AIR PROTECTION BRANCH

2018 Air Quality Report

GEORGIA
DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

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.
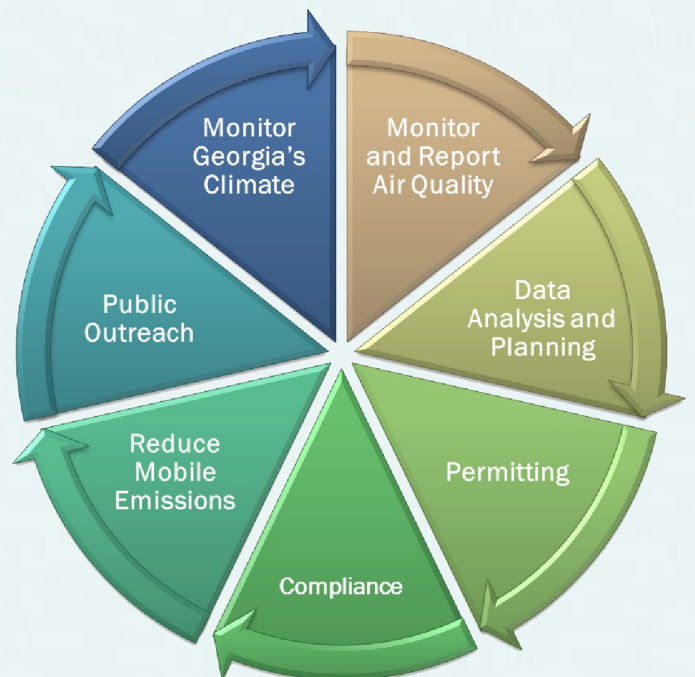
Who We Are

- 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 federally required emission testing on cars

Air Quality in Georgia: 2018

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 40 sites in 28 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 2018 and shows that the air quality in Georgia has steadily improved over the last few decades.

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

How are we doing as a state?

> **Between 1990 and 2018, total emissions of the six principal air pollutants dropped by 69 percent, while the gross domestic product increased by 318 percent.**
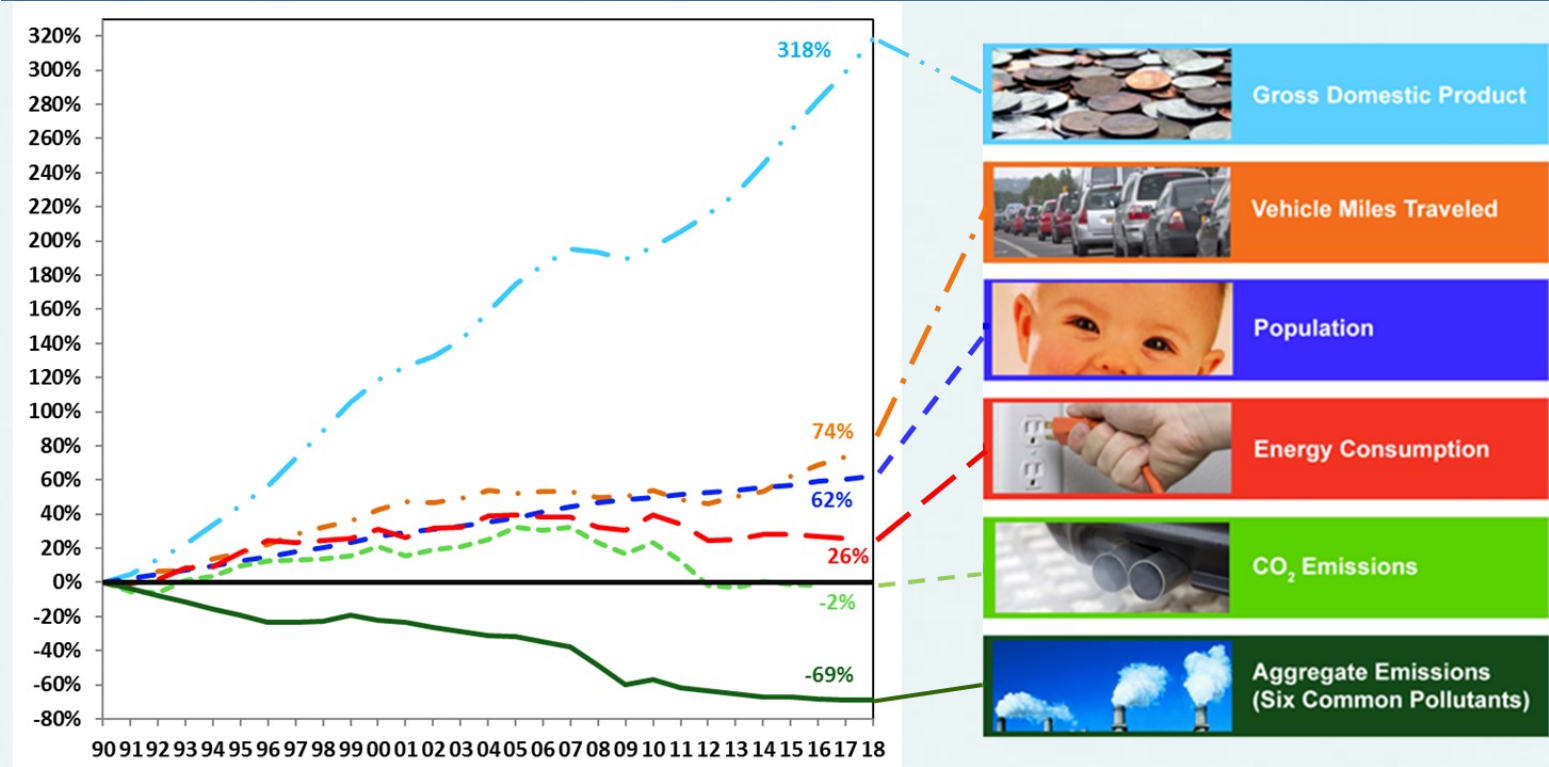
Air Monitoring FAQs

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 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 (https://airgeorgia.org/) and AirNow, a national air quality database, to provide real-time information.

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 https://airgeorgia.org/. Georgia's air quality data is also uploaded to a national air quality information database called AirNow (https://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. 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 https://airgeorgia.org/

Social Media
Georgia Climate Office

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

https://twitter.com/gaclimateoffice

Working Together

Field and laboratory personnel involved in producing ambient air quality data took tours to see how the whole process works together to prepare the data for the public.
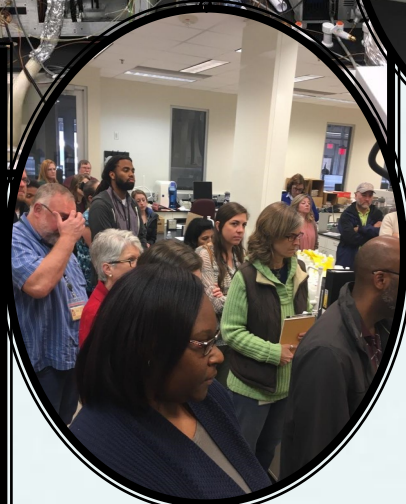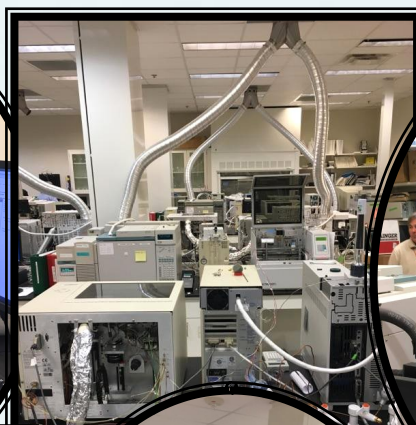
Air Quality Awareness Week (AQAW)

In 2018, the Air Protection Branch hosted its first Air Quality Awareness Week starting on April 30th. Multiple activities took place throughout the week which are highlighted here.

Left: Maria Geonczy gives a presentation on how to bike to work safely.

Right: APB employees dressed up in specific colors during the week including green to represent a 'Good' Air Quality Index and blue for blue skies Friday.

The APB also participated by sending out informational resources via email and the Clear the Deck campaign where people were allowed to telework in an attempt to reduce the number of cars in the parking lot/deck.

The APB participated in an activity to look at commutes. The red, blue and purple strings represent single commuter, carpool and transit commutes. Green pins represent people who telework once a week, and the red pins represent workers who do not telework.

Director's Office Visits South DeKalb

Members of the Director's Office visited the South DeKalb monitoring site in May 2018 to learn about what is monitored there. South DeKalb is our most comprehensive monitoring site and part of the national NATTS, PAMS, IMPROVE and NCore networks.
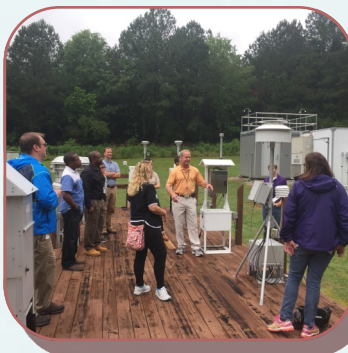
Reaching out into the Community

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.

GA EPD air quality forecasters presenting information at air quality conferences.
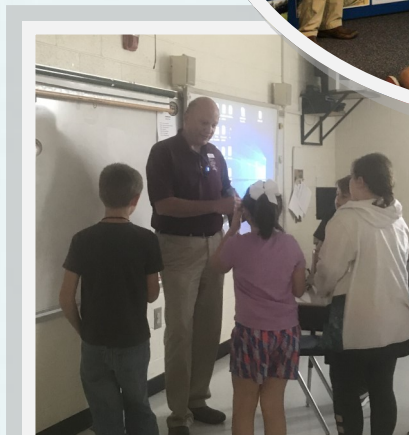
GA EPD air quality forecasters presenting to local schools.

Students from Georgia State University visited the South DeKalb site in November as a part of a class project to learn more about environmental monitoring stations.

Voluntary Emissions Reductions Programs– GA EPD Partners

Encouraging fewer vehicles on the road...

- 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 metropolitan area.

- Rewards commuters for trying an alternative to driving alone to and from work (e.g. carpooling or trying transit).

http://gacommuteoptions.com/
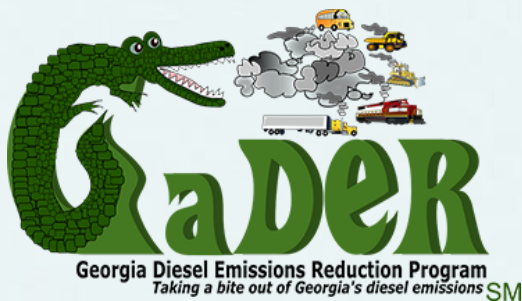
With a focus on reducing all sources of diesel emissions in Georgia, the GADER program not only encompasses the Georgia School Bus Retrofit initiative, but also assists with funding, and education assistance and outreach for voluntary measures such as idling reduction, Truck Stop Electrification, the 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, and the newer buses come equipped 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.

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.

Working to reduce locomotive and rail yard emissions...

- Locomotives can be retrofitted with cleaner engines and technology that helps improve air quality.

- Smaller, more efficient modular diesel engines reduce emissions.

