unitless probability)

HQ: Hazard quotient (unitless ratio)

Conc: Measured ambient air concentration in $\mu g/m^3$

IUR: Inhalation unit risk ($1/(\mu g/m^3)$)

RfC: Reference concentration ($\mu g/m^3$)

## Results and Interpretation

Seventy-one (71) air toxic chemicals were assessed at six sites in Georgia. Out of these 71 air toxic chemicals, nine (9) were found to be above the screening values. Table 2 shows the theoretical cancer risk and non-cancer hazard that would result from an individual breathing air containing the detected chemicals at the estimated concentrations daily for 70 years, or a full lifetime. These cancer risk and hazard quotient estimates are likely conservative because they were calculated assuming continuous exposure to outdoor air at breathing rates typical of moderate exertion. Real risk cannot be calculated, but may be substantially lower. Lifetime cancer risks for the limited number of chemicals exceeding screening values exceeded $1 \times 10^{-6}$ or one in one million, a value generally deemed as insignificant. However, lifetime cancer risks for these chemicals did not exceed $2 \times 10^{-5}$ or two in one-hundred thousand. This risk estimate falls within EPA's acceptable cancer risk range of $1 \times 10^{-6}$ to $1 \times 10^{-4}$ commonly used for regulatory decision making.

In contrast to cancer risks, non-cancer hazards are not expressed as a probability of an individual suffering an adverse effect. Instead, the non-cancer hazard to individuals is expressed in terms of a ratio defined as the hazard quotient (HQ). These HQ values relate daily exposure concentrations, or dose, to a concentration or an amount thought to be without appreciable risks of causing deleterious non-cancer effects in sensitive individuals as well as the general population. HQ values less than 1.0 indicate the air "dose" is less than the threshold dose required to cause toxic effects other than cancer.

| Site | Chemical | CAS # | Annual Average ($\mu g/m^3$) | Detection Frequency | Cancer Risk | Hazard Quotient |
|---|---|---|---|---|---|---|
| Macon-Forestry | Arsenic | 7440-38-2 | 5.9E-04 | 22/29 | 3.E-06 | 0.04 |
| | Chromium | 18540-29-9 | 1.4E-03 | 29/29 | 1.E-05 | 0.01 |
| | Benzene | 71-43-2 | 4.2E-01 | 7/29 | 3.E-06 | 0.01 |
| | 1,3 Butadiene | 106-99-0 | 2.9E-01 | 1/29 | 9.E-06 | 0.1 |
| | Acrolein | 107-02-8 | 6.8E-01 | 23/29 | N/A | 34 |
| Savannah-E. Pres. St. | Arsenic | 7440-38-2 | 4.8E-04 | 24/30 | 2.E-06 | 0.03 |
| | Chromium | 18540-29-9 | 1.7E-03 | 30/30 | 1.E-05 | 0.02 |
| | Acrolein | 107-02-8 | 3.3E-01 | 7/25 | N/A | 17 |
| | Bromomethane | 74-83-9 | 5.9E-01 | 3/25 | N/A | 0.1 |
| | Benzene | 71-43-2 | 4.5E-01 | 6/25 | 4.E-06 | 0.01 |
| General Coffee | Arsenic | 7440-38-2 | 3.7E-04 | 15/28 | 2.E-06 | 0.02 |
| | Chromium | 18540-29-9 | 1.2E-03 | 28/28 | 1.E-05 | 0.01 |
| | Benzene | 71-43-2 | 4.2E-01 | 2/22 | 3.E-06 | 0.01 |
| | Acrolein | 107-02-8 | 3.3E-01 | 13/22 | N/A | 17 |
| South DeKalb | Arsenic | 7440-38-2 | 5.9E-04 | 49/61 | 3.E-06 | 0.04 |
| | Chromium | 18540-29-9 | 1.8E-03 | 61/61 | 2.E-05 | 0.02 |
| | Acrolein | 107-02-8 | 3.2E-01 | 20/60 | N/A | 16 |
| | Benzene | 71-43-2 | 5.9E-01 | 32/60 | 5.E-06 | 0.02 |
| Yorkville | Arsenic | 7440-38-2 | 8.0E-04 | 24/29 | 3.E-06 | 0.05 |
| | Chromium | 18540-29-9 | 1.9E-03 | 29/29 | 2.E-05 | 0.02 |
| | Acrolein | 107-02-8 | 3.6E-01 | 15/28 | N/A | 18 |
| | Benzene | 71-43-2 | 4.2E-01 | 2/28 | 3.E-06 | 0.01 |
| DMRC | Benzene | 71-43-2 | 6.5E-01 | 17/29 | 5.E-06 | 0.02 |
| | Acrolein | 107-02-8 | 3.4E-01 | 12/29 | N/A | 17 |

CAS # is Chemical Abstracts Services number for each compound, which is a specific way to identify each compound.

Table 2. Site-specific detection frequency, mean concentration, cancer risk, and hazard quotient by location for chemicals that exceeded their screening values in 2016.

| Site | Aggregate Cancer Risk | Hazard Index |
|---|---|---|
| **Macon-Forestry** | 3.E-05 | 34 |
| **Savannah-E. Pres. St.** | 3.E-05 | 17 |
| **General Coffee** | 2.E-05 | 17 |
| **DMRC** | 5.E-06 | 17 |
| **South DeKalb** | 2.E-05 | 16 |
| **Yorkville** | 2.E-05 | 18 |

Table 3. Aggregate cancer risk and hazard index by site for 2016.

Figure 53 is a graphical representation of the data in Table 3, and it is also used to display the comparison between the previous two consecutive years of hazard indices and their respective cancer risks..

The screening values utilized in this assessment are listed in Appendix B.

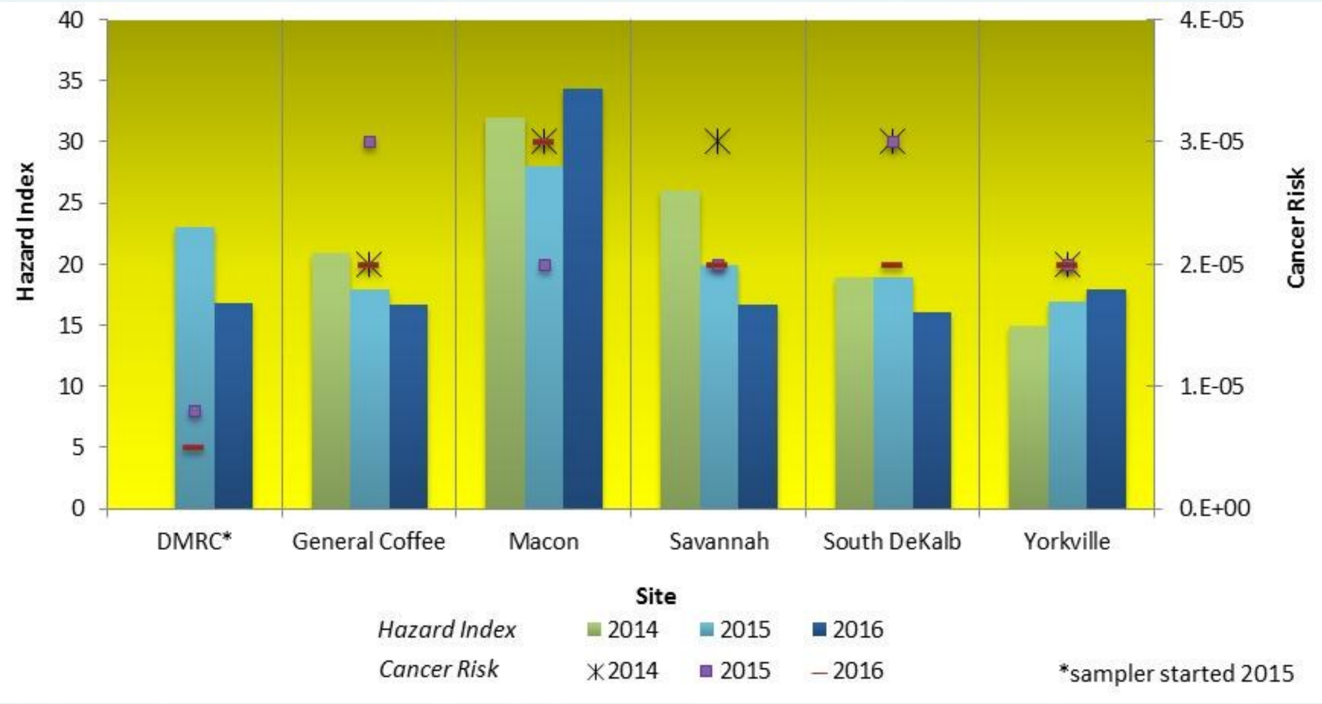



Figure 53. Aggregate cancer risk and hazard index by site for 2014-2016

The following table shows the summary information for the PAMS site. Of the chemicals that are evaluated in conjunction with the Air Toxics data, benzene and ethylbenzene were two chemicals found above the screening value at this site.

| Site | Chemical | CAS # | Detection Frequency | 1st Max | 2nd Max | Annual Average | Hazard Quotient | Cancer Risk |
|---|---|---|---|---|---|---|---|---|
| South DeKalb | Benzene | 71-43-2 | 61/61 | 13.4 | 12.1 | 3.8 | 0.1 | 3.E-05 |
| | Ethylbenzene | 100-41-4 | 39/61 | 4.8 | 4.8 | 1.5 | 1 | 4.E-06 |

Table 4. Detection frequency, 1st and 2nd maximums, mean, cancer risks, and hazard quotients for VOCs from the PAMs site which exceeded their screening levels in 2016.

There are three air monitoring sites in Georgia that collect carbonyls data in 2016, as discussed earlier. The risk assessment for this data is summarized in the following table.

| Site | Chemical | CAS # | Annual Average (µg/m$^3$) | Detection Frequency | Cancer Risk | Hazard Quotient |
|---|---|---|---|---|---|---|
| Savannah | Acetaldehyde | 75-07-0 | 1.6 | 23/30 | 4.E-06 | 0.2 |
| | Formaldehyde | 50-00-0 | 3.5 | 30/30 | 5.E-05 | 0.4 |
| Yorkville | Acetaldehyde | 75-07-0 | 2.0 | 28/30 | 4.E-06 | 0.2 |
| | Formaldehyde | 50-00-0 | 4.4 | 28/30 | 6.E-05 | 0.4 |
| South DeKalb | Acetaldehyde | 75-07-0 | 1.1 | 27/27 | 2.E-06 | 0.1 |
| | Propionaldehyde | 123-83-6 | 0.8 | 4/27 | N/A | 0.1 |
| | Formaldehyde | 50-00-0 | 1.5 | 26/26 | 2.E-05 | 0.1 |

Table 5. Detection frequency, mean, cancer risks, and hazard quotients for carbonyls which exceeded their screening levels in 2016.

This report summarizes the concentrations measured and associated cancer risk and hazard quotient as detailed above. For specific questions regarding public health, please contact:

**Franklin Sanchez, REHS**

*Director*

Chemical Hazards Program

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Atlanta, GA 30303-3142

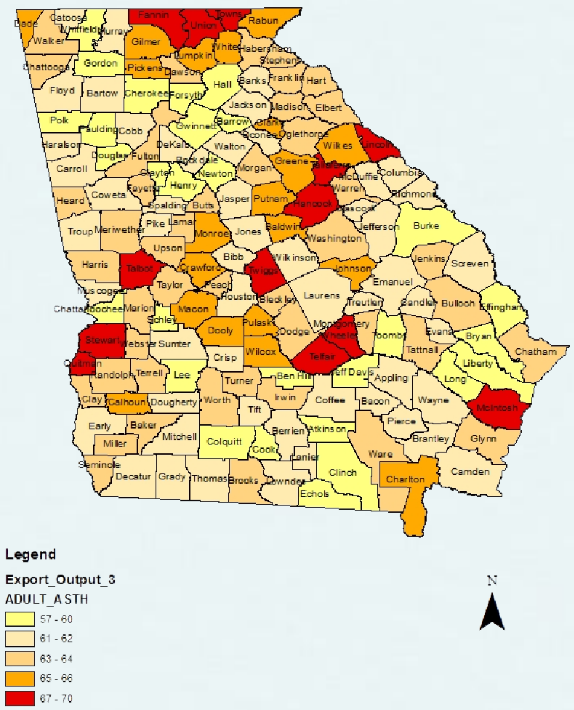
404.657.6534

Fax: 404.657.6516

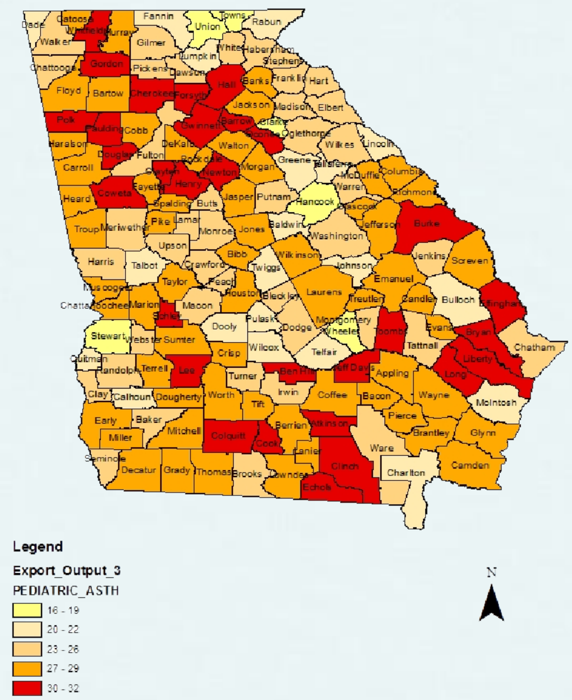
Franklin.Sanchez@dph.ga.gov

The maps included on the following page show the estimated rate of lung related diseases per county in Georgia. This is based on data obtained from the American Lung Association's 'Estimated Prevalence and Incidence of Lung Disease' (http://www.lung.org/assets/documents/research/estimated-prevalence.pdf). These rates are mapped as the number of estimated lung related disease cases per 1000 or 100 people in each county, based on 2012 data.

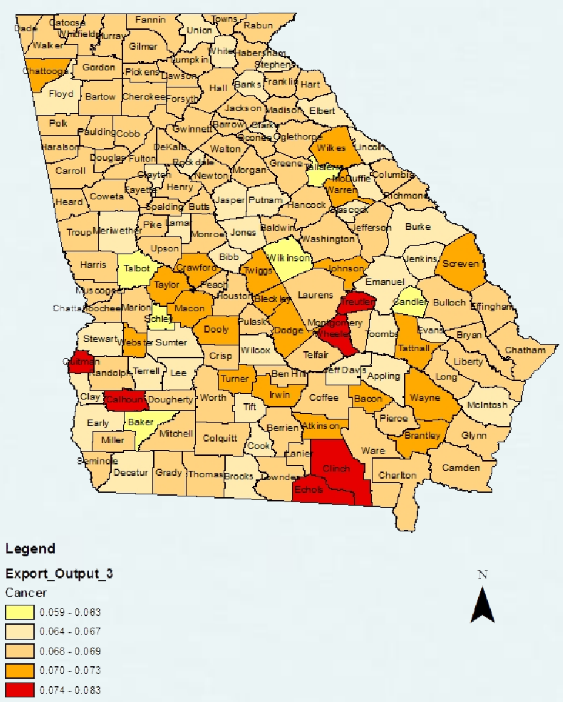
## Adult Asthma Rate Per 1000




## Pediatric Asthma Rate Per 1000




## Lung Cancer Rate Per 100




## COPD Rate Per 1000

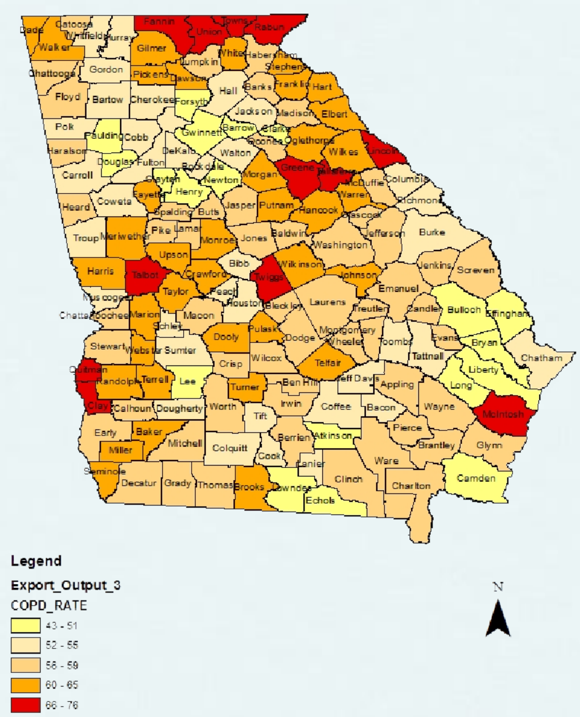



Figure 54. Estimated incidence of lung related diseases in Georgia

# METEOROLOGICAL REPORT

## State Climatology and Meteorological Summary of 2016

- The climate across North and Central Georgia varies based on a variety of factors, the most prominent of which is terrain.
- The Gulf of Mexico and the Atlantic Ocean are the two nearby maritime bodies that exert an important influence on the North Georgia climate, acting as major sources of moisture support.
- A complete suite of meteorological instrumentation is used to characterize meteorological conditions around metropolitan Atlanta. See Appendix C for details.