- 1 "genset" conversion was completed. The genset with Tier 4 engines utilize two or more smaller engines that can combine to equal the horsepower of the older engine.

- Automatic engine start/stop technology reduces idling.

- 9 conversions were completed that use in-cylinder strategies including better fuel injection timing, and better rings and oil separators.

- 'Mother'-'Slug' sets operate in tandem. A Mother is diesel powered and provides excess electrical power to drive a Slug's traction motors, saving fuel and reducing air pollution.

- 41 locomotives have been converted to 25 Mothers and 16 Slugs in Georgia.

- Electric plugin stations allow the diesel engine to be shut down when temperatures drop below freezing by maintaining the water temperature above freezing.

NORFOLK SOUTHERN

41 LOCOMOTIVES CONVERTED INTO **25** MOTHERS AND **16** SLUGS

CSX TRANSPORTATION

6 CONVERSIONS

GaDER Georgia Diesel Emissions Reduction Program

ARGOS

1 LOCOMOTIVE CONVERTED INTO A TIER-4 GENSET

Air Quality in Georgia

Pollutants of Concern and Their Sources in Georgia

The list below shows the most common air pollutants in Georgia by percentage and their sources as found in the 2014 National Emissions Inventory (NEI) Version 2 . 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.

Particulate matter 2.5
PM$_{2.5}$
47% 33% 12% 3% 2% 2% 1%

Particulate matter 10
PM$_{10}$
79% 12% 5% 2% 1% 1%

Volatile organic compounds
VOCs
84% 4% 4% 3% 2% 1% 1%

Sulfur dioxide
SO$_2$
54% 30% 8% 3% 3% 3%

Nitrogen oxides
NOx
46% 17% 17% 8% 5% 5% 3%

Carbon monoxide
CO
37% 20% 18% 11% 9% 4%

Lead
Pb
67% 20% 7% 7%
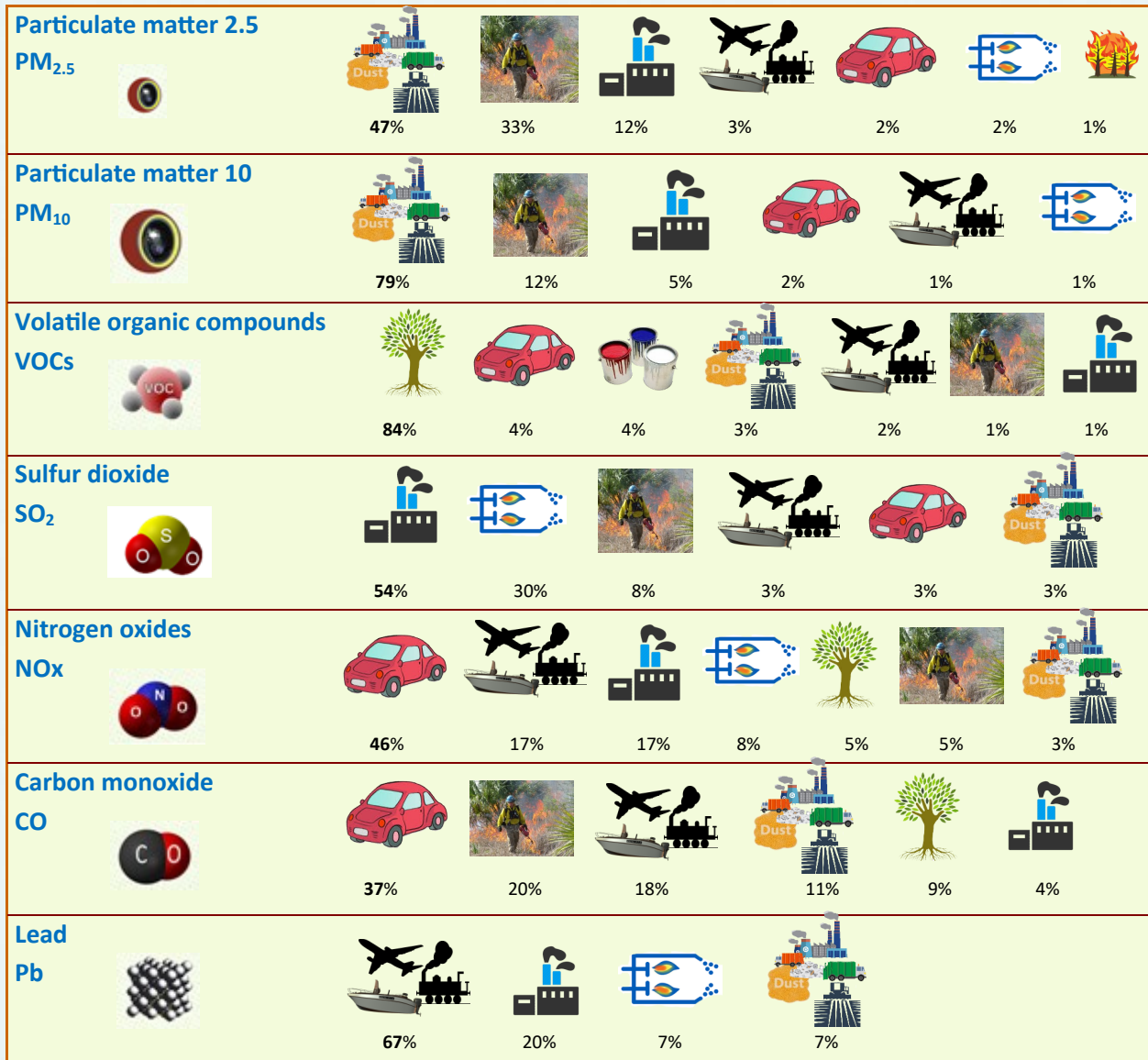
*CO is more of a concern for indoor air quality than it is for outdoor air quality.

Key:

On-road Mobile | Non-road Mobile | Stationary/ Other | Fuel Combustion (EGU) | Prescribed Fire | Wildfires | Miscellaneous | Biogenics | Solvent

Figure 1. Pollutants of Concern and Their Sources in Georgia

Source: 2014v2 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 2010 through 2018. In 2011, there was a wildfire in the Okefenokee Swamp area that showed an uptick in the data for that year.

Georgia's air quality is improving...
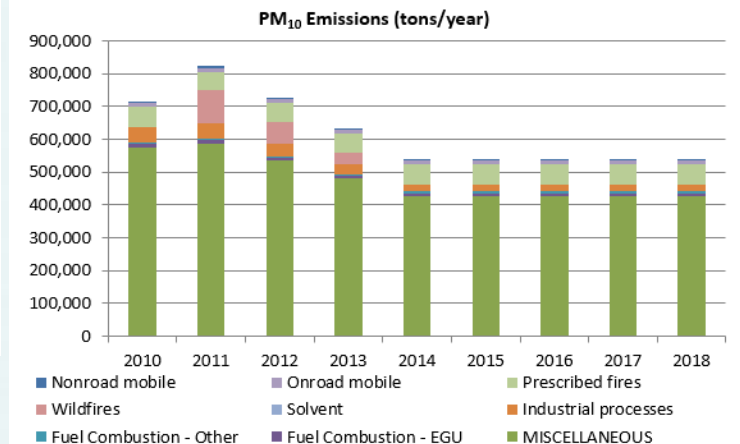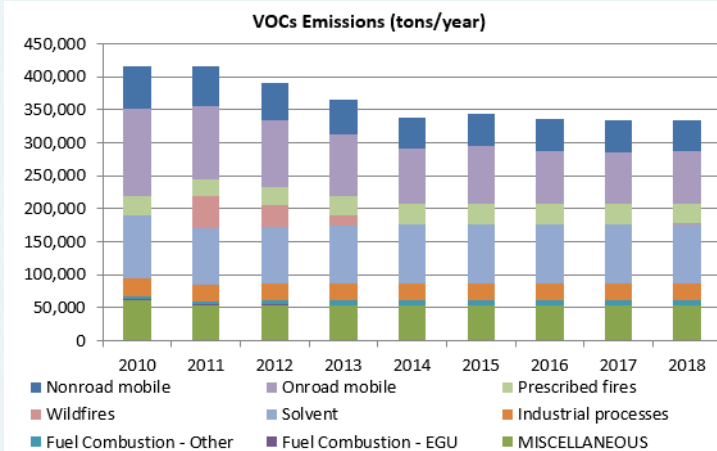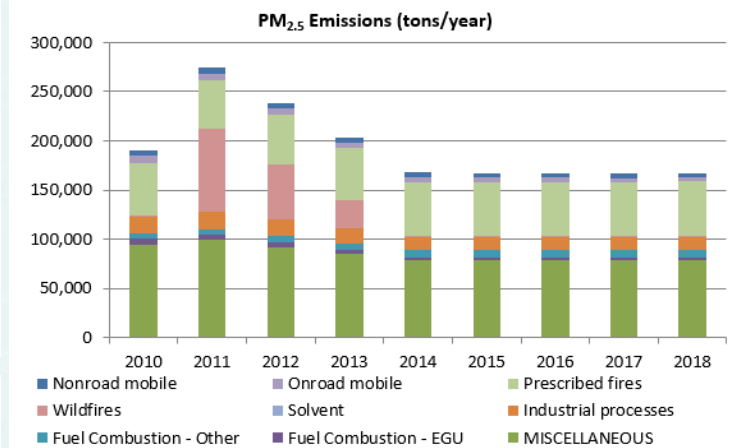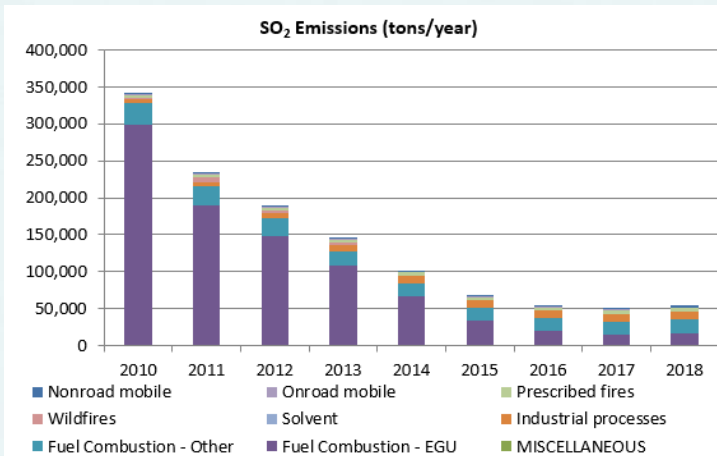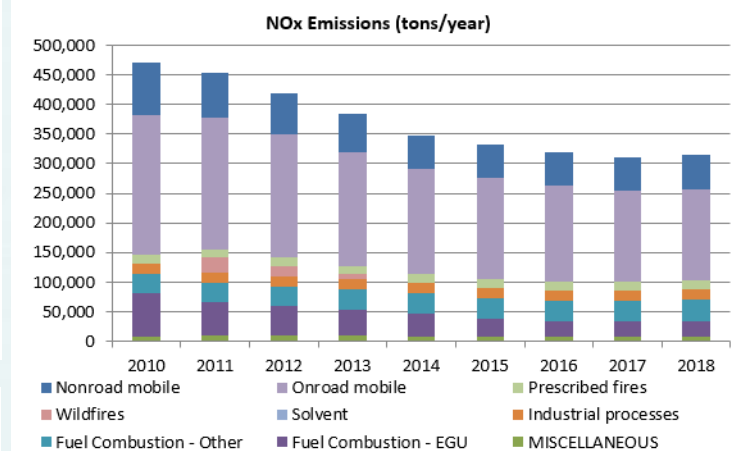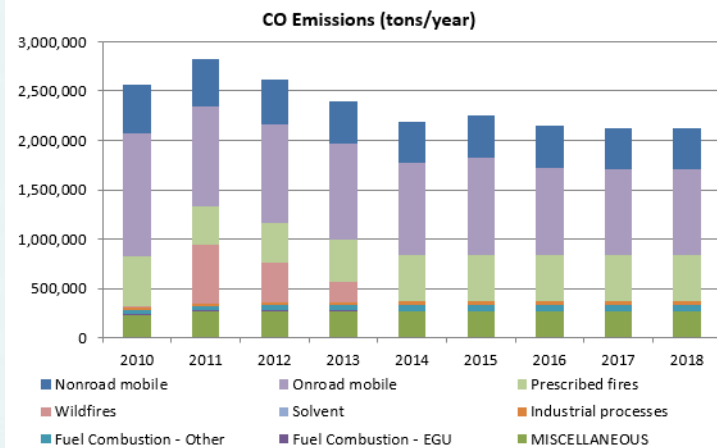
Figure 2. Emissions Trends in Georgia