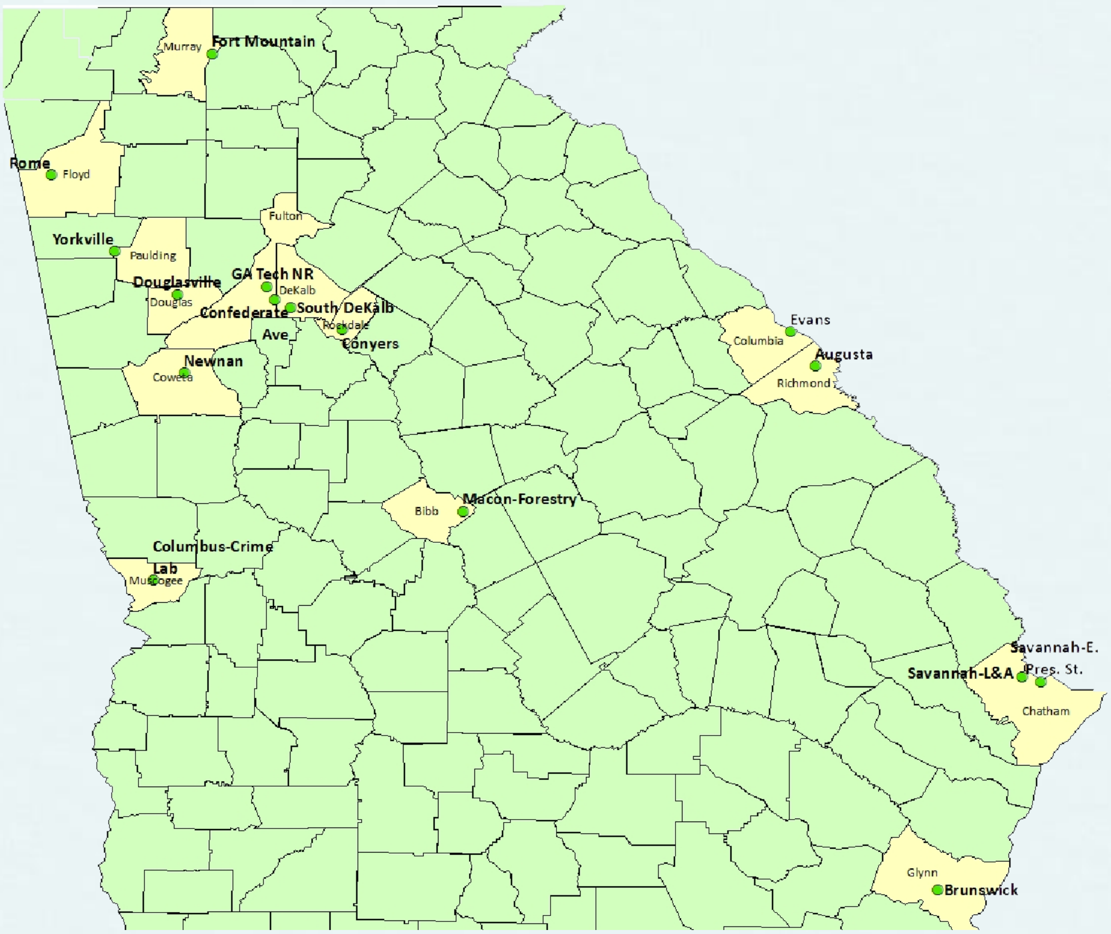



Figure 55. Meteorological Site Map


Figure 56. Sample meteorological instrumentation at EPD sites:
a) ceilometer, b) sonic anemometer, c) Temperature probe and relative humidity monitor, d) tipping bucket

# Meteorological Measurements for 2016

- The majority of locations in North and Central Georgia were much warmer than normal and drier than normal during 2016.
- A winter weather event impacted much of North Georgia from January 22nd through January 23rd, with light snow accumulations as far as south central Georgia.
- Several locations experienced record, or near-record, seasonal summer temperatures. Atlanta also experienced the 1st warmest Fall on record.


Figure 57. Total Snow January 22-23


Figure 58. Total Ice January 22-23

For more information regarding the Georgia Climate Office, see https://epd.georgia.gov/office-state-climatologist.

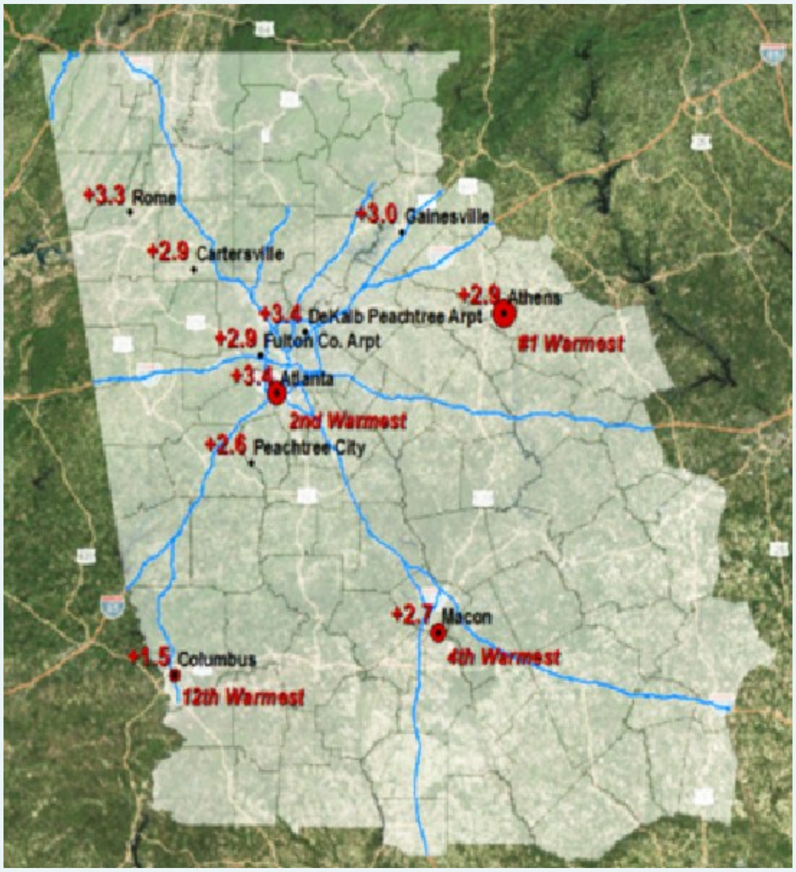



Figure 59. Seasonal Avg. Temperature (°F) and Rankings for Jun-Aug
*(National Weather Service at Peachtree City)*

| Site | Avg. Temp. and Current Ranking | Normal | Dep. from Normal | Previous Records |
|---|---|---|---|---|
| Athens | 67.4 (2nd Warmest) | 63.4 | +4.0 | 69.4 (1931) |
| Atlanta | 69.1 (#1 Warmest) | 63.6 | +5.5 | 67.8 (1931) |
| Columbus | 70.3 (5th Warmest) | 66.8 | +3.5 | 72.1 (1919) |
| Macon | 68.6 (4th Warmest) | 65.3 | +3.3 | 69.4 (1985) |
| Cartersville | 65.9 | 61.1 | +4.8 | |
| DeKalb Peachtree Arpt | 66.8 | 62.5 | +4.3 | |
| Fulton Co. Arpt | 66.6 | 62.8 | +3.8 | |
| Gainesville | 66.7 | 62.0 | +4.7 | |
| Peachtree City | 65.9 | 62.1 | +3.5 | |
| Rome | 66.6 | 61.3 | +5.3 | |

Figure 60. Seasonal Avg. Temperature (°F) and Rankings for Sept. – Nov.
*(National Weather Service at Peachtree City)*

# Drought Conditions for Georgia

- The Northeast Alabama, Northwest Georgia, and Southern Tennessee core drought area started showing noticeable rainfall deficits in March 2016.
- East Central Georgia saw rapidly degrading conditions in early summer 2016.
- A newer core emerged south of Macon area that began in early fall 2016, and expanded towards south Georgia along I-75, and along the Alabama/Georgia border.
- Drought led to North Georgia wildfire activity and air quality issues in mid-November 2016.

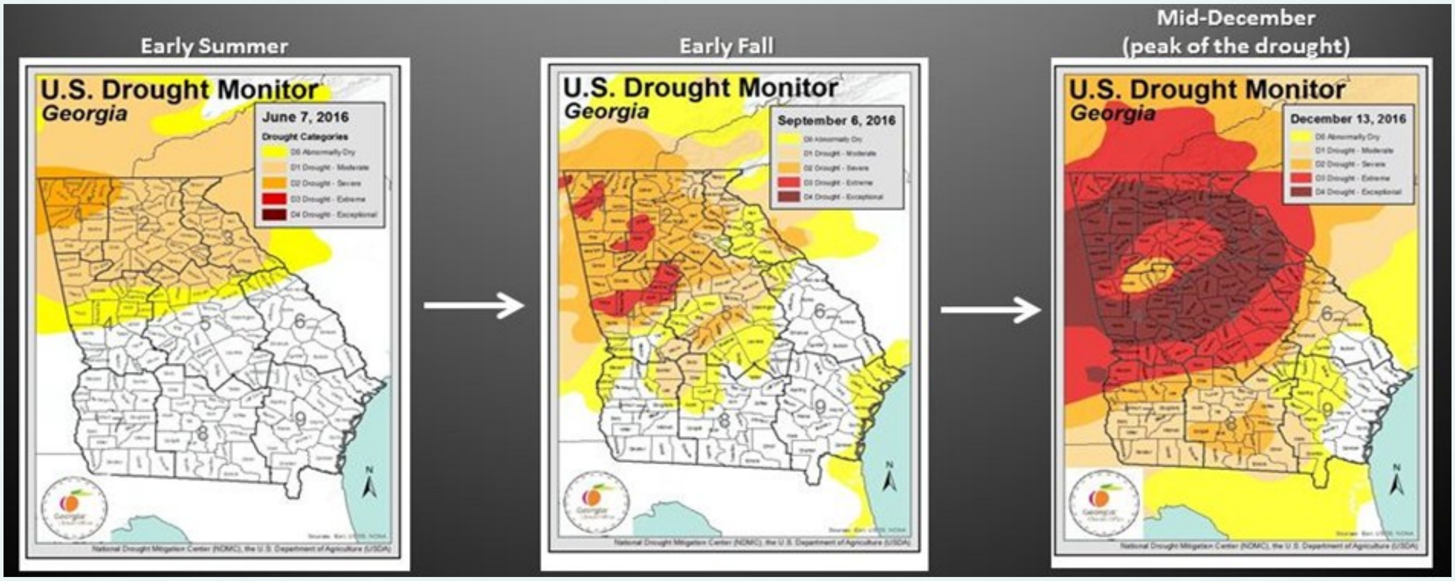



Figure 61. Drought Conditions in Georgia

## Agricultural Impacts

Agricultural impacts were widespread and devastating to farmers, who described extremely dry pastures, bringing in hay from out of state with no second cutting, losing their entire corn crop and feeding it to livestock, noticing ribs showing on lactating cows, and inability to plant winter grazing.

# Air Quality Forecasting Statistics

Table 6: Observed Air Quality

| | | Observed # of Days in AQI Category | | | |
|---|---|---|---|---|---|
| **Metro Area and Pollutant** | **Total # of days in record** | **Good** | **Moderate** | **Unhealthy for Sensitive Groups** | **Unhealthy** |
| **Atlanta Ozone** | 214 | 101 | 84 | 26 | 3 |
| **Macon Ozone** | 181 | 147 | 31 | 3 | 0 |
| **Atlanta $PM_{2.5}$** | 343 | 169 | 171 | 3 | 0 |
| **Columbus $PM_{2.5}$** | 322 | 278 | 43 | 1 | 0 |

Note: Total number of days in record based on AirNow data for observed measurements.

Table 7: Predicted Air Quality

| | Hits | Misses | False Alarms | Bias | Gross Error | Correlation (-1 to +1) | % Accurate 2 categories | % Accurate 5 categories |
|---|---|---|---|---|---|---|---|---|
| **Atlanta Ozone** | 12 | 17 | 10 | 1.6 ppbv | 7.6 ppbv | 0.65 | 87 | 63 |
| **Macon Ozone** | 1 | 2 | 1 | 3.8 ppbv | 7.3 ppbv | 0.70 | 98 | 80 |
| **Atlanta $PM_{2.5}$** | 1 | 2 | 1 | 0.2 mg/$m^3$ | 2.7 mg/$m^3$ | 0.47 | 99 | 72 |
| **Columbus $PM_{2.5}$** | 0 | 1 | 0 | 1.0 mg/$m^3$ | 2.8 mg/$m^3$ | 0.48 | 99+ | 87 |

**Notes:**

Hits are the number of days on which an observed exceedance of the daily NAAQS was correctly predicted.

Misses are the number of days on which an observed exceedance of the daily NAAQS was not predicted.

False Alarms are the number of days on which an exceedance of the daily NAAQS was predicted, but was not later observed.

Bias is the average tendency to over-predict (positive bias) or under-predict (negative bias) the observed pollutant concentration.

Gross Error is the average absolute error of the predictions relative to the observations.

Correlation is a measure of the ability to predict the relative change in observed concentrations. Higher positive correlation implies that the predictions are accurately anticipating changes in the observed concentrations.

% Accurate 2 categories is the percentage of days when the forecast prediction correctly matched the observation for the "no smog alert" / "smog alert" condition (i.e. 2 categories).

% Accurate 5 categories is the percentage of days when the forecast prediction correctly matched the observation for five categories of the Air Quality Index (Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, and Very Unhealthy).