Georgia's Ambient Air Monitoring Sites

Atlanta MSA

- Dawsonville
- Kennesaw
- Gwinnett Tech
- Fire Station #8
- NR - GA Tech
- United Avenue
- Douglasville
- NR - 285
- South DeKalb
- Conyers
- Forest Park
- McDonough
- EPA CASTNET

Rossville

Fort Mountain

Summerville

Kraftsman Rome

Gainesville

See Atlanta MSA Inset

Athens

Evans
Augusta

Sandersville

Macon - Allied **Macon - Forestry**

Warner Robins

See Columbus MSA Inset

Savannah - Mercer **Savannah - E. President**
Savannah - L&A

Leslie

Albany

General Coffee

Brunswick

Valdosta

Columbus MSA

- Columbus - Airport
- Columbus - Health Department
- Columbus - Allied
- Columbus - Joy Road
- Columbus - Cusseta

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)
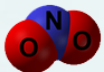
Oxides of Nitrogen (NO$_2$)

Sulfur Dioxide (SO$_2$)

Ozone (O$_3$)

Lead (Pb)

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.

Particulate Matter (PM)
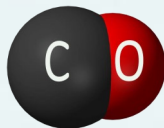
Carbon Monoxide (CO)

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, 55% of the carbon monoxide comes from mobile sources including cars, construction equipment, aircraft, locomotives, and on the coast commercial marine vessels.

37%	20%	18%	11%	9%	4%
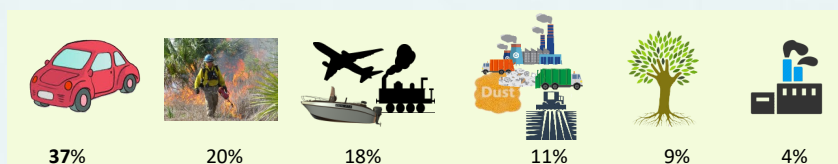
See page 18 for icon key.

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
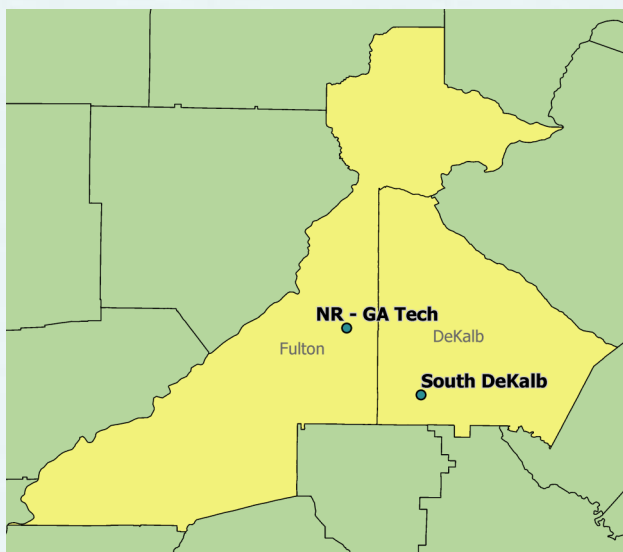
Figure 4. Georgia carbon monoxide monitoring sites

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.
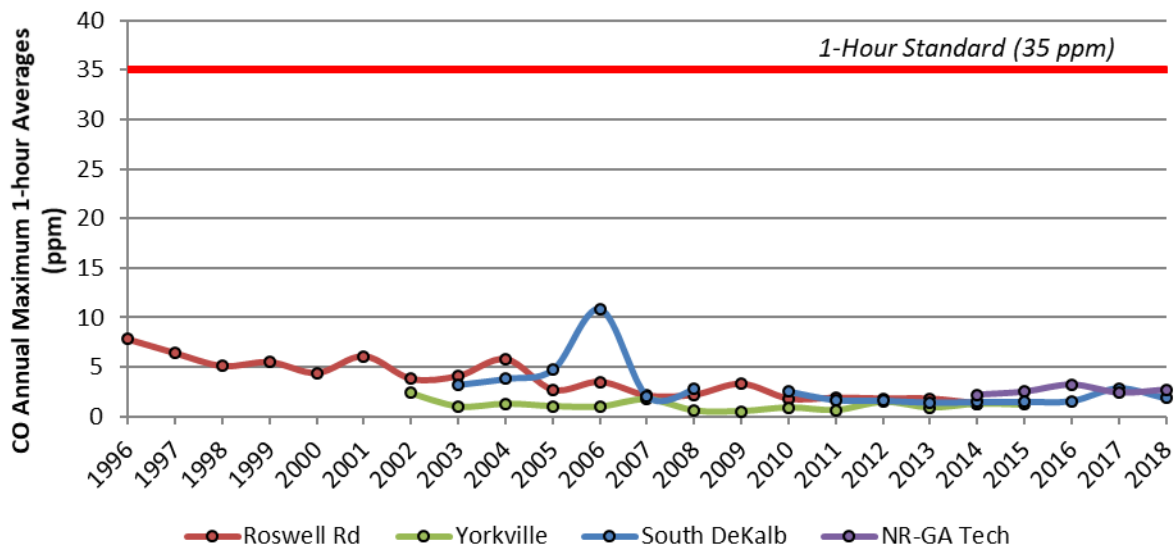
Figure 5. Carbon monoxide annual maximum 1-hour average compared to the 1-hour standard
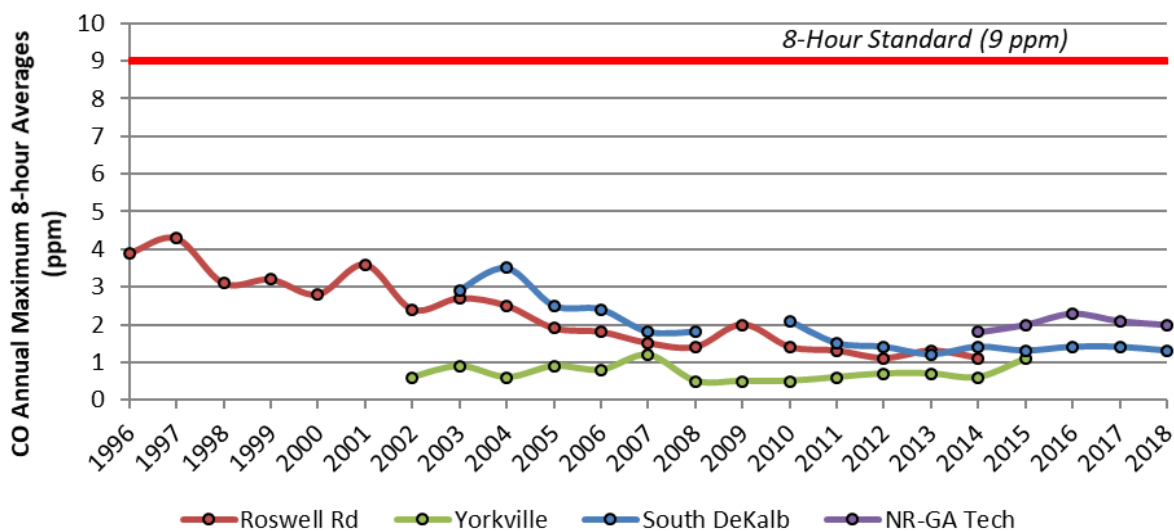
Figure 6. Carbon monoxide annual 8-hour average compared to the 8-hour standard

Oxides of Nitrogen (NO, NO$_2$, NO$_x$ and NO$_Y$)

NO

NO$_2$

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, 46% of NOx comes from vehicles.

- NO$_2$ is formed from the oxidation of nitric oxide (NO).

- NO$_Y$ consists of all atmospheric reactive nitrogen oxide compounds.

| 46% | 17% | 17% | 8% | 5% | 5% | 3% |
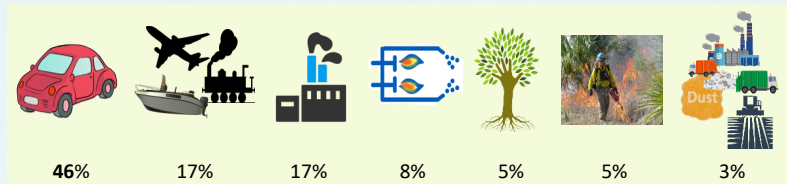
See page 18 for icon key.