Observed and Predicted Air Quality:

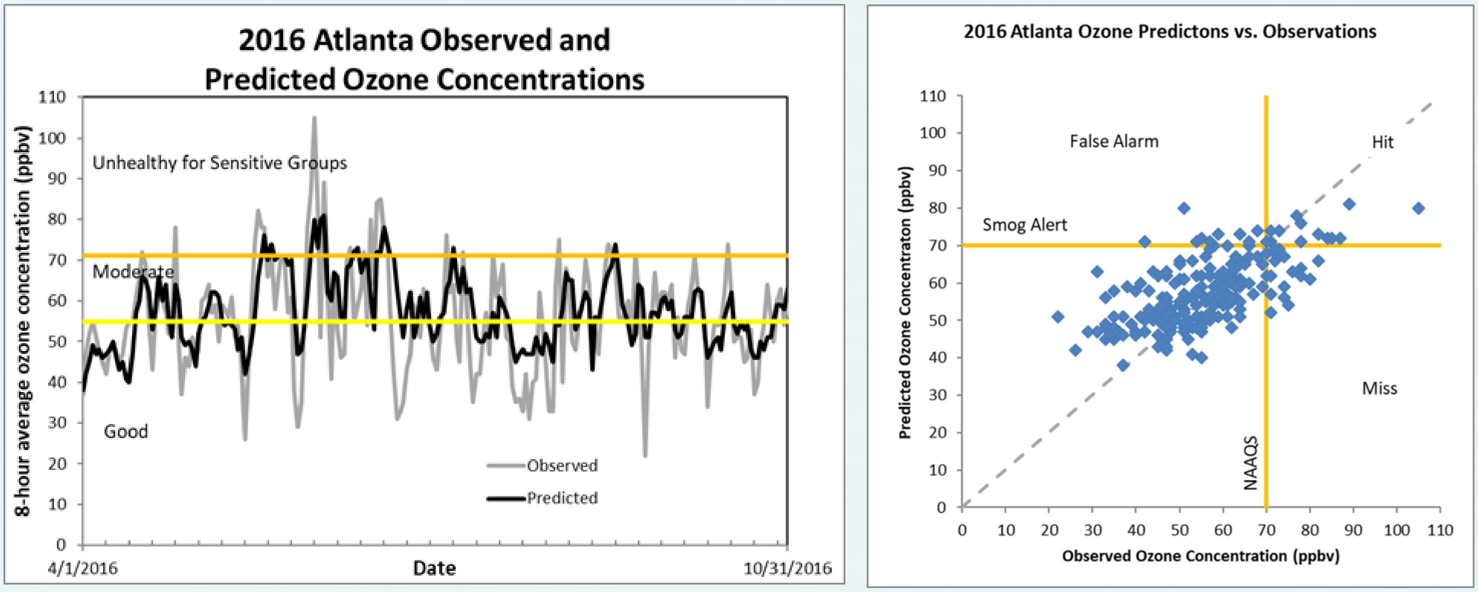



Figure 62. Atlanta observed and predicted ozone, 2016

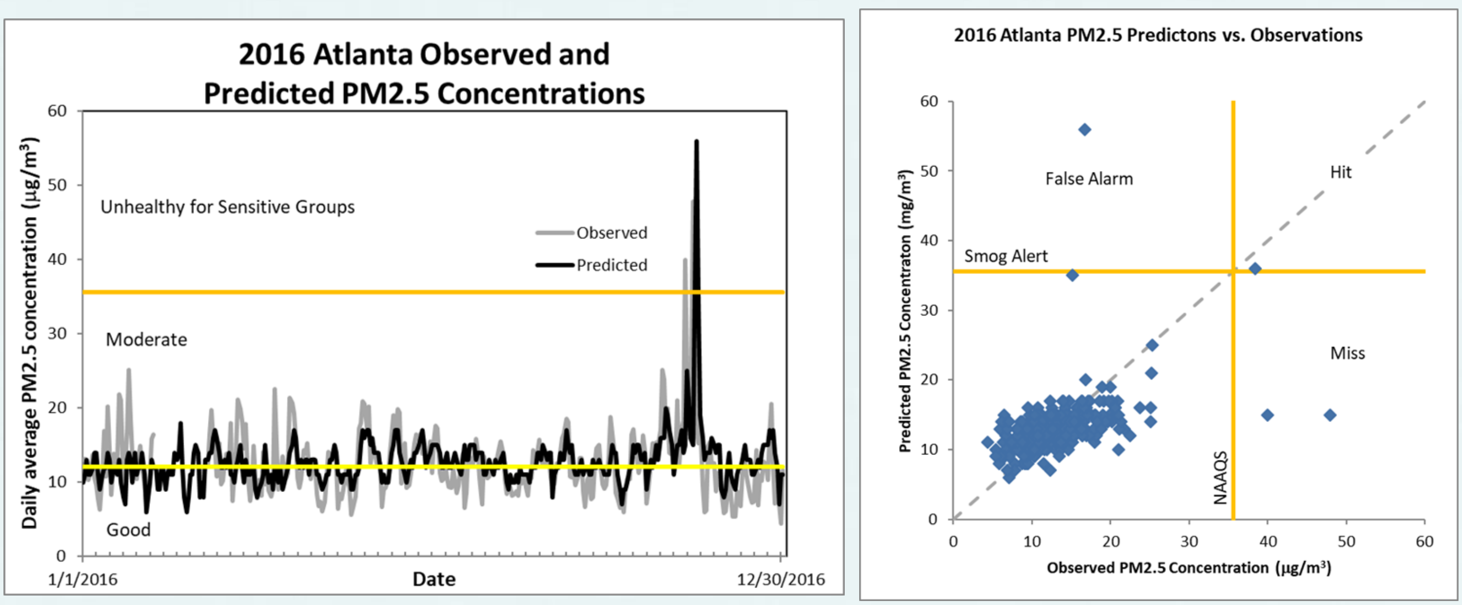



Figure 63. Atlanta observed and predicted $PM_{2.5}$, 2016

Observed and Predicted Air Quality:

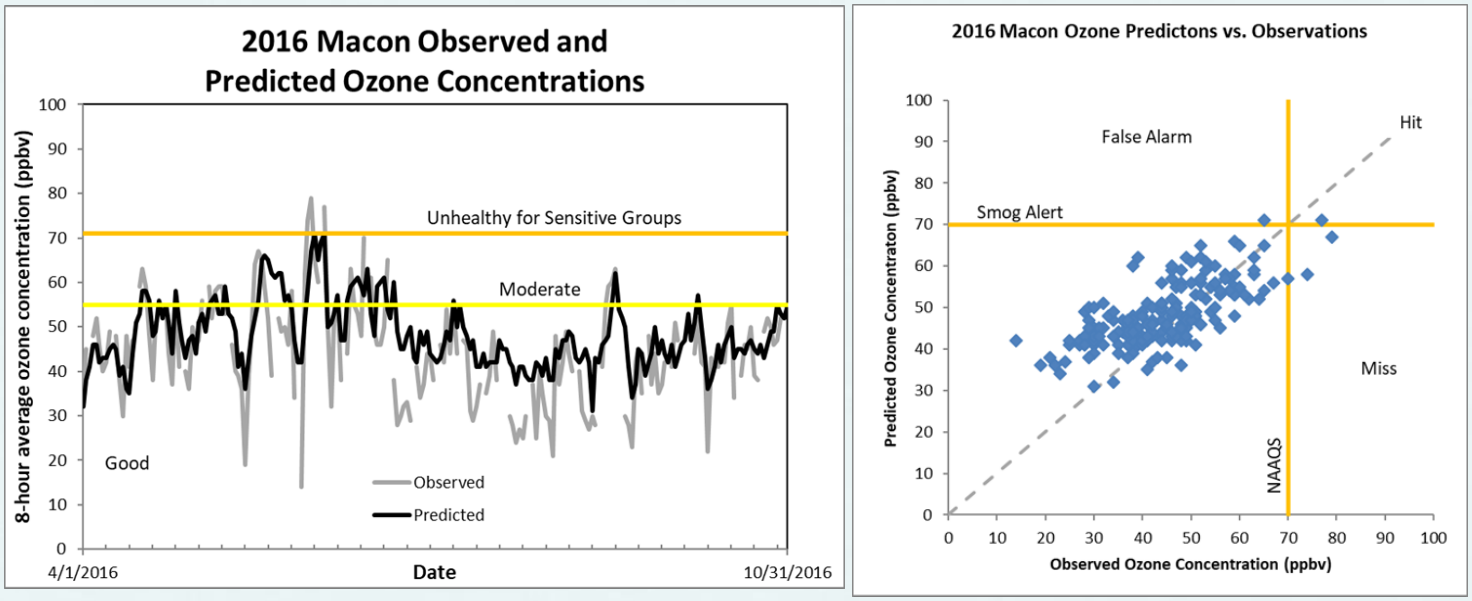



Figure 64. Macon observed and predicted ozone, 2016

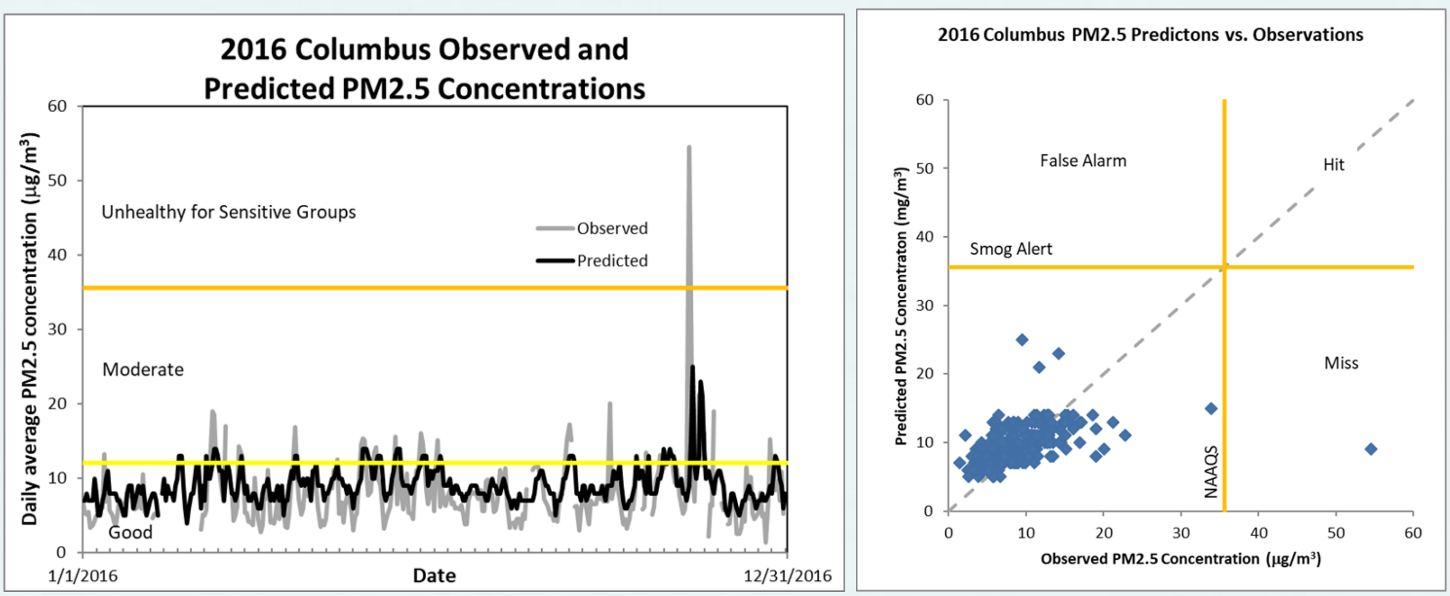



Figure 65. Columbus observed and predicted $PM_{2.5}$, 2016

# Quality Assurance/Quality Control Program

The purpose of the QA/QC Program is to assure the quality of data from EPD's air monitoring network. The GA EPD meets or exceeds the QA requirements defined in 40 CFR 58 and all applicable appendices. With the QA Program, GA EPD independently challenges the ambient air monitors to ensure they meet the requirements of 40 CFR 58.

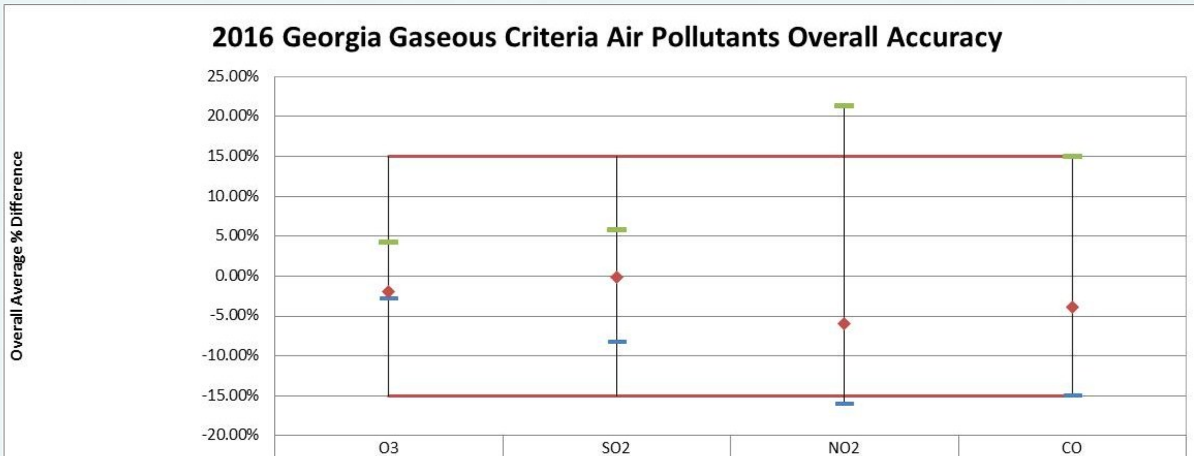
The QA/QC program includes but is not limited to the following activities:

- Instruments performance audits
- Monitor siting evaluations
- Precision and span checks
- Bias determination
- Flow rate determination
- Leak checks
- Data validation

For additional independent quality assurance activities, the EPD participates in EPA's National Performance Audit Program (NPAP) and Performance Evaluation Program (PEP) for criteria pollutants. EPD's samplers are compared on a national basis through these independent audits.

As the Primary Quality Assurance Program for ambient air monitoring activities in Georgia, the Ambient Monitoring Program operates under an EPA approved Quality Management Plan and utilizes Quality Assurance Project Plans (QAPPs) for each state wide monitoring network. The primary purpose of the QAPP is to provide an overview of the project, describe the need for the measurements and define QA/QC activities to be applied to the project. All other ambient air monitoring initiatives, including state and industrial projects, must have an approved monitoring plan for each specific project.