Health Impacts

- Increases risk of respiratory infections, respiratory diseases and asthma

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$_2$O — 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/

Georgia Monitoring Information for Oxides of Nitrogen
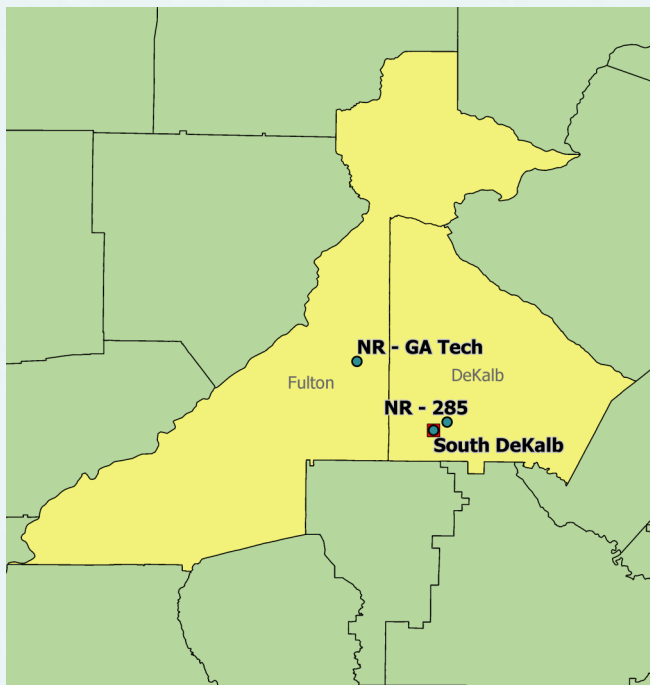
Figure 7. Georgia's NO/NO$_2$/NO$_x$ monitoring sites (green circles) and NO$_Y$ site (red square)

Measurement Techniques

Measured continuously with a chemiluminescent method[2] and a photolytic method[3]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

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

3 http://www.teledyne-api.com/products/nitrogen-compound-instruments/t200up?SortField=Title&SortDir=Desc&View=%7B42F03482-B71F-4F84-BDA7-DE93805FDA4B%7D

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.
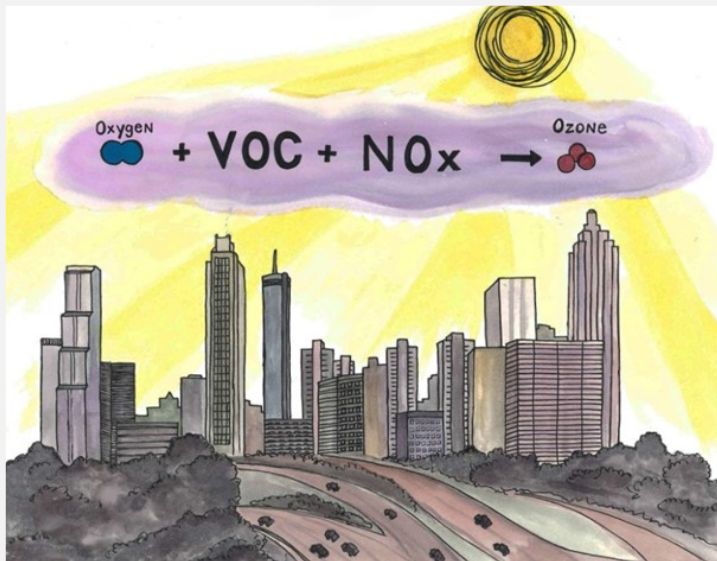
(Courtesy of Jamie Smith)

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, NR-285 and NR-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.
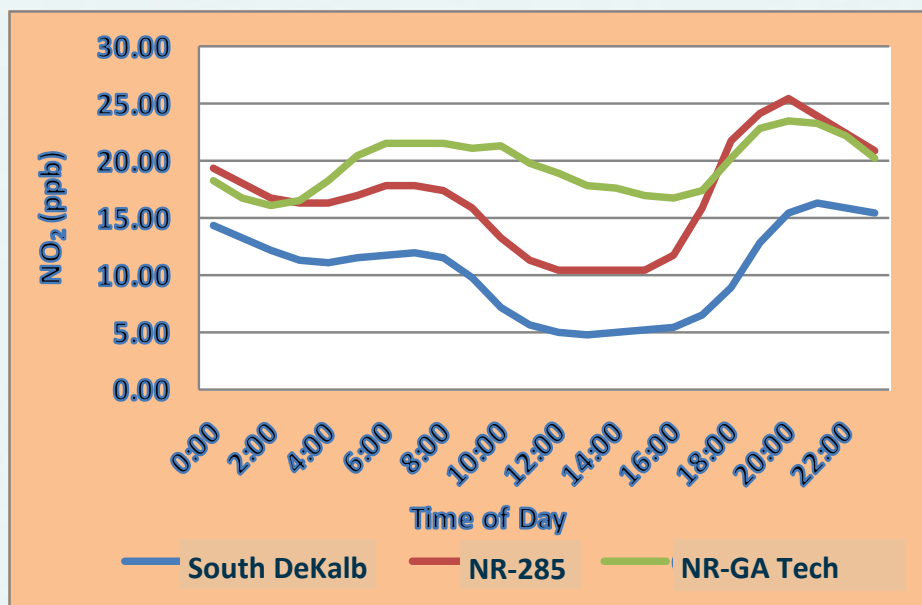
Figure 8. Diurnal Pattern of NO$_2$

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.
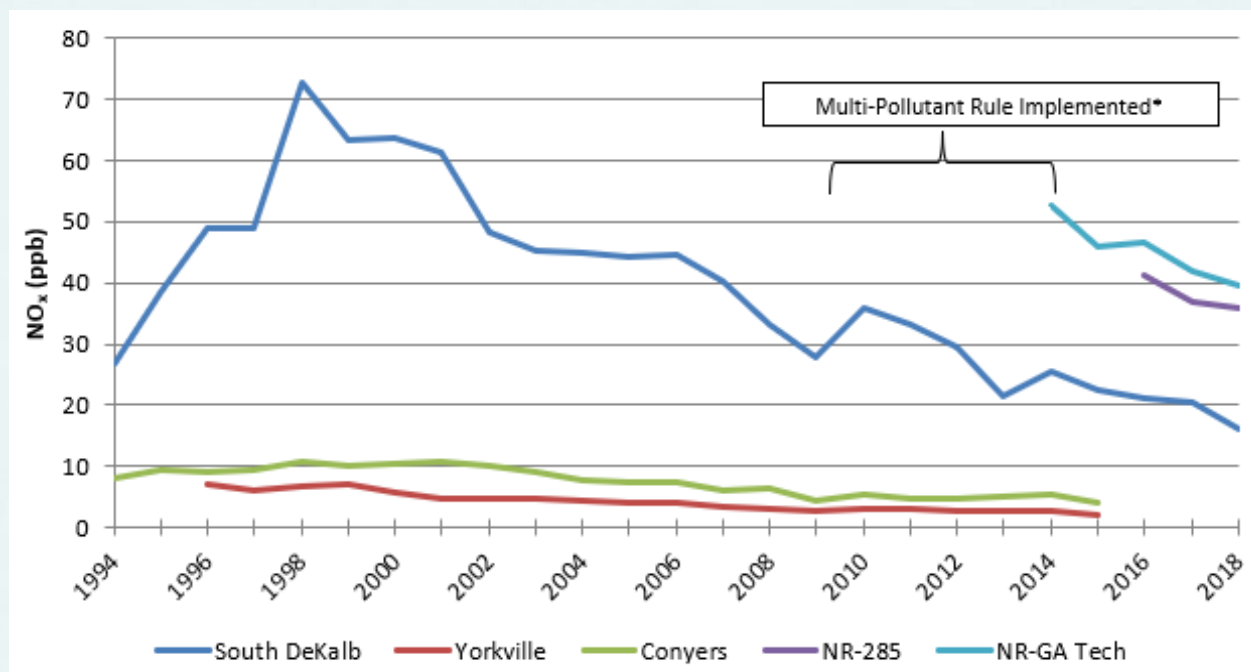
*Multi-pollutant Rule is discussed on page 27.

Figure 9. Implementation of NO$_x$ Controls

National Ambient Air Quality Standards for Nitrogen Dioxide

Primary NAAQS: Annual mean must not exceed 53 ppb

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 2018. Annual average concentrations are well below the standard of 53 ppb.
- EPD operates two near-road monitoring sites (NR-GA Tech and NR-285) 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.
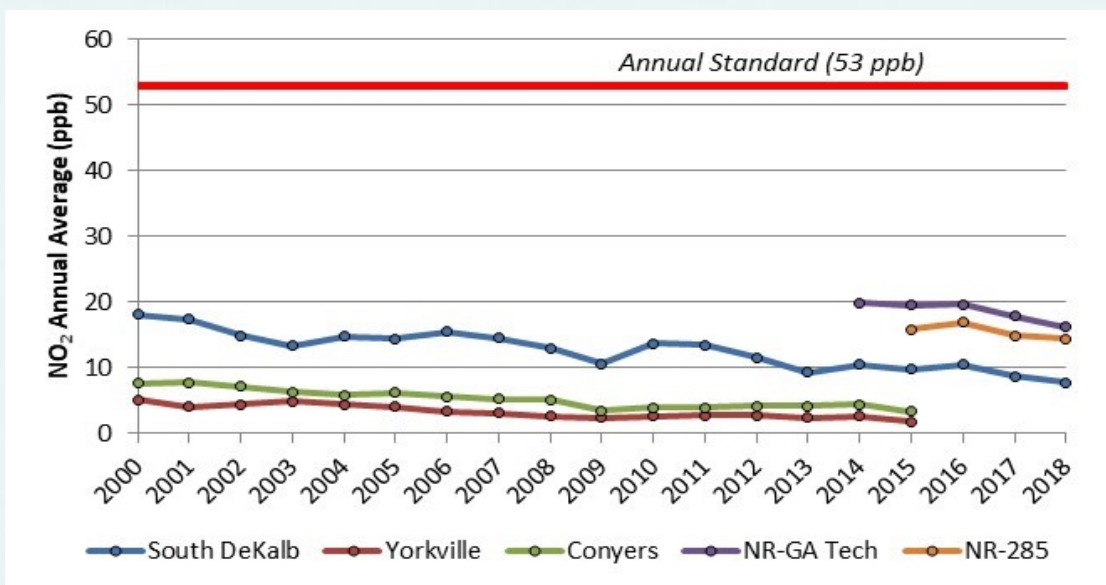
Figure 10. Nitrogen dioxide annual averages compared to the annual standard
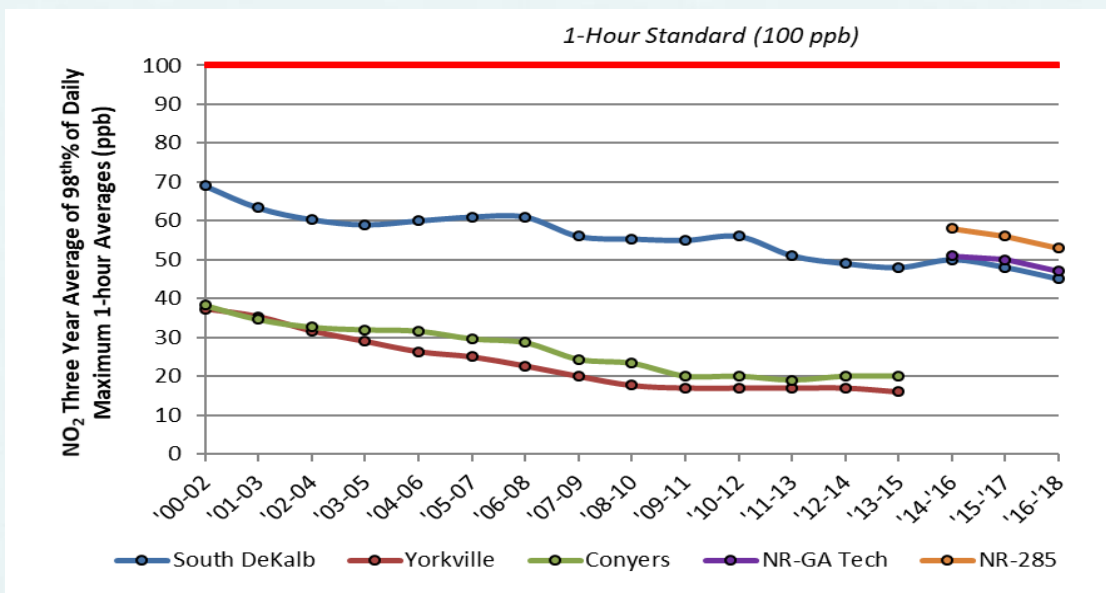
Figure 11. Nitrogen dioxide 1-hour design values compared to the 1-hour standard

Sulfur Dioxide (SO$_2$)
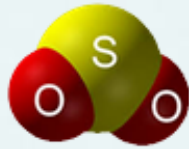
What is it?