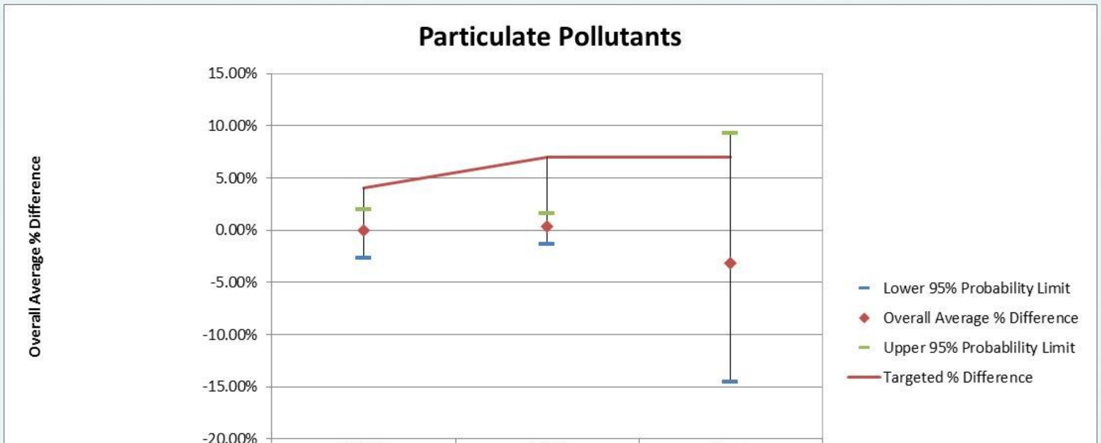
## Accuracy Levels




| | O3 | SO2 | NO2 | CO |
|---|---|---|---|---|
| Lower 95% Probability Limit | -2.92% | -8.35% | -16.06% | -15.03% |
| Overall Average % Difference | -1.96% | -0.12% | -5.93% | -3.93% |
| Upper 95% Probability Limit | 4.25% | 5.82% | 21.30% | 15.02% |
| Targeted % Difference | 15% | 15% | 15% | 15% |
| Targeted % Difference | -15% | -15% | -15% | -15% |

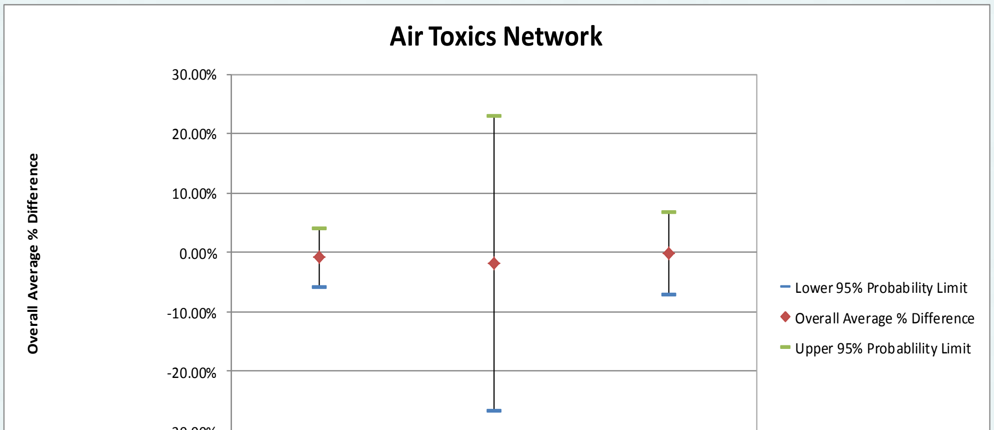
Gaseous Criteria Air Pollutants

## Accuracy Levels



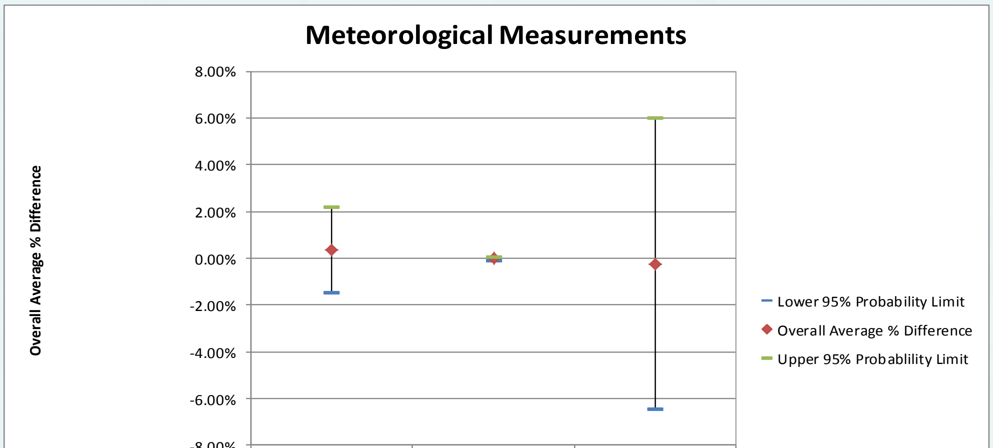

| | PM 2.5 | PM 10 | Lead |
|---|---|---|---|
| Lower 95% Probability Limit | -2.70% | -1.36% | -14.54% |
| Overall Average % Difference | 0.01% | 0.39% | -3.08% |
| Upper 95% Probablility Limit | 1.91% | 1.55% | 9.23% |
| Targeted % Difference | 4% | 7% | 7% |

**Particulate Pollutants Accuracy Estimates**




| | TSP Metals | Carbonyls | Canister VOCs |
|---|---|---|---|
| Lower 95% Probability Limit | -5.93% | -26.75% | -7.03% |
| Overall Average % Difference | -0.91% | -1.93% | -0.17% |
| Upper 95% Probablility Limit | 4.13% | 22.90% | 6.70% |

**Summary of Flow Rate Accuracy Performance Audit**




| | Ambient Temperature | Barometirc Pressure | Relative Humidity |
|---|---|---|---|
| Lower 95% Probability Limit | -1.45% | -0.11% | -6.47% |
| Overall Average % Difference | 0.36% | -0.02% | -0.25% |
| Upper 95% Probablility Limit | 2.17% | 0.07% | 5.98% |

**Performance Overall Average Audit Results**

# Appendix Section

## Appendix A: Georgia Air Monitoring Network

| SITE ID | Site Name | COUNTY | $O_3$ | CO | $PM_{2.5}$ FRM | $PM_{2.5}$ Cont. | $PM_{2.5}$ Spec. | PM Coarse | NOx | $NO_2$ | NOy | $SO_2$ | Pb | $PM_{10}$ | $PM_{10}$ Cont. | PAMS VOC | VOC | SVOC | Carb-onyls | Met | Black Car-bon | Met als |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Rome MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 131150003 | Rome | Floyd | | | S | S | X | | | | | S | | | | | | | | | | |
| **Brunswick MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 131270006 | Brunswick | Glynn | S | | S | | | | | | | | | | | | | | | NR | | |
| **Valdosta MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 131850003 | Valdosta | Lowndes | | | S | S | | | | | | | | | | | | | | | | |
| **Warner Robins MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 131530001 | Warner Rob- | Houston | | | S | S | | | | | | | | | | | | | | | | |
| **Dalton MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 132130003 | Fort Moun- | Murray | S | | | | | | | | | | | | | | | | | NR | | |
| **Albany MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 130950007 | Albany | Dougherty | | | S | S | | | | | | | | | | | | | | | | |
| **Gainesville MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 131390003 | Gainesville | Hall | | | S | S | | | | | | | | | | | | | | | | |
| **Athens-Clark County MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 130590002 | Athens | Clarke | S | | S | S | X | | | | | | | | | | | | | | | |
| **Macon MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 130210007 | Macon-Allied | Bibb | | | S | | X | | | | | | | | | | | | | | | |
| 130210012 | Macon- | Bibb | S | | S | S | | | | | | S | | | | | NR | NR | | NR | | NR |
| **Columbus Georgia- Alabama MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 132150001 | Columbus-Health Dept. | Muscogee | | | S | | | | | | | | | | | | | | | | | |
| 132150008 | Columbus- | Muscogee | S | | S | S | | | | | | | | | | | | | | | | |
| 132150009 | Columbus- | Muscogee | | | | | | | | | | | S | | | | | | | | | |
| 132150010 | Columbus-Ft. Benning | Muscogee | | | | | | | | | | | S | | | | | | | | | |
| 132150011 | Columbus- | Muscogee | | | S | | X | | | | | | S | | | | | | | | | |
| 132151003 | Columbus-Crime Lab | Muscogee | | | | | | | | | | | | | | | | | | NR | | |
| **Savannah MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 130510021 | Savannah-E. President St. | Chatham | S | | | | | | | | | S | | | | | NR | NR | NR | NR | | NR |
| 130510091 | Savannah- | Chatham | | | S | | | | | | | | | | | | | | | | | |
| 130511002 | Savannah- | Chatham | | | | S | | | | | | S | | | | | | | | NR | | |
| **Augusta Georgia-South Carolina MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 130730001 | Evans | Columbia | S | | | | | | | | | | | | | | | | | NR | | |
| 132450091 | Augusta | Richmond | S | | S | S | X | | | | | S | | S | | | | | | NR | | |

Monitoring Types: S=SLAMS; P=PAMS; C=NCore; X=Supplemental Speciation; T=STN; N=NATTS; R=Near-Road; NR=Non-Regulatory; A=CASTNET

## Appendix A: Georgia Air Monitoring Network (continued)

| SITE ID | Site Name | COUNTY | $O_3$ | CO | $PM_{2.5}$ FRM | $PM_{2.5}$ Cont. | $PM_{2.5}$ Spec. | PM Coarse | NO/ NOx | $NO_2$ | NOy | $SO_2$ | Pb | $PM_{10}$ | $PM_{10}$ Cont | PAMS VOC | VOC | SVOC | Carb-onyls | Met | Black Car- | Metals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Atlanta-Sandy Springs-Roswell MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 130630091 | Forest Park | Clayton | | | S | | | | | | | | | | | | | | | | | |
| 130670003 | Kennesaw | Cobb | S | | S | | | | | | | | | | | | | | | | | |
| 130770002 | Newnan | Coweta | S | | | S | | | | | | | | | | | | | | NR | | |
| 130850001 | Dawsonville | Dawson | S | | | | | | | | | | | | | | | | | NR | | |
| 130890002 | South DeK-alb | DeKalb | S/ | S/ P/C | S/C | S/C | T/C | C | S/P | S/P | S/P/ C | C | | | C | P | N | N | P/N | P | N | N |
| 130890003 | DMRC | DeKalb | | | | | | | R | R | | | S | | | | R | | | | R | |
| 130970004 | Douglasville | Douglas | S | | | | | | | | | | | | | | | | | NR | | |
| 131210039 | Fire Station | Fulton | | | S | | | | | | | | | S | | | | | | | | |
| 131210055 | Confederate | Fulton | S | | | S | | | | | | S | | | | | | | | NR | | |
| 131210056 | GA Tech-Near Road | Fulton | | R | R | | | | R | R | | | | | | | | | | R | R | |
| 131350002 | Gwinnett | Gwinnett | S | | S | S | | | | | | | | | | | | | | | | |
| 131510002 | McDonough | Henry | S | | | S | | | | | | | | | | | | | | | | |
| 132230003 | Yorkville | Paulding | S/P | S/P | S | S | | | | | | | | | | | NR | NR | NR | P | | NR |
| 132319991 | EPA CAST- | Pike | A | | | | | | | | | | | | | | | | | | | |
| 132470001 | Conyers | Rockdale | S/P | | | | | | | | | | | | | | | | | P | | |
| **Chattanooga Tennessee-Georgia MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 132950002 | Rossville | Walker | | | S | S | X | | | | | | | | | | | | | | | |
| **Not In An MSA** | | | | | | | | | | | | | | | | | | | | | | |
| 130550001 | Summerville | Chattooga | S | | | | | | | | | | | | | | | | | | | |
| 130690002 | General | Coffee | | | | | X | | | | | | | | | | NR | NR | | | | NR |
| 132611001 | Leslie | Sumter | S | | | | | | | | | | | | | | | | | | | |
| 133030001 | Sandersville | Washing- | | | S | | | | | | | | | | | | | | | | | |
| 133190001 | Gordon | Wilkinson | | | S | | | | | | | | | | | | | | | | | |

Monitoring Types: S=SLAMS; P=PAMS; C=NCore; X=Supplemental Speciation; T=STN; N=NATTS; R=Near-Road; NR=Non-Regulatory; A=CASTNET

## Appendix B: Air Toxics Compounds Monitored and Risk Assessment Screening Values used in Initial Assessment

| CAS # | Chemical | Screen Value (µg/m³) | CAS # | Chemical | Screen Value (µg/m³) |
|---|---|---|---|---|---|
| | **Metals** | | | | |
| 7440-36-0 | Antimony | 0.02 | 7440-48-4 | Cobalt | 0.01 |
| 7440-38-2 | Arsenic | 0.00023 | 7439-92-1 | Lead | 0.15 |
| 7440-41-7 | Beryllium | 0.00042 | 7439-96-5 | Manganese | 0.3 |
| 7440-43-9 | Cadmium | 0.00056 | 7440-02-0 | Nickel | 0.0021 |
| 18540-29-9 | Chromium** | 0.000012 | 7782-49-2 | Selenium | 2 |
| | | | 7440-66-6 | Zinc | N/A |
| | **Semi-Volatiles** | | | | |
| 83-32-9 | Acenaphthene | 0.3 | 27208-37-3 | Cyclopenta(cd)pyrene | N/A |
| 208-96-8 | Acenaphthylene | 0.3 | 53-70-3 | Dibenzo(a,h)anthracene | 0.00083 |
| 120-12-7 | Anthracene | 0.3 | 206-44-0 | Fluoranthene | 0.3 |
| 56-55-3 | Benzo(a)anthracene | 0.0091 | 86-73-7 | Fluorene | 0.3 |
| 205-99-2 | Benzo(b)fluoranthene | 0.0091 | 193-39-5 | Indeno(1,2,3-c,d)pyrene | 0.0091 |
| 207-08-9 | Benzo(k)fluoranthene | 0.0091 | 91-20-3 | Naphthalene | 0.3*** |
| 191-24-2 | Benzo(g,h,i)perylene | 0.3 | 85-01-8 | Phenanthrene | 0.3 |
| 50-32-8 | Benzo(a)pyrene | 0.00091 | 198-55-0 | Perylene | N/A |
| 192-97-2 | Benzo(e)pyrene | 0.3 | 129-00-0 | Pyrene | 0.3 |
| 218-01-9 | Chrysene | 0.091 | | | |
| | **Volatile Organic Compounds** | | | | |
| 71-43-2 | Benzene | 0.13 | 108-38-3/106-42-3 | 1,3 and 1,4-Dimethylbenzene (m/p-Xylene) | 10 |
| 100-52-7 | Benzenecarbonal (Benzaldehyde) | N/A | 75-07-0 | Ethanal (Acetaldehyde) | 0.45 |
| 100-44-7 | Benzyl chloride | 0.02 | 100-41-4 | Ethylbenzene | 0.4 |
| 74-83-9 | Bromomethane (Methyl bromide) | 0.5 | 100-42-5 | Ethenylbenzene (Styrene) | 100 |
| 106-99-0 | 1,3-Butadiene | 0.03 | 622-97-9 | Benzene,1-ethenyl-4-methyl (p-Ethyltoluene) | N/A |
| 123-72-8 | Butanal (Butyraldehyde) | N/A | 76-13-1 | Freon 113 | N/A |
| 108-90-7 | Chlorobenzene (Phenyl chloride) | 100 | 87-68-3 | Hexachloro-1,3-Butadiene(Hexachlorobutadiene) | 0.045 |
| 75-00-3 | Chloroethane (Ethyl chloride) | 1000 | 110-54-3 | n-Hexane | 70 |
| 75-01-4 | Chloroethene (Vinyl chloride) | 0.11 | 50-00-0 | Methanal (Formaldehyde) | 0.0769 |
| 74-87-3 | Chloromethane (Methyl chloride) | 9.0 | 108-88-3 | Methylbenzene/Phenylmethane (Toluene) | 40 |
| 110-82-7 | Cyclohexane | 6300* | 123-38-6 | Propanal (Propionaldehyde) | 0.8 |
| 106-93-4 | 1,2-Dibromoethane (Ethylene dibromide) | 0.002 | 67-64-1 | 2-Propanone (Acetone) | 32000* |
| 95-50-1 | 1,2-Dichlorobenzene | 210* | 107-02-8 | Propenal (Acrolein) | 0.002 |
| 541-73-1 | 1,3-Dichlorobenzene | N/A | 79-34-5 | 1,1,2,2-Tetrachloroethane | 0.017 |
| 106-46-7 | 1,4-Dichlorobenzene | 0.091 | 127-18-4 | Tetrachloroethene (Perchloroethylene) | 3.846 |
| 75-71-8 | Dichlorodifluoromethane (Freon 12) | 100* | 56-23-5 | Tetrachlormethane (Carbon tetrachloride) | 0.17 |
| 75-34-3 | 1,1-Dichloroethane (Ethylidene chloride) | 0.63 | 120-82-1 | 1,2,4-Trichlorobenzene | 20 |
| 156-59-2 | cis-1,2-Dichloroethene | N/A | 526-73-8 | 1,2,3-Trimethylbenzene | 63* |
| 75-35-4 | 1,1-Dichloroethene (1,1-Dichloroethylene) | 210* | 95-63-6 | 1,2,4-Trimethylbenzene | 63* |
| 75-09-2 | Dichloromethane (Methylene chloride) | 100 | 108-67-8 | 1,3,5-Trimethylbenzene | N/A |
| 78-87-5 | 1,2-Dichloropropane (Propylene dichloride) | 0.076* | 71-55-6 | 1,1,1-Trichloroethane (Methyl chloroform) | 5000 |
| 10061-01-5 | cis-1,3-Dichloropropene | N/A | 79-00-5 | 1,1,2-Trichloroethane | 0.063 |
| 10061-02-6 | trans-1,3-Dichloropropene | N/A | 79-01-6 | Trichloroethene (Trichloroethylene) | 0.244 |
| 76-14-2 | 1,1-Dichloro-1,2,2,2-tetrafluoroethane(Freon114) | N/A | 75-69-4 | Trichlorofluoromethane (Freon 11) | N/A* |
| 95-47-6 | 1,2-Dimethylbenzene (o-Xylene) | 10 | 67-66-3 | Trichloromethane (Chloroform) | 9.8 |

Sources: 'A Preliminary Risk-Based Screening Approach for Air Toxics Monitoring Data Sets' (U.S. EPA, 2010)(https://archive.org/details/APreliminaryRisk-basedScreeningApproachForAirToxicsMonitoringDataSets), "Table 1. Prioritized Chronic Dose-Response Values for Screening Risk Assessments (5/09/2014)(https://www.epa.gov/sites/production/files/2014-05/documents/table1.pdf)."
*Regional Screening Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017)
**Chromium is a ratio of the total chromium value.
***Naphthalene: 1 in 10,000 uncertainty in IUR; therefore IUR not used in developing screening value.