- 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?

- 84% of SO$_2$ emissions in Georgia come from industrial processes and fuel combustion (electric generation).

- 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.

| 54% | 30% | 8% | 3% | 3% | 3% |

See page 18 for icon key.
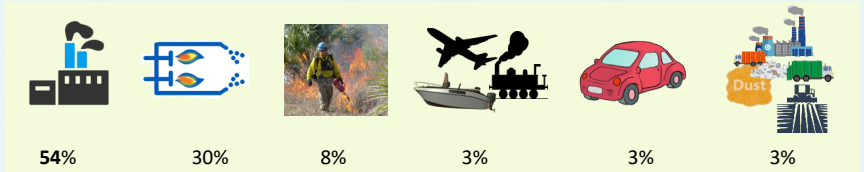
Environmental Impacts

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
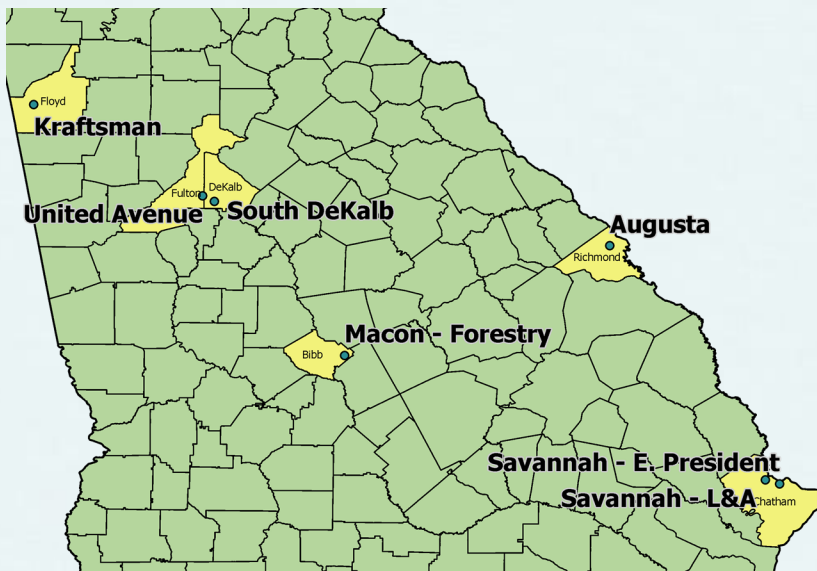
Measurement Technique

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.
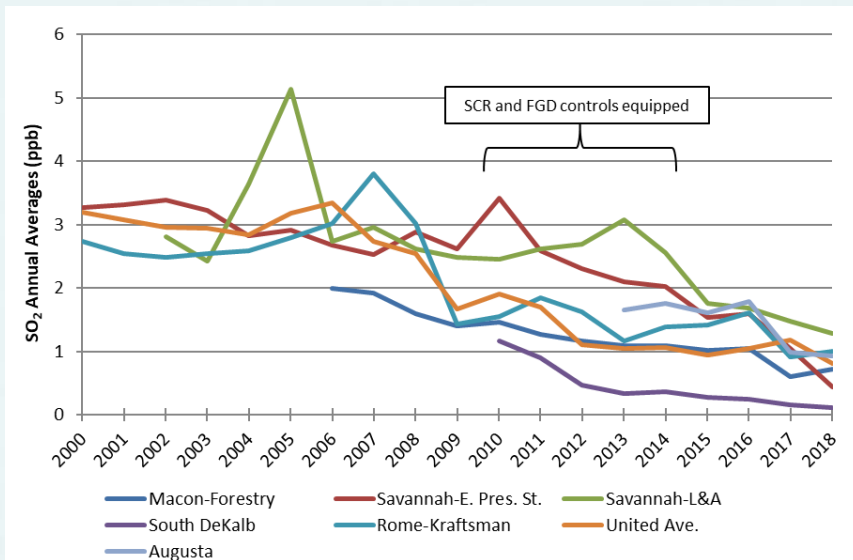
Figure 13. Implementation of SO$_2$ Controls
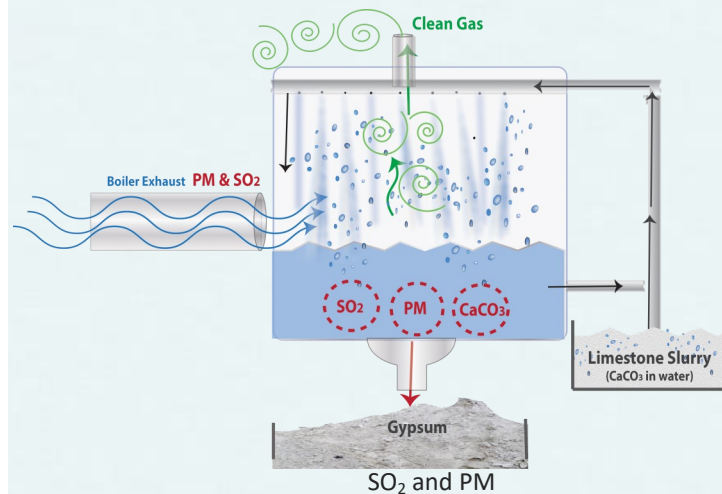
Figure 14. Schematic design of the absorber of an FGD

Statewide SO$_2$ Concentration Comparison from 2005 to 2016

- Figure 15 compares the concentrations of sulfur dioxide from 2005 and 2016 in Georgia on a scale of 0 to 0.8 in Dobson units (DU)[5].

- These maps were created by NASA using satellite data and depict 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 2016.

https://earthobservatory.nasa.gov/images/90276/the-ups-and-downs-of-sulfur-dioxide-in-north-america
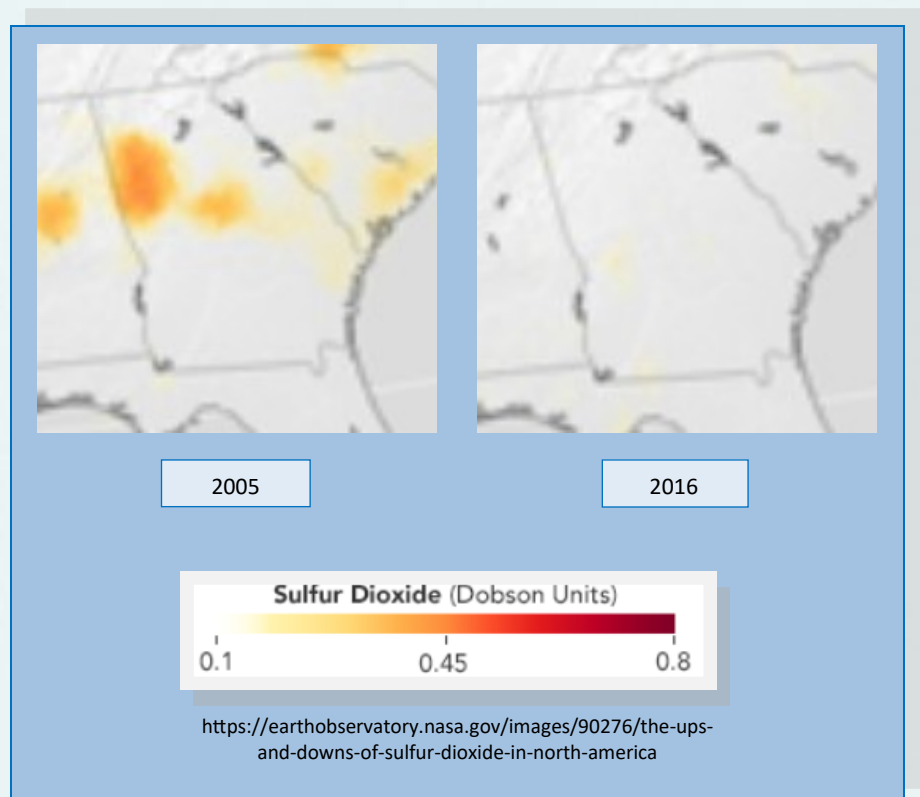
Figure 15. SO$_2$ Statewide Concentration Comparison from 2005 to 2016

[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[6].

- All the SO_2 design[7] values, for 2016-2018 in Georgia, were below the 1-hour standard, with the highest design value occurring at the Augusta site (52 ppb).
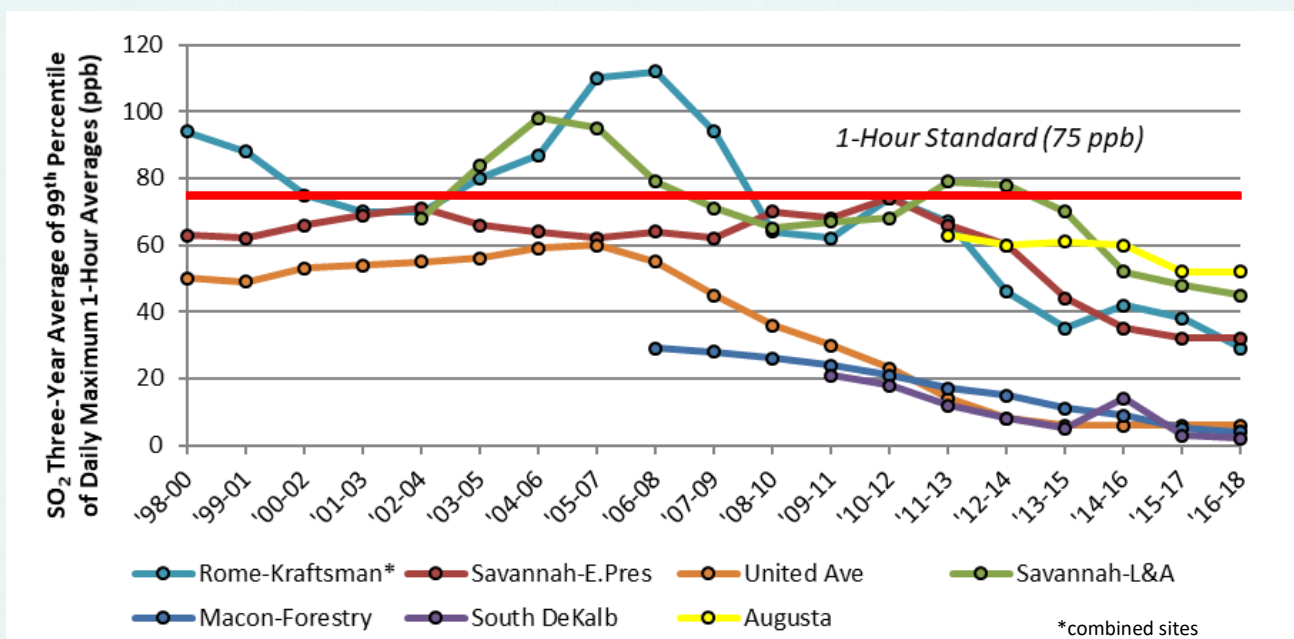
Figure 16. SO_2 three-year averages of the 99th percentile of annual daily max 1-hour averages

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.
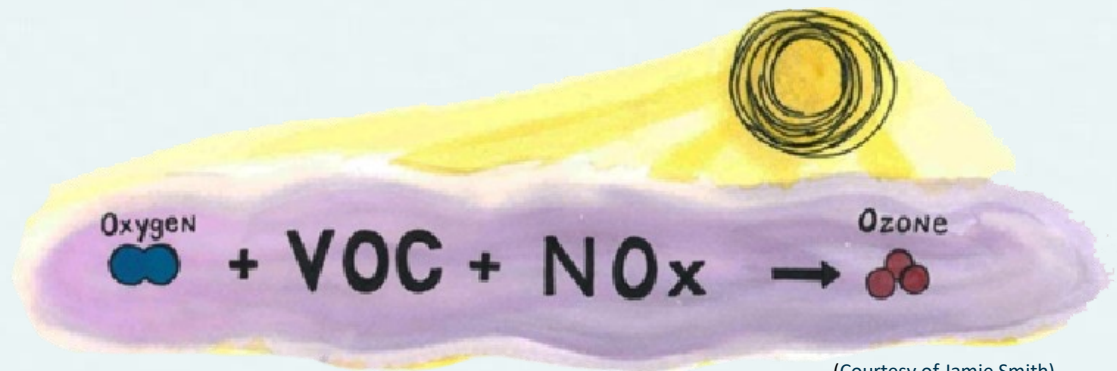
(Courtesy of Jamie Smith)

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
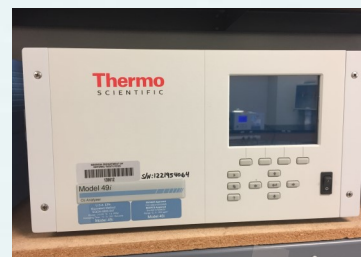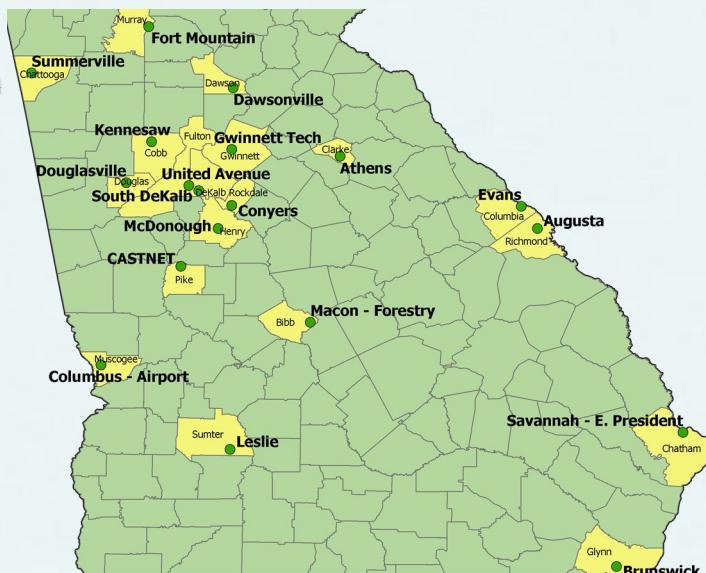
Measurement Technique

Continuous ultraviolet photometric method[8]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

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

Figure 18. Georgia's ozone monitoring

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).
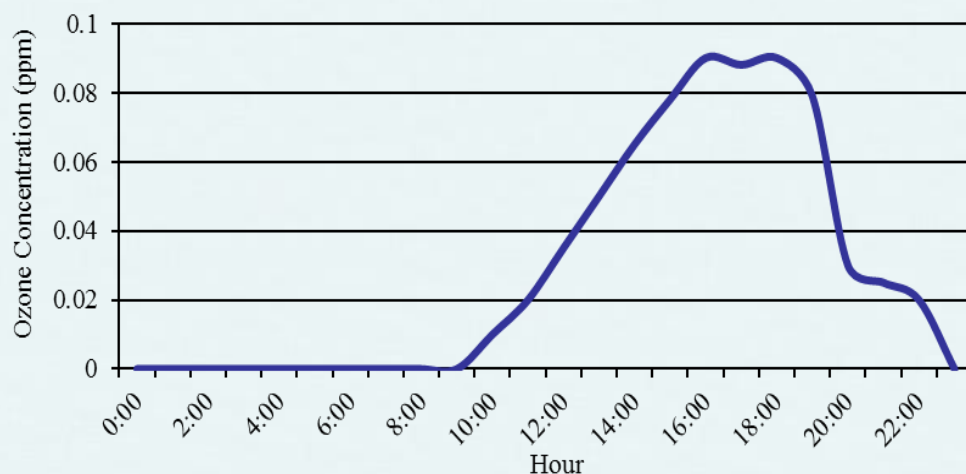
Figure 19. Typical urban 1-hour ozone diurnal pattern

- 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.

Volatile organic compounds VOCs

| 84% | 4% | 4% | 3% | 2% | 1% | 1% |

See page 18 for icon key.

- 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 nine monitors located in nine 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.

- With the 2013-2015 ozone data, the entire state of Georgia (including Atlanta) met the 2008 ozone standard of 0.075 ppm for ozone.
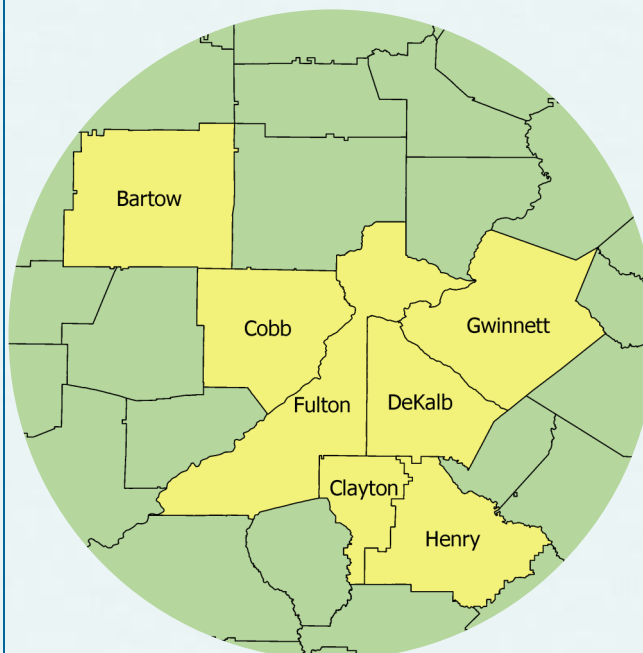
Figure 20. Georgia's 8-hour ozone nonattainment area (NAA) map for the 2015 standard

- Georgia was redesignated to attainment of the 2008 standard on May 22, 2017.

- On October 1, 2015, EPA lowered the ozone standard to 0.070 ppm[9].

- Then for this 2015 standard, and with the 2014-2016 data, the Atlanta area was redesignated to include only a 7-county area for the non-attainment area (Figure 20) (Federal Register, Vol. 83, No. 107, page 25776).

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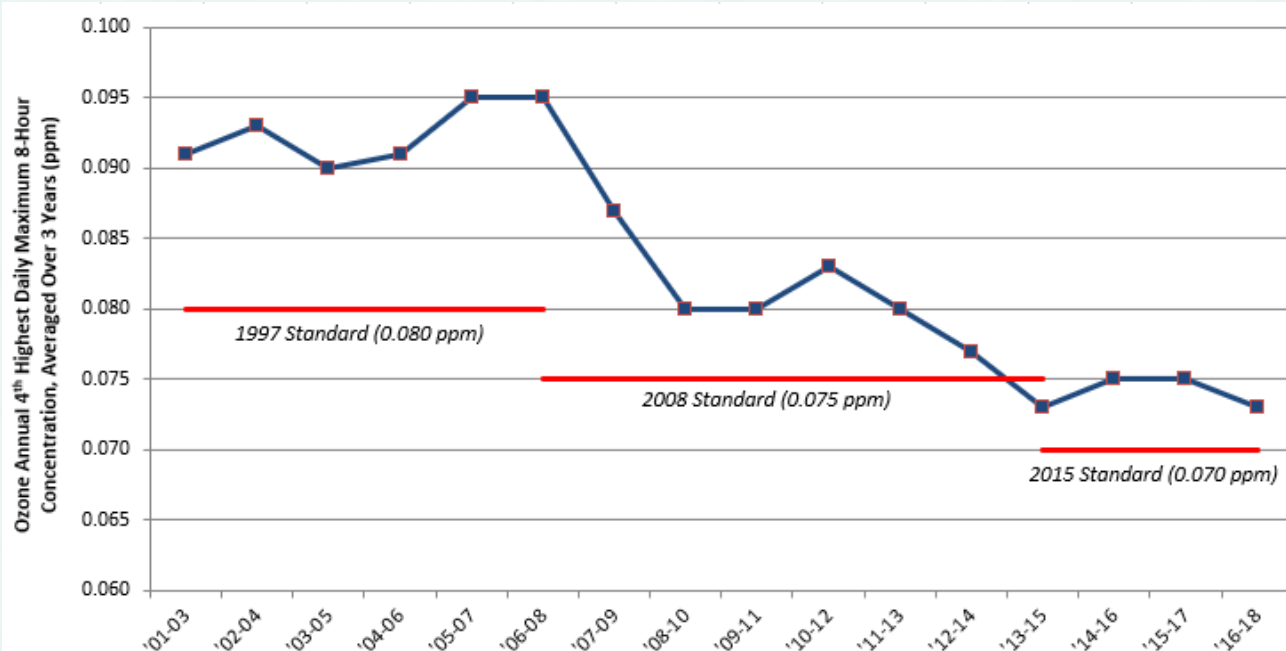
Figure 21. Ozone design values for Atlanta-Sandy Springs-Roswell MSA

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

In 2018, the Atlanta-Sandy Springs-Roswell MSA area had a total of 10 days that exceeded the current (0.070 ppm) 8-hour standard. This was a decrease from 2016 and 2017, which had 29 and 11 days respectively. 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 2018 are mapped in Figure 22.