## Appendix C: Meteorological Instruments used in 2016

| PARAMETER | COM-PANY | INSTRUMENT | MODEL | LOCATION | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Augusta | Brunswick | ColCrLab | ConfAve. | Conyers | Dawsonville | S.DeKalb | Sav.Pres | Yorkville | MaconSE | Douglasville | Newnan | Ft.Mtn | Evans | NR-GT | SavL&A |
| Wind Speed/Wind Direction | R.M. Young | Ultrasonic Ane-mometer | 81000 | X | X | X | | X | X | X | X | X | | X | X | | | X | X |
| | R.M. Young | Ultrasonic Ane-mometer | 85000 | | | | X | | | | | | X | | | X | X | | |
| Ambient Tempera-ture/ Relative Hu-midity | R.M. Young | TEMP/RH Probe | 41375VC | X | | X | | | | | | X | | | | X | | | |
| | R.M. Young | TEMP/RH SENSOR, DEG C | 41382VC | | | | | X | | X | X | | | | | | X | | |
| Barometric Pressure | R.M. Young | Barometric Pres-sure Sensor | 61201 | X | | | | X | | | | X | | | | | | | |
| | R.M. Young | Barometric Pres-sure Sensor | 61302V | | | X | | | | X | X | | | | | | | | |
| Precipitation | No-valynx | Tipping Bucket Rain Gauge | 260-2501 | X | | X | | X | | X | | X | | | | | | | |
| Solar Radiation | Eppley Lab | Standard Precision Pyronometer | PSP/SPP | | | | | X | | | | X | | | | | | | |
| Total Ultraviolet Radiation | Eppley Lab | Total Ultraviolet Radiometer | TUVR | | | | | X | | | | X | | | | | | | |
| Data Logger | ESC | Data System Con-troller | 8832 | X | X | | X | X | X | X | X | X | X | X | X | X | X | X | X |
| | ESC | Data System Con-troller | 8816 | | | X | | | | | | | | | | | | | |
| Towers | Aluma Tower Inc. | Crank-Up Tower | T-135 | X | X | X | X | X | | X | X | X | X | X | X | | | X | X |
| | Aluma Tower Inc. | Fold-Over Tower | FOT-10 | | | | | | X | | | | | | | X | X | | |

## Appendix D: Pollutant Concentrations

**National Ambient Air Quality Standards for Carbon Monoxide**

**Primary NAAQS:** 8-hour average not to exceed 9 ppm more than once per year

**Secondary NAAQS:** None

**Criteria Pollutant Summary Report - 2016**

**Pollutant:** Carbon Monoxide

**Data Interval:** Hourly **Units:** Parts per million (ppm)

| Site ID | City | County | Site Name | Hours Measured | Max 1 - Hour | | Obs. ≥ 35 | Max 8 - Hour | | Obs. ≥ 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 2nd | | 1st | 2nd | |
| 130890002 | Decatur | DeKalb | South DeKalb | 7159 | 1.569 | 1.558 | 0 | 1.4 | 1.2 | 0 |
| 131210056 | Atlanta | Fulton | GA Tech Near Road | 8599 | 3.2 | 2.7 | 0 | 2.3 | 2.2 | 0 |

**National Ambient Air Quality Standards for Nitrogen Dioxide**

**Primary NAAQS:** Annual mean must not exceed 53 ppb

3-year average of the 98th percentile of daily maximum one-hour averages must not exceed 100 ppb

**Secondary NAAQS:** Annual mean must not exceed 53 ppb

**Criteria Pollutant Summary Report - 2016**

**Pollutant:** Nitrogen Dioxide

**Data Interval:** Hourly **Units:** Parts per billion (ppb)

| Site ID | City | County | Site Name | Hours Measured | 98th% | Max 1-Hour | | Annual Arithmetic Mean |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 1st | 2nd | |
| 130890002 | Decatur | DeKalb | South DeKalb | 8033 | 49.4 | 59.2 | 57.1 | 10.52 |
| 130890003 | Atlanta | DeKalb | DMRC | 8569 | 61.1 | 72.8 | 65.5 | 16.94 |
| 131210056 | Atlanta | Fulton | GA Tech Near Road | 8536 | 53.6 | 61.0 | 59.6 | 19.65 |

**Pollutant Summary Report - 2016**

**Pollutant:** NOx

**Data Interval:** Hourly    **Units:** Parts per billion (ppb)

| Site ID | City | County | Site Name | Hours Measured | Max 1-Hour | | Annual Arithmetic Mean |
|---|---|---|---|---|---|---|---|
| | | | | | 1st | 2nd | |
| 130890002 | Decatur | DeKalb | South DeKalb | 8033 | 268.6 | 261.6 | 21.27 |
| 130890003 | Atlanta | DeKalb | DMRC | 8568 | 414.4 | 405.2 | 41.28 |
| 131210056 | Atlanta | Fulton | GA Tech Near Road | 8536 | 298.7 | 265.4 | 46.59 |

**Pollutant Summary Report - 2016**

**Pollutant:** NOy

**Data Interval:** Hourly    **Units:** Parts per billion (ppb)

| Site ID | City | County | Site Name | Hours Meas-ured | Max 1-Hour | | Annual Arith-metic Mean |
|---|---|---|---|---|---|---|---|
| | | | | | 1st | 2nd | |
| 130890002 | Decatur | DeKalb | South DeKalb | 7985 | 202.0 | 200.0 | 20.88 |

National Ambient Air Quality Standards for Ozone

Primary NAAQS: 3-year average of 4th highest daily maximum 8-hr concentration not to exceed 0.070 ppm

Secondary NAAQS: Same as the Primary Standards

Criteria Pollutant Summary Report - 2016

Pollutant: Ozone

Data Interval: Hourly    Units: Parts per million (ppm)

8-Hour Averages

| Site ID | City | County | Site Name | Days Meas-ured | 1st Max | 2nd Max | 3rd Max | 4th Max | Number of Days >0.070 |
|---|---|---|---|---|---|---|---|---|---|
| 130210012 | Macon | Bibb | Macon-Forestry | 241 | 0.079 | 0.077 | 0.074 | 0.070 | 3 |
| 130510021 | Savannah | Chatham | Savannah-E. Pres. St. | 220 | 0.062 | 0.059 | 0.059 | 0.058 | 0 |
| 130550001 | Summerville | Chattooga | Summerville | 240 | 0.068 | 0.066 | 0.065 | 0.065 | 0 |
| 130590002 | Athens | Clarke | Athens | 244 | 0.071 | 0.069 | 0.069 | 0.069 | 1 |
| 130670003 | Kennesaw | Cobb | Kennesaw | 244 | 0.105 | 0.076 | 0.071 | 0.070 | 3 |
| 130730001 | Evans | Columbia | Evans | 241 | 0.068 | 0.066 | 0.065 | 0.062 | 0 |
| 130770002 | Newnan | Coweta | Newnan | 244 | 0.087 | 0.069 | 0.069 | 0.066 | 1 |
| 130850001 | Dawsonville | Dawson | Dawsonville | 240 | 0.078 | 0.076 | 0.069 | 0.067 | 2 |
| 130890002 | Decatur | DeKalb | South DeKalb | 233 | 0.083 | 0.082 | 0.078 | 0.074 | 7 |
| 130970004 | Douglasville | Douglas | Douglasville | 243 | 0.086 | 0.075 | 0.074 | 0.071 | 7 |
| 131210055 | Atlanta | Fulton | Confederate Ave. | 241 | 0.088 | 0.085 | 0.078 | 0.075 | 12 |
| 131270006 | Brunswick | Glynn | Brunswick | 224 | 0.064 | 0.060 | 0.059 | 0.057 | 0 |
| 131350002 | Lawrenceville | Gwinnett | Gwinnett Tech | 243 | 0.082 | 0.082 | 0.080 | 0.078 | 6 |
| 131510002 | McDonough | Henry | McDonough | 243 | 0.089 | 0.084 | 0.078 | 0.078 | 8 |
| 132130003 | Chatsworth | Murray | Fort Mountain | 241 | 0.074 | 0.069 | 0.068 | 0.067 | 1 |
| 132150008 | Columbus | Muscogee | Columbus-Airport | 237 | 0.075 | 0.068 | 0.065 | 0.065 | 1 |
| 132230003 | Yorkville | Paulding | Yorkville | 227 | 0.078 | 0.071 | 0.069 | 0.067 | 2 |
| 132319991 | Williamson | Pike | CASTNET | 234 | 0.078 | 0.075 | 0.074 | 0.071 | 4 |
| 132450091 | Augusta | Richmond | Augusta | 241 | 0.067 | 0.066 | 0.066 | 0.065 | 0 |
| 132470001 | Conyers | Rockdale | Conyers | 238 | 0.082 | 0.077 | 0.077 | 0.076 | 9 |
| 132611001 | Leslie | Sumter | Leslie | 243 | 0.071 | 0.067 | 0.066 | 0.065 | 1 |

Criteria Pollutant Summary Report - 2016

Pollutant: Ozone

Data Interval: Hourly — Units: Parts per million (ppm)

1-Hour Averages

| Site ID | City | County | Site Name | Days Meas-ured | 1st Max | 2nd Max |
|---|---|---|---|---|---|---|
| 130210012 | Macon | Bibb | Macon-Forestry | 243 | 0.089 | 0.089 |
| 130510021 | Savannah | Chatham | Savannah-E. Pres. St. | 227 | 0.074 | 0.069 |
| 130550001 | Summerville | Chattooga | Summerville | 242 | 0.085 | 0.072 |
| 130590002 | Athens | Clarke | Athens | 245 | 0.086 | 0.079 |
| 130670003 | Kennesaw | Cobb | Kennesaw | 245 | 0.115 | 0.087 |
| 130730001 | Evans | Columbia | Evans | 241 | 0.075 | 0.073 |
| 130770002 | Newnan | Coweta | Newnan | 245 | 0.100 | 0.078 |
| 130850001 | Dawsonville | Dawson | Dawsonville | 244 | 0.090 | 0.082 |
| 130890002 | Decatur | DeKalb | South DeKalb | 234 | 0.105 | 0.097 |
| 130970004 | Douglasville | Douglas | Douglasville | 245 | 0.091 | 0.087 |
| 131210055 | Atlanta | Fulton | Confederate Ave. | 242 | 0.102 | 0.097 |
| 131270006 | Brunswick | Glynn | Brunswick | 227 | 0.071 | 0.069 |
| 131350002 | Lawrenceville | Gwinnett | Gwinnett Tech | 245 | 0.094 | 0.092 |
| 131510002 | McDonough | Henry | McDonough | 244 | 0.106 | 0.097 |
| 132130003 | Chatsworth | Murray | Fort Mountain | 243 | 0.086 | 0.072 |
| 132150008 | Columbus | Muscogee | Columbus- Airport | 237 | 0.083 | 0.076 |
| 132230003 | Yorkville | Paulding | Yorkville | 236 | 0.084 | 0.079 |
| 132319991 | Williamson | Pike | CASTNET | 236 | 0.085 | 0.082 |
| 132450091 | Augusta | Richmond | Augusta | 244 | 0.080 | 0.076 |
| 132470001 | Conyers | Rockdale | Conyers | 241 | 0.100 | 0.095 |
| 132611001 | Leslie | Sumter | Leslie | 245 | 0.075 | 0.074 |

**National Ambient Air Quality Standards for Sulfur Dioxide**

**Primary NAAQS:** 3-year average of 99th percentile of the daily maximum 1-hour concentration not to exceed 75 ppb

**Secondary NAAQS:** 3-hour concentrations not to exceed 0.5 ppm (500 ppb) more than once per year

**Criteria Pollutant Summary Report - 2016**

**Pollutant:** Sulfur Dioxide

**Data Interval:** Hourly    **Units:** Parts per billion (ppb)

| Site ID | City | County | Site Name | Hours Meas-ured | Max 24 - Hour | | Max 3 - Hour | | Max 1-Hour | | 99th Pctl 1- Hr | Maxi-mum 5-Minute Average | Annual Arith-metic Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1st | 2nd | 1st | 2nd | 1st | 2nd | | | |
| 130210012 | Macon | Bibb | Macon-Forestry | 8604 | 2.6 | 1.8 | 6.8 | 5.5 | 13.7 | 7.6 | 6.0 | 13.7 | 1.04 |
| 130510021 | Savan-nah | Chat-ham | Savannah-E. Pres. St | 8252 | 10.6 | 10.5 | 28.7 | 22.9 | 38.3 | 33.5 | 28.7 | 38.3 | 1.57 |
| 130511002 | Savan-nah | Chat-ham | Savannah-L&A | 8555 | 12.8 | 12.4 | 29.7 | 27.0 | 60.7 | 46.5 | 40.1 | 60.7 | 1.68 |
| 130890002 | Decatur | DeKalb | South DeKalb | 8293 | 2.4 | 1.5 | 8.0 | 6.5 | 32.2 | 31.9 | 31.6 | 32.2 | 0.24 |
| 131150003 | Rome | Floyd | Rome | 8667 | 14.8 | 7.7 | 41.3 | 37.7 | 78.7 | 73.1 | 48.7 | 78.7 | 1.61 |
| 131210055 | Atlanta | Fulton | Confeder-ate Ave. | 8500 | 4.2 | 3.3 | 9.9 | 8.7 | 38.2 | 13.2 | 6.3 | 38.2 | 1.04 |
| 132450091 | Augusta | Rich-mond | Augusta | 8590 | 12.0 | 9.7 | 38.5 | 35.3 | 89.5 | 78.3 | 58.0 | 89.5 | 1.79 |

National Ambient Air Quality Standards for Particulate Matter $PM_{2.5}$

Primary NAAQS: 3-year average of the annual weighted mean not to exceed 12.0µg/$m^3$

3-year average of the $98^{th}$ percentile of 24-hour concentration not to exceed 35µg/$m^3$

Secondary NAAQS: 3-year average of the annual weighted mean not to exceed 15.0µg/$m^3$

3-year average of the $98^{th}$ percentile of 24-hour concentration not to exceed 35µg/$m^3$

Criteria Pollutant Summary Report - 2016

Pollutant: Particulate Matter $PM_{2.5}$

Data Interval: 24-Hour Units: Micrograms per cubic meter (µg/$m^3$)

$98^{th}$% and Annual Arithmetic Mean

Integrated Sampling (midnight to midnight) Using Federal Reference Method

| Site ID | City | County | Site Name | Days Meas-ured | $98^{th}$ Percen-tile | Values Exceeding Applicable Daily Stand-ard | Annual Arith-metic Mean |
|---|---|---|---|---|---|---|---|
| 130210007 | Macon | Bibb | Macon-Allied | 287 | 21.2 | 1 | 9.73 |
| 130210012 | Macon | Bibb | Macon-Forestry | 115 | 14.2 | 1 | 6.53 |
| 130510091 | Savannah | Chatham | Savannah-Mercer | 116 | 24.5 | 1 | 8.33 |
| 130590002 | Athens | Clarke | Athens | 117 | 14.8 | 1 | 8.33 |
| 130630091 | Forest Park | Clayton | Forest Park | 120 | 17.3 | 1 | 9.28 |
| 130670003 | Kennesaw | Cobb | Kennesaw | 303 | 18.2 | 1 | 9.26 |
| 130890002 | Decatur | DeKalb | South DeKalb | 291 | 18.3 | 1 | 8.92 |
| 130950007 | Albany | Dougherty | Albany | 294 | 20.4 | 0 | 8.62 |
| 131150003 | Rome | Floyd | Rome | 298 | 18.4 | 0 | 9.43 |
| 131210039 | Atlanta | Fulton | Fire Station #8 | 122 | 19.9 | 1 | 9.92 |
| 131210056 | Atlanta | Fulton | GA Tech Near Road | 122 | 24.2 | 1 | 10.76 |
| 131270006 | Brunswick | Glynn | Brunswick | 121 | 34.2 | 2 | 7.86 |