Site	2016	2017	2018
CASTNET	4	1	1
Conyers	9	1	2
Dawsonville	2	2	2
Douglasville	7	1	0
Gwinnett Tech	6	0	0
Kennesaw	3	0	0
McDonough	8	3	3
South DeKalb	7	1	0
United Ave.	12	6	4

- ☐ 2016
- ☐ 2017
- ☐ 2018
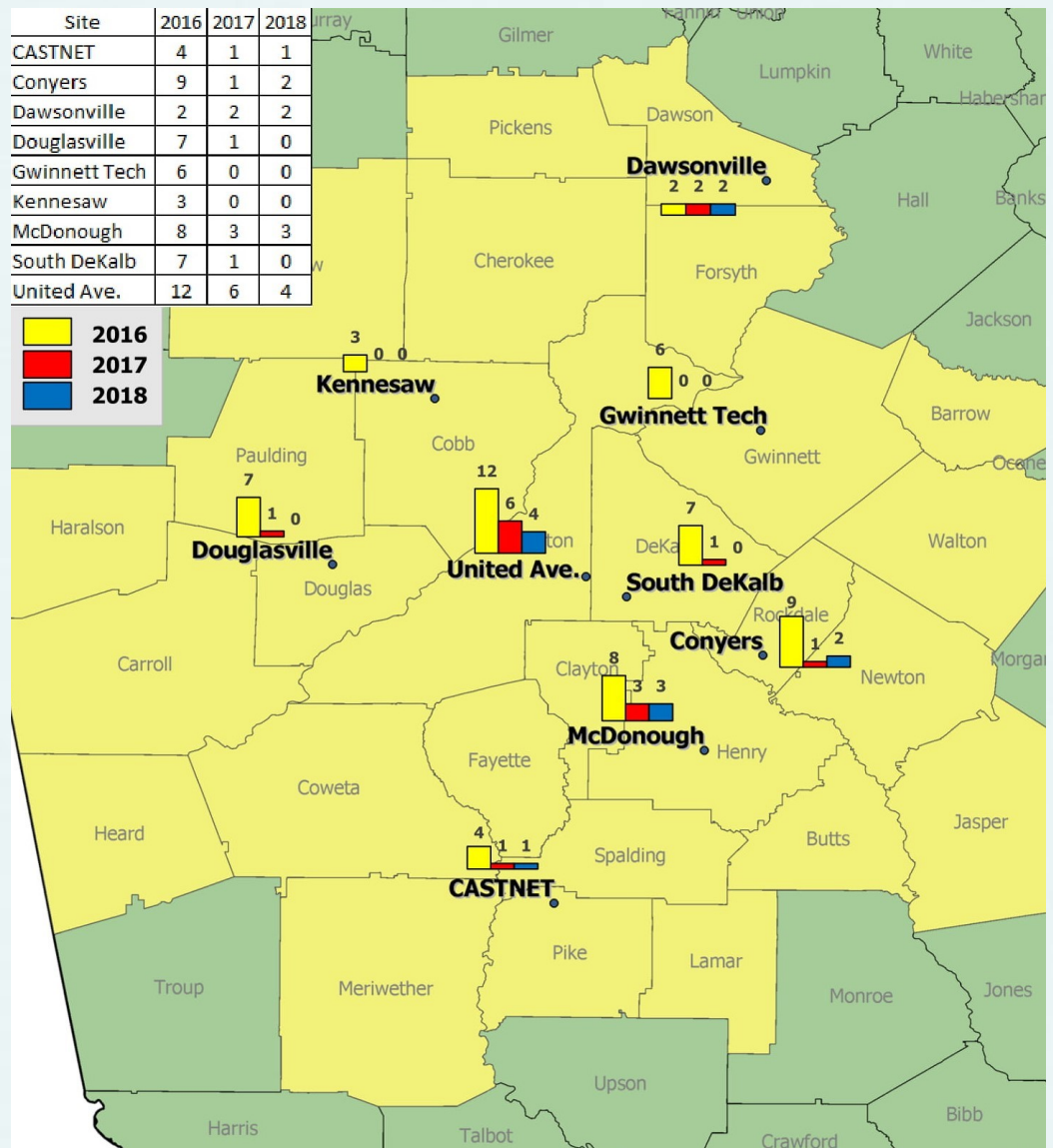
Figure 22. Map of 2018 Georgia Ozone Exceedances

National 8-hour ozone concentrations

Figure 23 was taken from EPA's "Our Nation's Air" which summarizes the national air quality status and trends through 2018 (https://gispub.epa.gov/air/trendsreport/2019/). It shows the fourth maximum reading for the 8-hour ozone readings across the United States. Georgia's fourth maximum ozone readings in 2018 were in the 0.055-0.07 ppm (light blue) range, except for one monitor that was in the 0.071-0.085 ppm (red) range.
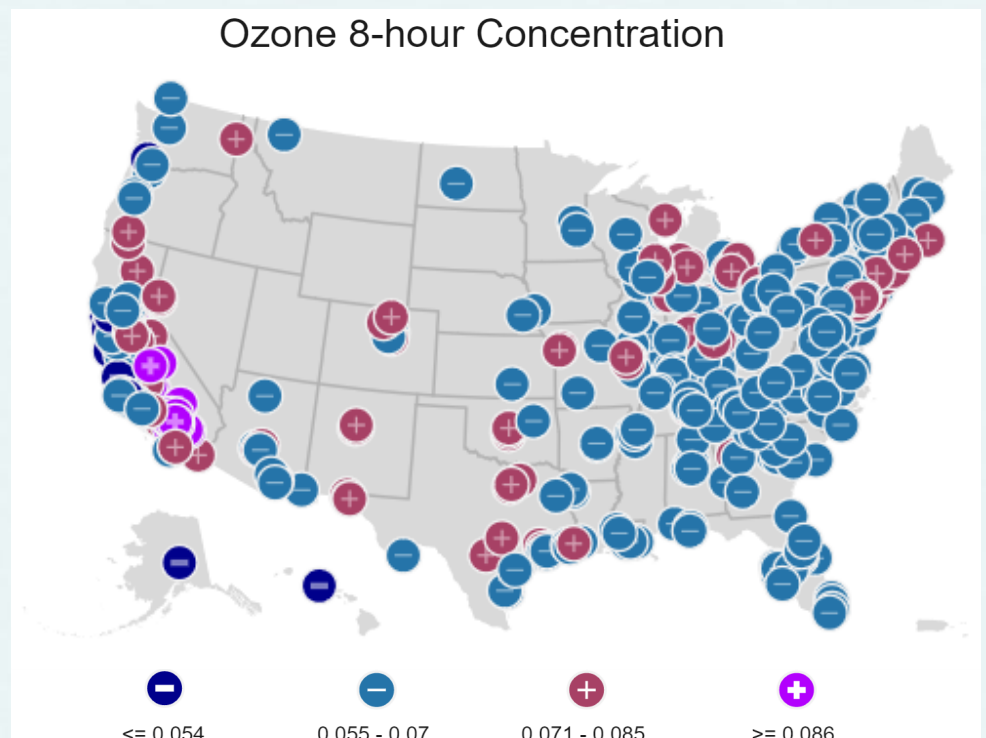
Figure 23. 2018 Ozone 4th Maximum Values Across the United States

Ozone 8-hour Concentration

⊖	⊖	⊕	✚
<= 0.054	0.055 - 0.07	0.071 - 0.085	>= 0.086

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 2018.

- 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.

67%   **20%**   **7%**   **7%**
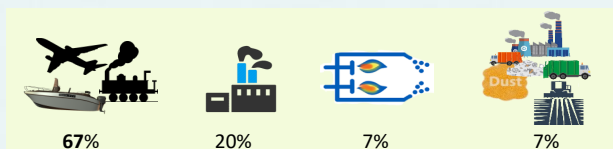
See page 18 for icon key.
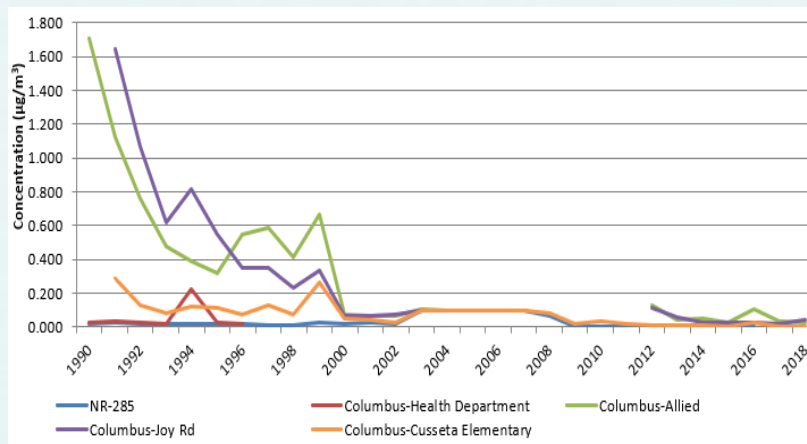
Figure 24. Georgia's Annual Lead Averages

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

Columbus - Joy Road   Columbus - Allied
Columbus - Cusseta

Muscogee
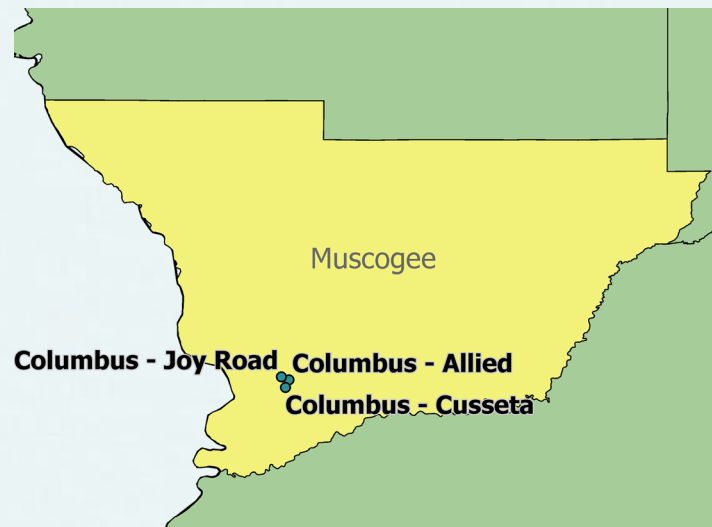
Figure 25. Georgia's lead monitoring sites

Measurement Technique

24-hour total suspended particulate (100 microns or less) on 8"x10" pre-weighed fiberglass filter[10]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

[10] 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 2018.

- The last of the three months used for each average is indicated on the graph.