National Ambient Air Quality Standards for Particulate Matter $PM_{2.5}$

Primary NAAQS: 3-year average of the annual weighted mean not to exceed 12.0μg/$m^3$

3-year average of the $98^{th}$ percentile of 24-hour concentration not to exceed 35μg/$m^3$

Secondary NAAQS: 3-year average of the annual weighted mean not to exceed 15.0μg/$m^3$

3-year average of the $98^{th}$ percentile of 24-hour concentration not to exceed 35μg/$m^3$

**Criteria Pollutant Summary Report - 2016**

**Pollutant:** Particulate Matter $PM_{2.5}$

**Data Interval:** 24-Hour **Units:** Micrograms per cubic meter (μg/$m^3$ )

**$98^{th}$% and Annual Arithmetic Mean**

**Integrated Sampling (midnight to midnight) Using Federal Reference Method**

| Site ID | City | County | Site Name | Days Meas-ured | $98^{th}$ Percentile | Values Exceeding Applicable Daily Stand-ard | Annual Arithmetic Mean |
|---|---|---|---|---|---|---|---|
| 131350002 | Lawrenceville | Gwinnett | Gwinnett Tech | 121 | 18.1 | 1 | 8.47 |
| 131390003 | Gainesville | Hall | Gainesville | 119 | 23.3 | 2 | 8.50 |
| 131530001 | Warner Robins | Houston | Warner Robins | 119 | 19.1 | 1 | 7.89 |
| 131850003 | Valdosta | Lowndes | Valdosta | 117 | 17.1 | 0 | 7.26 |
| 132150001 | Columbus | Muscogee | Columbus-Health Dept. | 117 | 18.0 | 1 | 9.10 |
| 132150008 | Columbus | Muscogee | Columbus Airport | 121 | 16.5 | 0 | 8.68 |
| 132150011 | Columbus | Muscogee | Columbus-Cusseta | 121 | 33.8 | 2 | 9.57 |
| 132230003 | Yorkville | Paulding | Yorkville | 116 | 14.2 | 0 | 7.31 |
| 132450091 | Augusta | Richmond | Augusta | 119 | 30.0 | 2 | 9.55 |
| 132950002 | Rossville | Walker | Rossville | 115 | 16.9 | 1 | 9.21 |
| 133030001 | Sandersville | Washing-ton | Sandersville | 119 | 25.0 | 1 | 8.08 |
| 133190001 | Gordon | Wilkinson | Gordon | 117 | 20.1 | 2 | 9.52 |

**Pollutant Summary Report - 2016**

**Pollutant:** Particulate Matter $PM_{2.5}$

**Data Interval:** 1-Hour **Units:** Micrograms per cubic meter ($\mu g/m^3$)

**Hourly Averages of Semi-Continuous Measurements**

| Site ID | City | County | Site Name | Hours Meas-ured | 1st Max | 2nd Max | Annual Arith-metic Mean |
|---|---|---|---|---|---|---|---|
| 130210012 | Macon | Bibb | Macon-Forestry | 8579 | 115.6 | 114.7 | 7.38 |
| 130511002 | Savannah | Chatham | Savannah-L&A | 8367 | 154.1 | 113.7 | 8.3 |
| 130590002 | Athens | Clarke | Athens | 8597 | 177.0 | 172.2 | 7.79 |
| 130770002 | Newnan | Coweta | Newnan | 8611 | 139.4 | 110.6 | 7.56 |
| 130890002 | Decatur | DeKalb | South DeKalb | 6614 | 100.0 | 95.0 | 12.83 |
| 130950007 | Albany | Dougherty | Albany | 6345 | 82.0 | 68.0 | 9.11 |
| 131210055 | Atlanta | Fulton | Confederate Avenue | 8583 | 90.4 | 84.8 | 11.09 |
| 131350002 | Lawrenceville | Gwinnett | Gwinnett Tech | 8444 | 151.2 | 147.4 | 8.05 |
| 131510002 | McDonough | Henry | McDonough | 8669 | 96.5 | 84.1 | 7.62 |
| 131530001 | Warner Robins | Houston | Warner Robins | 8118 | 82.0 | 78.0 | 8.56 |
| 131850003 | Valdosta | Lowndes | Valdosta | 7745 | 90.0 | 87.0 | 8.63 |
| 132150008 | Columbus | Muscogee | Columbus-Airport | 8434 | 143.1 | 127.0 | 7.98 |
| 132230003 | Yorkville | Paulding | Yorkville | 8406 | 155.9 | 146.6 | 10.26 |
| 132450091 | Augusta | Richmond | Augusta | 8589 | 121.7 | 121.6 | 8.88 |
| 132950002 | Rossville | Walker | Rossville | 8181 | 161.0 | 151.0 | 10.4 |

**National Ambient Air Quality Standards for Particulate Matter $PM_{10}$**

**Primary NAAQS:** Number of days with a maximum of 24-hour concentration of 150µg/$m^3$ must not exceed more than once per year on average over 3 years

**Secondary NAAQS:** Same as the Primary Standards

## Criteria Pollutant Summary Report - 2016

**Pollutant:** Particulate Matter $PM_{10}$

**Data Interval:** 24-Hour

**Units:** Micrograms per cubic meter (µg/$m^3$ )

### 24-Hour Integrated Measurements

| Site ID | City | County | Site Name | Days Meas-ured | 1st Max | Number Values ≥150 | Annual Arithmetic Mean |
|---|---|---|---|---|---|---|---|
| 131210039 | Atlanta | Fulton | Fire Station #8 | 60 | 68 | 0 | 15.8 |
| 132450091 | Augusta | Richmond | Augusta | 58 | 43 | 0 | 15.5 |

### Hourly Continuous Measurements

| Site ID | City | County | Site Name | Hours Measured | 1st Max | Annual Arith-metic Mean |
|---|---|---|---|---|---|---|
| 130890002 | Decatur | DeKalb | South DeKalb | 8687 | 212 | 17.2 |

National Ambient Air Quality Standards for Lead

Primary NAAQS: Rolling 3-month average not to exceed 0.15 μg/m$^3$

Secondary NAAQS: Same as the Primary Standard

**Criteria Pollutant Summary Report - 2016**

**Pollutant:** Lead

**Data Interval:** 24-Hour **Units:** Micrograms per cubic meter (μg/m$^3$)

| Site ID | 130890003 | 132150009 | 132150010 | 132150011 |
|---|---|---|---|---|
| City | Atlanta | Columbus | Columbus | Columbus |
| County | DeKalb | Muscogee | Muscogee | Muscogee |
| Site Name | DMRC | Columbus-UPS | Columbus-Ft. Benning | Columbus-Cusseta |
| Number of Obs. | 45 | 70 | 71 | 65 |
| Nov 2015-Jan 2016 | 0.0019 | 0.1431 | 0.0196 | 0.0039 |
| Dec 2015-Feb 2016 | 0.0023 | 0.1466 | 0.0148 | 0.0031 |
| Jan 2016-Mar 2016 | 0.0022 | 0.1451 | 0.0169 | 0.0020 |
| Feb 2016-Apr 2016 | 0.0022 | 0.0133 | 0.0219 | 0.0027 |
| Mar 2016-May 2016 | 0.0016 | 0.0154 | 0.0218 | 0.0039 |
| Apr 2016-Jun 2016 | 0.0016 | 0.0287 | 0.0176 | 0.0043 |
| May 2016-Jul 2016 | | 0.0331 | 0.0107 | 0.0030 |
| Jun 2016-Aug 2016 | | 0.0296 | 0.0429 | 0.0026 |
| Jul 2016-Sep 2016 | | 0.0179 | 0.0477 | 0.0028 |
| Aug 2016-Oct 2016 | | 0.0154 | 0.0539 | 0.0124 |
| Sep 2016-Nov 2016 | | 0.3566 | 0.0334 | 0.0735 |
| Oct 2016-Dec 2016 | | 0.3565 | 0.0261 | 0.0750 |
| # of Values ≥ 0.15 | 0 | 2 | 0 | 0 |

| PAMS Continuous Hydrocarbon Data (June-August 2016) | | | | | |
|---|---|---|---|---|---|
| (concentrations in parts per billion Carbon (ppbC)) | | | | | |
| **Name** | **Site** | **#Samples** | **Avg.** | **1st Max** | **2nd Max** |
| *PAMSHC* | S. DeKalb | 1937 | 39.87 | 205.8 | 178 |
| *TNMOC* | S. DeKalb | 1937 | 53.59 | 251.4 | 216.4 |
| *Ethane* | S. DeKalb | 1939 | 4.191 | 38.29 | 28.83 |
| *Ethylene* | S. DeKalb | 1939 | 1.502 | 10.62 | 8.68 |
| *Propane* | S. DeKalb | 19.39 | 3.189 | 23.14 | 21.85 |
| *Propylene* | S. DeKalb | 1939 | 0.842 | 4.54 | 4.32 |
| *Acetylene* | S. DeKalb | 1939 | 0.520 | 7.30 | 5.7 |
| *n-Butane* | S. DeKalb | 1939 | 1.408 | 16.13 | 8.26 |
| *Isobutane* | S. DeKalb | 1939 | 0.662 | 8.41 | 7.88 |
| *trans-2-Butene* | S. DeKalb | 1939 | 0.053 | 0.83 | 0.68 |
| *cis-2-Butene* | S. DeKalb | 1939 | 0.045 | 2.74 | 0.82 |
| *n-Pentane* | S. DeKalb | 1939 | 2.041 | 19.03 | 18.46 |
| *Isopentane* | S. DeKalb | 1939 | 2.836 | 42.45 | 25.88 |
| *1-Pentene* | S. DeKalb | 1939 | 0.081 | 0.99 | 0.51 |
| *trans-2-Pentene* | S. DeKalb | 1939 | 0.078 | 1.09 | 0.99 |
| *cis-2-Pentene* | S. DeKalb | 1939 | 0.034 | 0.52 | 0.44 |
| *3-Methylpentane* | S. DeKalb | 1939 | 0.366 | 5.02 | 4.08 |
| *n-Hexane* | S. DeKalb | 1940 | 0.527 | 7.36 | 3.89 |
| *n-Heptane* | S. DeKalb | 1940 | 0.304 | 10.16 | 6.14 |
| *n-Octane* | S. DeKalb | 1940 | 0.130 | 0.82 | 0.74 |

| PAMS Continuous Hydrocarbon Data (June-August 2016)(continued) | | | | | |
|---|---|---|---|---|---|
| (concentrations in ppbC) | | | | | |
| Name | Site | #Samples | Avg. | 1st Max | 2nd Max |
| *n-Nonane* | S. DeKalb | 1940 | 0.127 | 4.21 | 3.28 |
| *n-Decane* | S. DeKalb | 1940 | 0.163 | 9.53 | 6.91 |
| *Cyclopentane* | S. DeKalb | 1939 | 0.148 | 1.66 | 1.12 |
| *Isoprene* | S. DeKalb | 1939 | 5.980 | 38.76 | 37.47 |
| *2,2-Dimethylbutane* | S. DeKalb | 1939 | 0.048 | 0.55 | 0.4 |
| *2,4-Dimethylpentane* | S. DeKalb | 1940 | 0.123 | 1.32 | 0.98 |
| *Cyclohexane* | S. DeKalb | 1940 | 0.138 | 1.21 | 0.91 |
| *3-Methylhexane* | S. DeKalb | 1940 | 0.438 | 9.73 | 4.76 |
| *2,2,4-Trimethylpentane* | S. DeKalb | 1940 | 0.573 | 4.75 | 4.46 |
| *2,3,4-Trimethylpentane* | S. DeKalb | 1940 | 0.169 | 1.60 | 1.29 |
| *3-Methylheptane* | S. DeKalb | 1940 | 0.113 | 0.93 | 0.92 |
| *Methylcyclohexane* | S. DeKalb | 1940 | 0.274 | 1.91 | 1.86 |
| *Methylcyclopentane* | S. DeKalb | 1940 | 0.345 | 3.97 | 2.8 |
| *2-Methylhexane* | S. DeKalb | 1940 | 0.305 | 5.53 | 3.08 |
| *1-Butene* | S. DeKalb | 1939 | 0.269 | 0.96 | 0.9 |
| *2,3-Dimethylbutane* | S. DeKalb | 1939 | 0.126 | 3.20 | 2.94 |
| *2-Methylpentane* | S. DeKalb | 1939 | 0.464 | 6.41 | 4.42 |
| *2,3-Dimethylpentane* | S. DeKalb | 1940 | 0.224 | 2.60 | 1.86 |
| *n-Undecane* | S. DeKalb | 1940 | 0.189 | 6.36 | 5.05 |
| *2-Methylheptane* | S. DeKalb | 1940 | 0.076 | 0.82 | 0.73 |

| PAMS Continuous Hydrocarbon Data (June-August 2016) (continued) | | | | | |
|---|---|---|---|---|---|
| (concentrations in ppbC) | | | | | |
| Name | Site | #Samples | Avg. | 1st Max | 2nd Max |
| *m & p Xylenes* | S. DeKalb | 1940 | 1.037 | 40.61 | 20.91 |
| *Benzene* | S. DeKalb | 1940 | 0.580 | 4.6 | 4.32 |
| *Toluene* | S. DeKalb | 1940 | 2.170 | 94.67 | 54.44 |
| *Ethylbenzene* | S. DeKalb | 1940 | 0.309 | 10.08 | 6.20 |
| *o-Xylene* | S. DeKalb | 1940 | 0.414 | 10.00 | 5.54 |
| *1,3,5-Trimethylbenzene* | S. DeKalb | 1940 | 0.201 | 5.46 | 2.81 |
| *1,2,4-Trimethylbenzene* | S. DeKalb | 1940 | 0.486 | 16.16 | 7.36 |
| *n-Propylbenzene* | S. DeKalb | 1940 | 0.076 | 3.87 | 2.17 |
| *Isopropylbenzene* | S. DeKalb | 1940 | 0.030 | 0.71 | 0.44 |
| *o-Ethyltoluene* | S. DeKalb | 1940 | 0.122 | 4.69 | 2.53 |
| *m-Ethyltoluene* | S. DeKalb | 1940 | 1.751 | 12.09 | 10.07 |
| *m-Diethylbenzene* | S. DeKalb | 1940 | 0.123 | 0.72 | 0.62 |
| *p-Diethylbenzene* | S. DeKalb | 1940 | 0.119 | 1.61 | 1.41 |
| *Styrene* | S. DeKalb | 1940 | 0.196 | 1.27 | 1.20 |
| *1,2,3-Trimethylbenzene* | S. DeKalb | 1940 | 2.876 | 14.29 | 14.22 |
| *p-Ethyltoluene* | S. DeKalb | 1940 | 0.296 | 8.01 | 6.23 |

| PAMS 2016 24-hour Canister Hydrocarbons | | | | | | |
|---|---|---|---|---|---|---|
| (concentrations in parts per billion Carbon (ppbC)) | | | | | | |
| Name | Site | #Samples | #Detects^ | Avg.* | 1st Max | 2nd Max |
| *PAMSHC* | S. DeKalb | 61 | 61 | 51.28 | 150 | 110 |
| *TNMOC* | S. DeKalb | 61 | 61 | 124.61 | 250 | 250 |
| *Ethane* | S. DeKalb | 61 | 57 | 6.25 | 18.0 | 13.0 |
| *Ethylene* | S. DeKalb | 61 | 1 | 0.04 | 2.2 | |
| *Propane* | S. DeKalb | 61 | 58 | 4.07 | 11.0 | 9.1 |
| *Propylene* | S. DeKalb | 61 | 49 | 0.60 | 3.2 | 1.5 |
| *Acetylene* | S. DeKalb | 46 | 40 | 1.30 | 7.4 | 2.7 |
| *n-Butane* | S. DeKalb | 61 | 42 | 3.63 | 20.0 | 13.0 |
| *Isobutane* | S. DeKalb | 61 | 26 | 0.76 | 5.5 | 3.3 |
| *trans-2-Butene* | S. DeKalb | 61 | ND | | | |
| *cis-2-Butene* | S. DeKalb | 61 | ND | | | |
| *n-Pentane* | S. DeKalb | 61 | 61 | 3.30 | 35.0 | 14.0 |
| *Isopentane* | S. DeKalb | 61 | 57 | 3.78 | 11.0 | 9.8 |
| *1-Pentene* | S. DeKalb | 61 | 22 | 0.11 | 0.6 | 0.5 |

| PAMS 2016 24-hour Canister Hydrocarbons (continued) | | | | | | |
|---|---|---|---|---|---|---|
| (concentrations in ppbC) | | | | | | |
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.*** | **1st Max** | **2nd Max** |
| ***trans-2-Pentene*** | **S. DeKalb** | **61** | **10** | **0.06** | **0.6** | **0.4** |
| ***cis-2-Pentene*** | **S. DeKalb** | **61** | **4** | **0.02** | **0.4** | **0.2** |
| ***3-Methylpentane*** | **S. DeKalb** | **61** | **58** | **0.87** | **2.1** | **1.9** |
| ***n-Hexane*** | **S. DeKalb** | **61** | **58** | **1.40** | **12.0** | **9.3** |
| ***n-Heptane*** | **S. DeKalb** | **61** | **42** | **0.38** | **1.3** | **1.2** |
| ***n-Octane*** | **S. DeKalb** | **61** | **17** | **0.08** | **0.5** | **0.5** |
| ***n-Nonane*** | **S. DeKalb** | **61** | **11** | **0.06** | **0.5** | **0.5** |
| ***n-Decane*** | **S. DeKalb** | **61** | **13** | **0.07** | **0.5** | **0.5** |
| ***Cyclopentane*** | **S. DeKalb** | **61** | **15** | **0.09** | **0.6** | **0.6** |
| ***Isoprene*** | **S. DeKalb** | **61** | **36** | **4.16** | **15** | **15** |
| ***2,2-Dimethylbutane*** | **S. DeKalb** | **61** | **19** | **0.12** | **0.6** | **0.6** |
| ***2,4-Dimethylpentane*** | **S. DeKalb** | **61** | **13** | **0.08** | **0.7** | **0.4** |
| ***Cyclohexane*** | **S. DeKalb** | **61** | **18** | **0.10** | **0.5** | **0.5** |
| ***3-Methylhexane*** | **S. DeKalb** | **61** | **41** | **0.42** | **1.4** | **1.3** |

| PAMS 2016 24-hour Canister Hydrocarbons (continued) | | | | | | |
|---|---|---|---|---|---|---|
| (concentrations in ppbC) | | | | | | |
| Name | Site | #Samples | #Detects^ | Avg.* | 1st Max | 2nd Max |
| *2,2,4-Trimethylpentane* | S. DeKalb | 61 | 56 | 1.62 | 4.3 | 3.0 |
| *2,3,4-Trimethylpentane* | S. DeKalb | 61 | 21 | 0.14 | 0.7 | 0.7 |
| *3-Methylheptane* | S. DeKalb | 61 | 10 | 0.04 | 0.5 | 0.4 |
| *Methylcyclohexane* | S. DeKalb | 61 | 20 | 0.15 | 0.9 | 0.7 |
| *Methylcyclopentane* | S. DeKalb | 61 | 44 | 0.53 | 3.0 | 3.0 |
| *2-Methylhexane* | S. DeKalb | 61 | 37 | 0.32 | 1.1 | 1.0 |
| *1-Butene* | S. DeKalb | 61 | 22 | 0.14 | 1.0 | 0.7 |
| *2,3-Dimenthylbutane* | S. DeKalb | 61 | 23 | 0.19 | 0.9 | 0.8 |
| *2-Methylpentane* | S. DeKalb | 61 | 56 | 1.07 | 3.6 | 3.5 |
| *2,3-Dimethylpentane* | S. DeKalb | 61 | 30 | 0.23 | 0.9 | 0.8 |
| *n-Undecane* | S. DeKalb | 61 | 22 | 0.10 | 0.5 | 0.4 |
| *2-Methylheptane* | S. DeKalb | 61 | 8 | 0.04 | 0.4 | 0.4 |
| *m & p Xylenes* | S. DeKalb | 61 | 58 | 1.34 | 3.8 | 3.7 |
| *Benzene* | S. DeKalb | 61 | 61 | 1.19 | 4.2 | 3.8 |

| PAMS 2016 24-HOUR Canister Hydrocarbons (continued) | | | | | | |
|---|---|---|---|---|---|---|
| (concentrations in ppbC) | | | | | | |
| Name | Site | #Samples | #Detects^ | Avg.* | 1st Max | 2nd Max |
| *Toluene* | S. DeKalb | 61 | 61 | 2.69 | 9.5 | 6.7 |
| *Ethylbenzene* | S. DeKalb | 61 | 39 | 0.34 | 1.1 | 1.1 |
| *o-Xylene* | S. DeKalb | 61 | 51 | 0.52 | 1.4 | 1.4 |
| *1,3,5-Trimethylbenzene* | S. DeKalb | 61 | 14 | 0.11 | 1.4 | 0.6 |
| *1,2,4-Trimethylbenzene* | S. DeKalb | 61 | 61 | 4.80 | 18.0 | 15.0 |
| *n-Propylbenzene* | S. DeKalb | 61 | 4 | 0.02 | 0.3 | 0.3 |
| *Isopropylbenzene* | S. DeKalb | 61 | ND | | | |
| *o-Ethyltoluene* | S. DeKalb | 61 | 32 | 0.24 | 0.9 | 0.8 |
| *m-Ethyltoluene* | S. DeKalb | 61 | 34 | 0.30 | 1.1 | 1.0 |
| *p-Ethyltoluene* | S. DeKalb | 61 | 43 | 0.36 | 1.0 | 0.9 |
| *m-Diethylbenzene* | S. DeKalb | 61 | 4 | 0.02 | 0.6 | 0.4 |
| *p-Diethylbenzene* | S. DeKalb | 61 | 7 | 0.04 | 0.5 | 0.4 |
| *Styrene* | S. DeKalb | 61 | 50 | 0.41 | 1.1 | 0.9 |
| *1,2,3-Trimethylbenzene* | S. DeKalb | 61 | 17 | 0.10 | 0.6 | 0.5 |

| 2016 Metals | | | | | | |
|---|---|---|---|---|---|---|
| (concentrations in micrograms per cubic meter (µg/m$^3$)) | | | | | | |
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.*** | **1st Max** | **2nd Max** |
| ***Antimony*** | Macon-Forestry | 29 | 29 | 0.00129 | 0.00945 | 0.00648 |
| | Savannah-E. Pres. St. | 30 | 30 | 0.00094 | 0.00190 | 0.00178 |
| | General Coffee | 28 | 27 | 0.00029 | 0.00063 | 0.04772 |
| | Yorkville | 29 | 29 | 0.00071 | 0.00202 | 0.00187 |
| | South DeKalb** | 61 | 61 | 0.00257 | 0.01264 | 0.00957 |
| ***Arsenic*** | Macon-Forestry | 29 | 22 | 0.00059 | 0.00167 | 0.00142 |
| | Savannah-E. Pres. St. | 30 | 24 | 0.00048 | 0.00104 | 0.00094 |
| | General Coffee | 28 | 15 | 0.00037 | 0.00093 | 0.00065 |
| | Yorkville | 29 | 24 | 0.00080 | 0.00246 | 0.00146 |
| | South DeKalb** | 61 | 49 | 0.00059 | 0.00161 | 0.00145 |
| ***Beryllium*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 30 | 3 | 0.00003 | 0.00015 | 0.00007 |
| | General Coffee | 28 | ND | | | |
| | Yorkville | 29 | 2 | 0.00003 | 0.00014 | 0.00004 |
| | South DeKalb** | 61 | 1 | 0.00003 | 0.00010 | |
| ***Cadmium*** | Macon-Forestry | 29 | 27 | 0.00008 | 0.00016 | 0.00014 |
| | Savannah-E. Pres. St. | 30 | 30 | 0.00017 | 0.00036 | 0.00031 |
| | General Coffee | 28 | 27 | 0.00007 | 0.00017 | 0.00016 |
| | Yorkville | 29 | 28 | 0.00008 | 0.00015 | 0.00014 |
| | South DeKalb** | 61 | 25 | 0.00009 | 0.00054 | 0.00049 |
| ***Chromium*** | Macon-Forestry | 29 | 29 | 0.00138 | 0.00263 | 0.00251 |
| | Savannah-E. Pres. St. | 30 | 30 | 0.00171 | 0.00378 | 0.00317 |
| | General Coffee | 28 | 28 | 0.00122 | 0.00214 | 0.00194 |
| | Yorkville | 29 | 29 | 0.00189 | 0.01051 | 0.00285 |
| | South DeKalb** | 61 | 61 | 0.00184 | 0.00390 | 0.00379 |
| ***Cobalt*** | Macon-Forestry | 29 | 4 | 0.00011 | 0.00048 | 0.00031 |
| | Savannah-E. Pres. St. | 30 | 7 | 0.00012 | 0.00041 | 0.00021 |
| | General Coffee | 28 | ND | | | |
| | Yorkville | 29 | 5 | 0.00009 | 0.00036 | 0.00021 |
| | South DeKalb** | 61 | 16 | 0.00008 | 0.00033 | 0.00020 |

| 2016 Metals (continued) | | | | | | |
|---|---|---|---|---|---|---|
| (concentrations in µg/m$^3$) | | | | | | |
| Name | Site | #Samples | #Detects^ | Avg.* | 1st Max | 2nd Max |
| *Lead* | Macon-Forestry | 29 | 29 | 0.00170 | 0.00396 | 0.00363 |
| | Savannah-E. Pres. St. | 30 | 30 | 0.00280 | 0.01551 | 0.00755 |
| | General Coffee | 28 | 28 | 0.00094 | 0.00153 | 0.00143 |
| | Yorkville | 29 | 29 | 0.00157 | 0.00514 | 0.00283 |
| | South DeKalb** | 61 | 61 | 0.00192 | 0.00668 | 0.00433 |
| *Manganese* | Macon-Forestry | 29 | 29 | 0.00807 | 0.02059 | 0.01845 |
| | Savannah-E. Pres. St. | 30 | 30 | 0.00883 | 0.03441 | 0.03430 |
| | General Coffee | 28 | 28 | 0.00313 | 0.00736 | 0.00697 |
| | Yorkville | 29 | 29 | 0.00596 | 0.02756 | 0.01341 |
| | South DeKalb** | 61 | 61 | 0.00441 | 0.01820 | 0.01264 |
| *Nickel* | Macon-Forestry | 29 | 27 | 0.00049 | 0.00091 | 0.00085 |
| | Savannah-E. Pres. St. | 30 | 28 | 0.00080 | 0.00179 | 0.00165 |
| | General Coffee | 28 | 26 | 0.00082 | 0.00231 | 0.00179 |
| | Yorkville | 29 | 27 | 0.00053 | 0.00107 | 0.00083 |
| | South DeKalb** | 61 | 57 | 0.00057 | 0.00114 | 0.00110 |
| *Selenium* | Macon-Forestry | 29 | 21 | 0.00029 | 0.00095 | 0.00090 |
| | Savannah-E. Pres. St. | 30 | 18 | 0.00021 | 0.00074 | 0.00069 |
| | General Coffee | 28 | 11 | 0.00012 | 0.00041 | 0.00032 |
| | Yorkville | 29 | 15 | 0.00019 | 0.00078 | 0.00056 |
| | South DeKalb** | 61 | 14 | 0.00016 | 0.00137 | 0.00079 |
| *Zinc* | Macon-Forestry | 21 | 21 | 0.02693 | 0.13502 | 0.06352 |
| | Savannah-E. Pres. St. | 23 | 23 | 0.02462 | 0.08524 | 0.04772 |
| | General Coffee | 21 | 21 | 0.01991 | 0.06599 | 0.04225 |
| | Yorkville | 28 | 28 | 0.01368 | 0.02803 | 0.02121 |
| | South DeKalb** | 60 | 60 | 0.01642 | 0.04189 | 0.04145 |

| 2016 Semi-Volatile Compounds | | | | | | |
|---|---|---|---|---|---|---|
| (concentrations in µg/m$^3$) | | | | | | |
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.**** | **1st Max** | **2nd Max** |
| *Acenaphthene* | Macon-Forestry | 22 | 22 | 0.00301 | 0.01330 | 0.00970 |
| | Savannah-E. Pres. St. | 21 | 21 | 0.00143 | 0.00509 | 0.00344 |
| | General Coffee | 20 | 15 | 0.00039 | 0.00198 | 0.00173 |
| | South DeKalb* | 55 | 55 | 0.00170 | 0.00456 | 0.00416 |
| | Yorkville | 27 | 25 | 0.00091 | 0.00155 | 0.00095 |
| *Acenaphthylene* | Macon-Forestry | 20 | 3 | 0.00011 | 0.00025 | 0.00020 |
| | Savannah-E. Pres. St. | 21 | 2 | 0.00017 | 0.00210 | 0.00025 |
| | General Coffee | 20 | 2 | 0.00011 | 0.00035 | 0.00015 |
| | South DeKalb* | 55 | 10 | 0.00021 | 0.00104 | 0.00080 |
| | Yorkville | 27 | 2 | 0.00015 | 0.00018 | 0.00015 |
| *Anthracene* | Macon-Forestry | 22 | ND | | | |
| | Savannah-E. Pres. St. | 21 | 1 | 0.00013 | 0.00090 | |
| | General Coffee | 20 | 2 | 0.00011 | 0.00045 | 0.00391 |
| | South DeKalb* | 55 | 2 | 0.00019 | 0.00248 | 0.00082 |
| | Yorkville | 27 | 1 | 0.00014 | 0.00015 | |
| *Benzo(a)anthracene* | Macon-Forestry | 22 | ND | | | |
| | Savannah-E. Pres. St. | 21 | 1 | 0.00011 | 0.00021 | |
| | General Coffee | 21 | ND | | | |
| | South DeKalb* | 55 | 1 | 0.00015 | 0.00073 | |
| | Yorkville | 27 | ND | | | |
| *Benzo(a)pyrene* | Macon-Forestry | 22 | ND | | | |
| | Savannah-E. Pres. St. | 21 | 1 | 0.00011 | 0.00021 | |
| | General Coffee | 21 | ND | | | |
| | South DeKalb* | 55 | 2 | 0.00015 | 0.00085 | 0.00015 |
| | Yorkville | 27 | ND | | | |
| *Benzo(b)fluoranthene* | Macon-Forestry | 22 | ND | | | |
| | Savannah-E. Pres. St. | 21 | 1 | 0.00011 | 0.00028 | 0.00015 |
| | General Coffee | 21 | ND | | | |
| | South DeKalb* | 55 | 3 | 0.00015 | 0.00032 | 0.00015 |
| | Yorkville | 27 | 1 | 0.00014 | 0.00015 | |
| *Benzo(e)pyrene* | Macon-Forestry | 22 | ND | | | |
| | Savannah-E. Pres. St. | 21 | ND | | | |
| | General Coffee | 21 | 1 | 0.00011 | 0.00018 | |
| | South DeKalb* | 55 | 7 | 0.00016 | 0.00085 | 0.00021 |
| | Yorkville | 27 | 1 | 0.00014 | 0.00015 | |

| 2016 Semi-Volatile Compounds (continued) (concentrations in µg/m³) | | | | | | |
|---|---|---|---|---|---|---|
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.**** | **1st Max** | **2nd Max** |
| ***Benzo(g,h,i)perylene*** | Macon-Forestry | 21 | ND | | | |
| | Savannah-E. Pres. St. | 21 | 2 | 0.00011 | 0.00021 | 0.00015 |
| | General Coffee | 21 | ND | | | |
| | South DeKalb* | 55 | 10 | 0.00016 | 0.00091 | 0.00021 |
| | Yorkville | 27 | 1 | 0.00014 | 0.00015 | |
| ***Benzo(k)fluoranthene*** | Macon-Forestry | 22 | ND | | | |
| | Savannah-E. Pres. St. | 21 | ND | | | |
| | General Coffee | 21 | 1 | 0.00011 | 0.00019 | |
| | South DeKalb* | 55 | 3 | 0.00015 | 0.00047 | 0.00033 |
| | Yorkville | 27 | 1 | 0.00014 | 0.00016 | |
| ***Chrysene*** | Macon-Forestry | 21 | ND | | | |
| | Savannah-E. Pres. St. | 21 | 2 | 0.00011 | 0.00020 | 0.00018 |
| | General Coffee | 21 | 1 | 0.00013 | 0.00035 | |
| | South DeKalb* | 55 | 8 | 0.00017 | 0.00113 | 0.00030 |
| | Yorkville | 27 | 1 | 0.00014 | 0.00015 | |
| ***Dibenzo(a,h)anthracene*** | Macon-Forestry | 22 | ND | | | |
| | Savannah-E. Pres. St. | 21 | ND | | | |
| | General Coffee | 21 | ND | | | |
| | South DeKalb* | 55 | ND | | | |
| | Yorkville | 27 | ND | | | |
| ***Fluoranthene*** | Macon-Forestry | 22 | 20 | 0.00085 | 0.00301 | 0.00213 |
| | Savannah-E. Pres. St. | 21 | 18 | 0.00049 | 0.00140 | 0.00136 |
| | General Coffee | 20 | 14 | 0.00047 | 0.00218 | 0.00125 |
| | South DeKalb* | 55 | 55 | 0.00076 | 0.00197 | 0.00186 |
| | Yorkville | 27 | 19 | 0.00044 | 0.00058 | 0.00050 |
| ***Fluorene*** | Macon-Forestry | 22 | 22 | 0.00225 | 0.00603 | 0.00570 |
| | Savannah-E. Pres. St. | 21 | 21 | 0.00132 | 0.00357 | 0.00209 |
| | General Coffee | 20 | 17 | 0.00056 | 0.00231 | 0.00143 |
| | South DeKalb* | 55 | 55 | 0.00219 | 0.00619 | 0.00544 |
| | Yorkville | 27 | 24 | 0.00150 | 0.00225 | 0.00185 |
| ***Indeno(1,2,3-cd)pyrene*** | Macon-Forestry | 22 | ND | | | |
| | Savannah-E. Pres. St. | 21 | 2 | 0.00011 | 0.00018 | 0.00015 |
| | General Coffee | 21 | 1 | 0.00011 | 0.00021 | |
| | South DeKalb* | 55 | 6 | 0.00015 | 0.00085 | 0.00018 |
| | Yorkville | 27 | 1 | 0.00014 | 0.00015 | |

| 2016 Semi-Volatile Compounds (continued) (concentrations in µg/m$^3$) | | | | | | |
|---|---|---|---|---|---|---|
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.**** | **1$^{st}$ Max** | **2$^{nd}$ Max** |
| *Naphthalene* | Macon-Forestry | 22 | 21 | 0.02190 | 0.05382 | 0.04517 |
| | Savannah-E. Pres. St. | 21 | 21 | 0.01342 | 0.04760 | 0.02344 |
| | General Coffee | 20 | 20 | 0.00772 | 0.06561 | 0.02103 |
| | South DeKalb* | 55 | 55 | 0.04823 | 0.12346 | 0.11569 |
| | Yorkville | 27 | 27 | 0.01620 | 0.02960 | 0.01831 |
| *Phenanthrene* | Macon-Forestry | 22 | 22 | 0.00487 | 0.01623 | 0.01457 |
| | Savannah-E. Pres. St. | 21 | 21 | 0.00239 | 0.00634 | 0.00568 |
| | General Coffee | 21 | 20 | 0.00138 | 0.00430 | 0.00391 |
| | South DeKalb* | 55 | 55 | 0.00389 | 0.00909 | 0.00768 |
| | Yorkville | 27 | 23 | 0.00252 | 0.00429 | 0.00283 |
| *Pyrene* | Macon-Forestry | 22 | 19 | 0.00032 | 0.00101 | 0.00068 |
| | Savannah-E. Pres. St. | 21 | 16 | 0.00026 | 0.00123 | 0.00057 |
| | General Coffee | 21 | 12 | 0.00051 | 0.00261 | 0.00138 |
| | South DeKalb* | 55 | 50 | 0.00039 | 0.00131 | 0.00055 |
| | Yorkville | 27 | 9 | 0.00022 | 0.00032 | 0.00020 |
| *Perylene* | South DeKalb* | 55 | ND | | | |

ND indicates no detection

^Detect is counted as any value above half method detection limit.

*Sample collected every 6 days.

**When a detected concentration is below one half of the method detection limit, then one half of the method detection level is used to calculate the average.

| 2016 Volatile Organic Compounds (concentrations in µg/m³) | | | | | | |
|---|---|---|---|---|---|---|
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.**** | **1st Max** | **2nd Max** |
| *Freon 113* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *Freon 114* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *1,3-Butadiene* | Macon-Forestry | 29 | 1 | 0.28956 | 0.37616 | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *Cyclohexane* | Macon-Forestry | 29 | 1 | 0.45185 | 0.61988 | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | 1 | 0.44310 | 0.75763 | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | 1 | 6.84299 | 185.9632 | |
| *Chloromethane* | Macon-Forestry | 29 | 29 | 1.09219 | 1.32188 | 1.28057 |
| | Savannah-E. Pres. St. | 25 | 25 | 1.27740 | 2.16871 | 1.75562 |
| | General Coffee | 22 | 22 | 0.95366 | 1.63170 | 1.48711 |
| | South DeKalb* | 60 | 60 | 1.03358 | 1.28057 | 1.23926 |
| | DMRC | 29 | 29 | 1.06921 | 1.50777 | 1.25992 |
| | Yorkville | 28 | 28 | 1.05694 | 1.46646 | 1.23926 |
| *Dichloromethane* | Macon-Forestry | 29 | 13 | 0.52026 | 1.28479 | 0.55558 |
| | Savannah-E. Pres. St. | 25 | 4 | 0.45609 | 0.48614 | 0.45141 |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | 10 | 0.45517 | 0.65976 | 0.59031 |
| | DMRC | 29 | 8 | 0.46588 | 0.59031 | 0.55558 |
| | Yorkville | 28 | 3 | 0.45081 | 0.45141 | 0.43405 |

| 2016 Volatile Organic Compounds (continued) (concentrations in µg/m³) | | | | | | |
|---|---|---|---|---|---|---|
| Name | Site | #Samples | #Detects^ | Avg.** | 1st Max | 2nd Max |
| *Chloroform* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *Carbon tetrachloride* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *Trichlorofluoromethane* | Macon-Forestry | 29 | 29 | 1.16947 | 1.40491 | 1.29252 |
| | Savannah-E. Pres. St. | 25 | 25 | 1.18012 | 1.40491 | 1.29252 |
| | General Coffee | 22 | 22 | 1.03673 | 1.40491 | 1.23632 |
| | South DeKalb* | 60 | 60 | 1.19183 | 1.5173 | 1.34871 |
| | DMRC | 29 | 29 | 1.16326 | 1.4611 | 1.34871 |
| | Yorkville | 28 | 28 | 1.15687 | 1.5173 | 1.34871 |
| *Chloroethane* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *1,1-Dichloroethane* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *Methyl chloroform* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |

| 2016 Volatile Organic Compounds (continued) (concentrations in µg/m³) | | | | | | |
|---|---|---|---|---|---|---|
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.**** | **1st Max** | **2nd Max** |
| ***Ethylene dichloride*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| ***Tetrachloroethylene*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| ***1,1,2,2-Tetrachloroethane*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| ***Bromomethane*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | 3 | 0.58625 | 0.66853 | 0.62396 |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| ***1,1,2-Trichloroethane*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| ***Dichlorodifluoromethane*** | Macon-Forestry | 29 | 29 | 1.99582 | 2.22515 | 1.58233 |
| | Savannah-E. Pres. St. | 25 | 25 | 2.04448 | 2.3735 | 2.22515 |
| | General Coffee | 22 | 22 | 1.66588 | 2.2746 | 2.17571 |
| | South DeKalb* | 60 | 60 | 1.98904 | 2.3735 | 1.92847 |
| | DMRC | 29 | 29 | 1.97627 | 2.3735 | 2.17571 |
| | Yorkville | 28 | 28 | 1.95575 | 2.47239 | 2.32405 |

| 2016 Volatile Organic Compounds (continued) (concentrations in µg/m³) | | | | | | |
|---|---|---|---|---|---|---|
| Name | Site | #Samples | #Detects^ | Avg.** | 1st Max | 2nd Max |
| *Trichloroethylene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *1,1-Dichloroethylene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *1,2-Dichloropropane* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *trans-1,3-Dichloropropene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *cis-1,3-Dichloropropene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *cis-1,2-Dichloroethene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |

| 2016 Volatile Organic Compounds (continued) | | | | | | |
|---|---|---|---|---|---|---|
| (concentrations in µg/m³) | | | | | | |
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.**** | **1st Max** | **2nd Max** |
| *Ethylene dibromide* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *Hexachlorobutadiene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *Vinyl chloride* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *m/p Xylene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | 11 | 0.56611 | 0.78184 | 0.54295 |
| | DMRC | 29 | 7 | 0.61389 | 1.04245 | 0.95558 |
| | Yorkville | 28 | ND | | | |
| *Benzene* | Macon-Forestry | 29 | 7 | 0.42242 | 0.54303 | 0.44720 |
| | Savannah-E. Pres. St. | 25 | 6 | 0.44781 | 0.92634 | 0.54303 |
| | General Coffee | 22 | 2 | 0.41966 | 0.54303 | 0.39928 |
| | South DeKalb* | 60 | 32 | 0.59440 | 3.51370 | 0.54295 |
| | DMRC | 29 | 17 | 0.65483 | 2.01239 | 1.50131 |
| | Yorkville | 28 | 2 | 0.42076 | 0.54303 | 0.47914 |
| *Toluene* | Macon-Forestry | 29 | 12 | 0.59361 | 1.05472 | 0.90405 |
| | Savannah-E. Pres. St. | 25 | 7 | 0.53026 | 0.79104 | 0.71571 |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | 29 | 0.87203 | 4.52025 | 0.54295 |
| | DMRC | 29 | 18 | 0.87454 | 2.71215 | 2.03411 |
| | Yorkville | 28 | ND | | | |

| 2016 Volatile Organic Compounds (continued) (concentrations in µg/m³) | | | | | | |
|---|---|---|---|---|---|---|
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.**** | **1st Max** | **2nd Max** |
| *Ethylbenzene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *o- Xylene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *1,3,5-Trimethylbenzene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *1,2,4-Trimethylbenzene* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *Styrene* | Macon-Forestry | 29 | 9 | 0.69878 | 1.49162 | 1.44900 |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| *Benzene,1-ethenyl-4-methyl* | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |

| 2016 Volatile Organic Compounds (continued) (concentrations in µg/m³) | | | | | | |
|---|---|---|---|---|---|---|
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.**** | **1st Max** | **2nd Max** |
| ***Chlorobenzene*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| ***1,2-Dichlorobenzene*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| ***1,3-Dichlorobenzene*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| ***1,4-Dichlorobenzene*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| ***Benzyl chloride*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |
| ***1,2,4-Trichlorobenzene*** | Macon-Forestry | 29 | ND | | | |
| | Savannah-E. Pres. St. | 25 | ND | | | |
| | General Coffee | 22 | ND | | | |
| | South DeKalb* | 60 | ND | | | |
| | DMRC | 29 | ND | | | |
| | Yorkville | 28 | ND | | | |

ND indicates no detection

^Detect is counted as any value above half method detection limit.

*Sample collected every 6 days

**When a detected concentration is below one half of the method detection limit, then one half of the method detection level is used to calculate the average.

| 2016 Black Carbon | | | | | | | |
|---|---|---|---|---|---|---|---|
| (concentrations in micrograms per cubic meter) | | | | | | | |
| **Site ID** | **City** | **County** | **Site Name** | **Hours Measured** | **Annual Mean** | **1st Max** | **2nd Max** |
| 130890002 | Decatur | DeKalb | South DeKalb | 5765 | 1.095 | 7.90 | 5.88 |
| 130890003 | Decatur | DeKalb | DMRC | 8756 | 1.604 | 34.64 | 23.76 |
| 131210056 | Atlanta | Fulton | GA Tech NR | 8745 | 1.902 | 11.73 | 9.13 |

| 2016 Carbonyl Compounds, 24-hour | | | | | | |
|---|---|---|---|---|---|---|
| (concentrations in micrograms per cubic meter) | | | | | | |
| **Name** | **Site** | **#Samples** | **#Detects^** | **Avg.**** | **1st Max** | **2nd Max** |
| *Formaldehyde* | Savannah-E. Pres. St. | 30 | 30 | 3.53751 | 38.57062 | 5.30051 |
| | Yorkville | 30 | 28 | 4.35711 | 29.08587 | 10.38422 |
| | South DeKalb* | 26 | 26 | 1.46554 | 4.29000 | 3.87000 |
| *Acetaldehyde* | Savannah-E. Pres. St. | 30 | 23 | 1.60942 | 20.41974 | 2.31665 |
| | Yorkville | 30 | 28 | 2.01350 | 18.00554 | 6.92281 |
| | South DeKalb* | 27 | 27 | 1.09107 | 2.97000 | 2.77000 |
| *Propionaldehyde* | Savannah-E. Pres. St. | 30 | 1 | 0.63719 | 2.89280 | |
| | Yorkville | 30 | 3 | 0.76155 | 5.19391 | 1.79993 |
| | South DeKalb* | 27 | 4 | 0.82479 | 6.64000 | 5.25000 |
| *Butyraldehyde* | Savannah-E. Pres. St. | 30 | 1 | 0.68476 | 4.36756 | |
| | Yorkville | 30 | 3 | 0.70084 | 3.73961 | 1.45379 |
| | South DeKalb* | 27 | 1 | 0.56266 | 0.60000 | |
| *Acetone* | Savannah-E. Pres. St. | 30 | 25 | 2.81264 | 7.34546 | 5.67215 |
| | Yorkville | 30 | 26 | 1.96488 | 5.67749 | 5.54017 |
| | South DeKalb* | 27 | 20 | 1.06631 | 4.29000 | 4.15000 |
| *Benzaldehyde* | Savannah-E. Pres. St. | 30 | ND | | | |
| | Yorkville | 30 | 1 | 0.56200 | 2.14681 | |
| | South DeKalb* | 26 | ND | | | |
| *Acrolein (with canister method)* | Savannah-E. Pres. St. | 25 | 7 | 0.33182 | 0.59656 | 0.45890 |
| | Yorkville | 28 | 15 | 0.35802 | 0.94074 | 0.48184 |
| | DMRC | 29 | 12 | 0.33614 | 0.61951 | 0.43595 |
| | Macon | 29 | 23 | 0.68320 | 1.44552 | 0.48184 |
| | General Coffee | 22 | 13 | 0.33428 | 0.48184 | 0.45890 |
| | South DeKalb* | 60 | 20 | 0.32027 | 0.66540 | 0.45890 |

ND indicates no detection

^Detect is counted as any value above half method detection limit.

* Sample collected every 6 days

** When a detected concentration is below one half of the method detection limit, then one half of the method detection level is used to calculate the average.