- The monitors in the Columbus GA-AL MSA are located near a lead battery manufacturer, and **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.
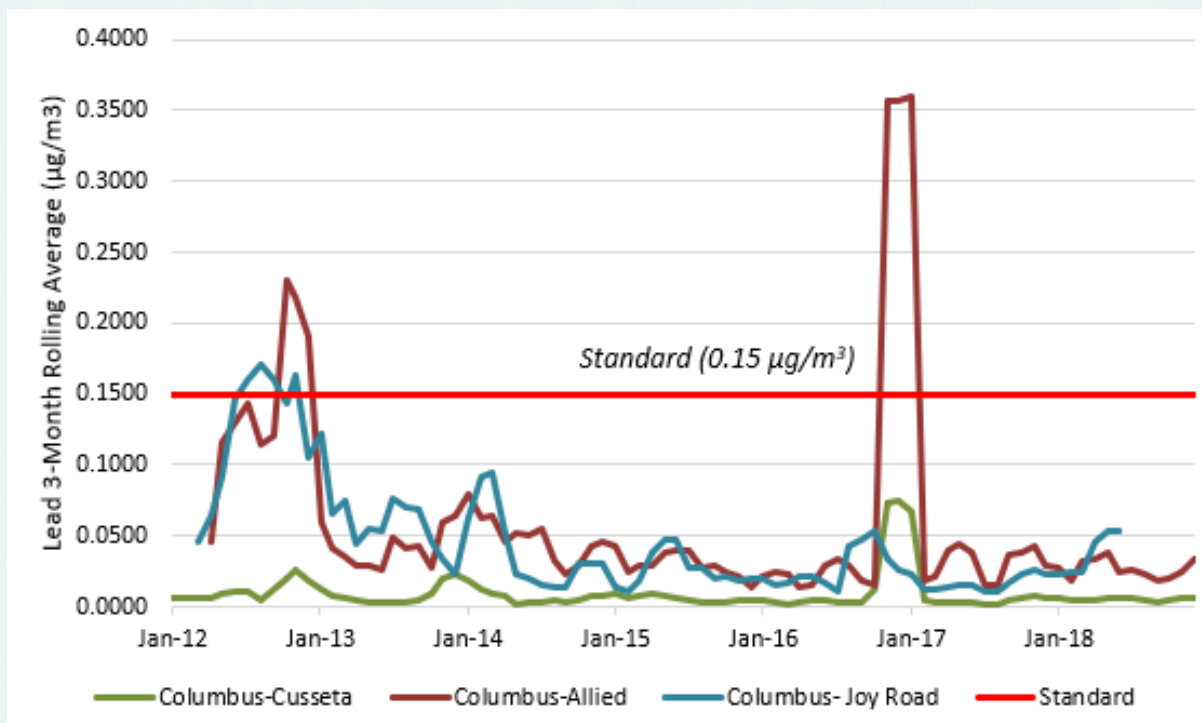
Figure 26. Georgia's three-month rolling averages, 2012-2018

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.
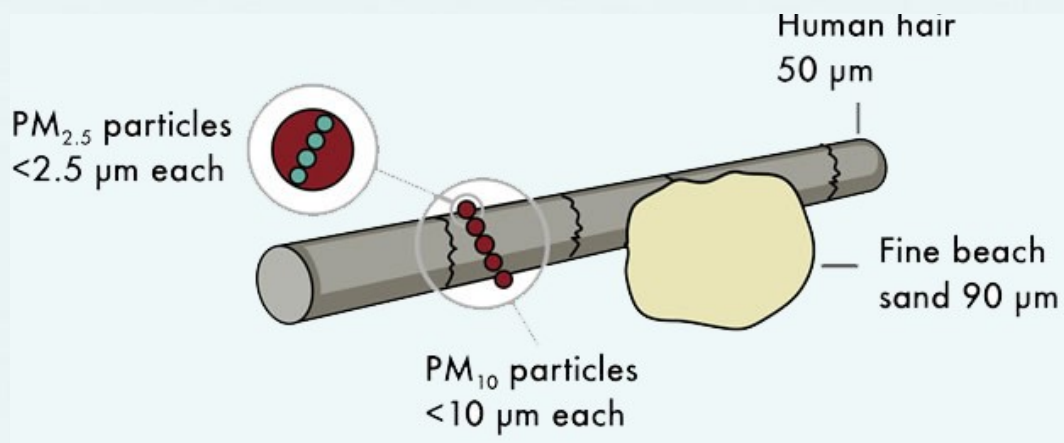
Figure 27. Comparison of particulate matter size to human hair

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.

| **79%** | 12% | 5% | 2% | 1% | 1% |

See page 18 for icon key.
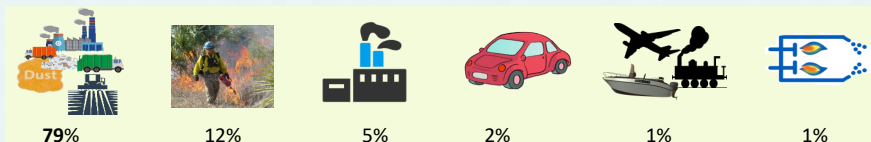
Health Impacts

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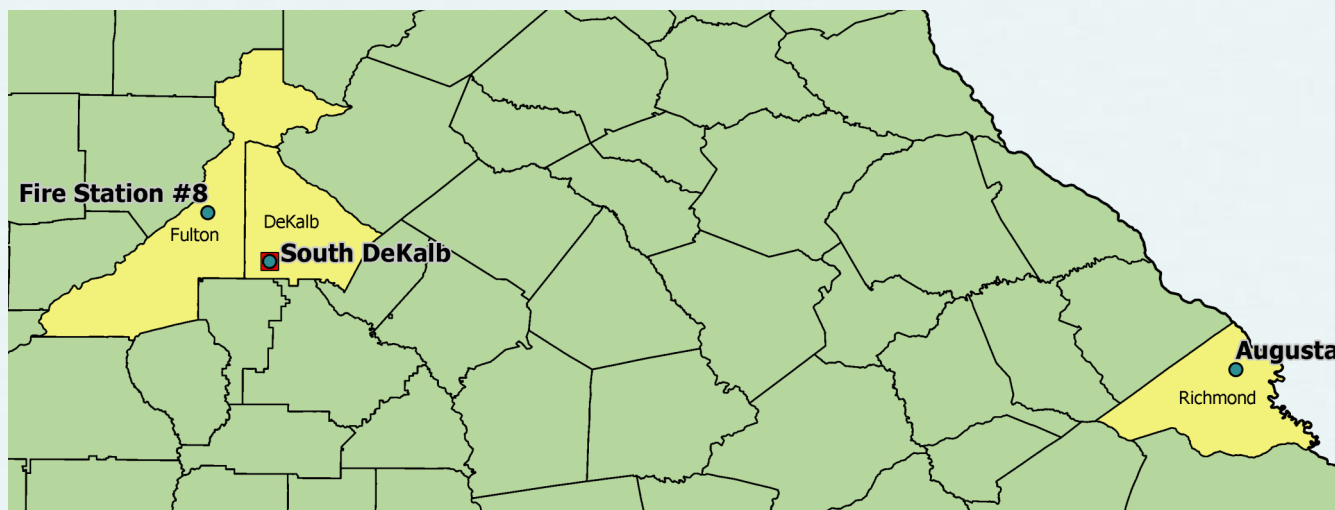
Figure 28. Georgia's PM$_{10}$ and PM$_{coarse}$ (red square) monitoring sites

Measurement Techniques

- Two categories of EPA-approved reference or equivalent monitors are used to determine attainment with the PM$_{10}$ standard (integrated and continuous):

⇒ 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.[11]

⇒ Continuous beta ray attenuation monitor (BAM), Teledyne T640X monitor, and tapered element oscillating microbalance (TEOM) method with an inlet designed to cut out particles larger than 10 microns in size.[12,13,14]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUES

[11] https://tisch-env.com/low-volume-air-sampler/
[12] http://metone.com/air-quality-particulate-monitors/regulatory/bam-1020/
[13] http://www.teledyne-api.com/products/particulate-instruments/t640
[14] https://www.thermofisher.com/order/catalog/product/1400AB

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.
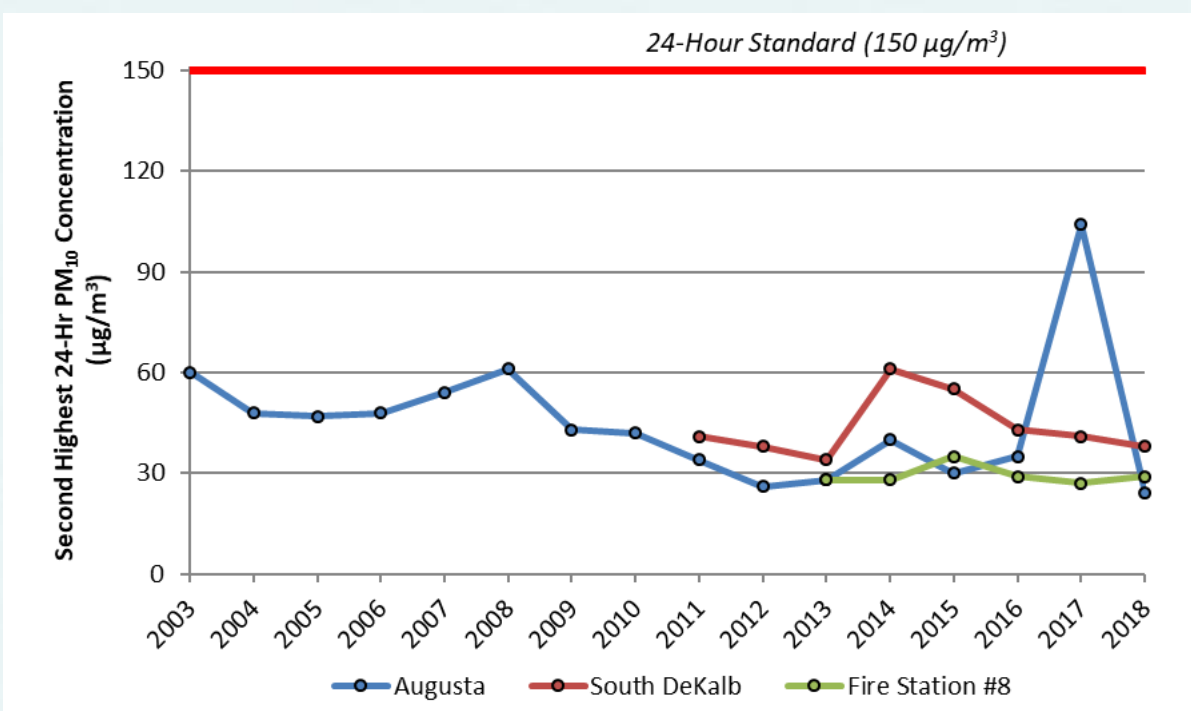
Note: A house fire nearby the Augusta site caused values to be higher than normal. In addition, the sampler at this site began collecting hourly data.

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.

| 47% | 33% | 12% | 3% | 2% | 2% | 1% |
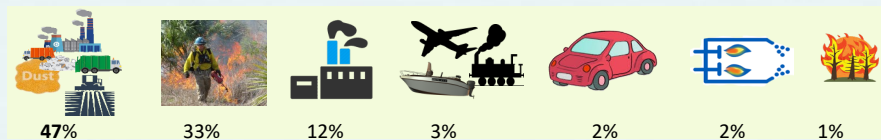
See page 18 for icon key.

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.[15]

- The continuous method consists of four types of instruments.

  ⇒ The beta attenuation method (BAM) is designed for the inlet to cut out particles larger than 2.5 microns in size. As of 2018, EPD as one site (Albany) where a BAM sampler is running as Federal Equivalent Method (FEM) sampler that can be used for attainment determinations as well .[16]

  ⇒ The Teledyne T640 is an optical aerosol spectrometer that converts optical measurements to mass measurements by determining sampled particle size via scattered light using 90° white-light scattering with polychromatic LED.[17] These samplers are also FEMs and collect data that can be used for attainment determinations.

  ⇒ 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.[18]

  ⇒ The nephelometer determines PM concentrations by measuring the shutter count which allows the light source to stabilize, and wavelengths which shows the average diameter of the measured particle size.[19]

- Continuous PM$_{2.5}$ data is reported every hour on Georgia's Ambient Air Monitoring web page located at https://airgeorgia.org/. The immediate availability of this data allows the public to make informed decisions regarding their outdoor activities.

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUES

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

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

[17] http://www.teledyne-api.com/products/particulate-instruments/t640

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

[19] https://www.ambilabs.com/nephelometer

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.
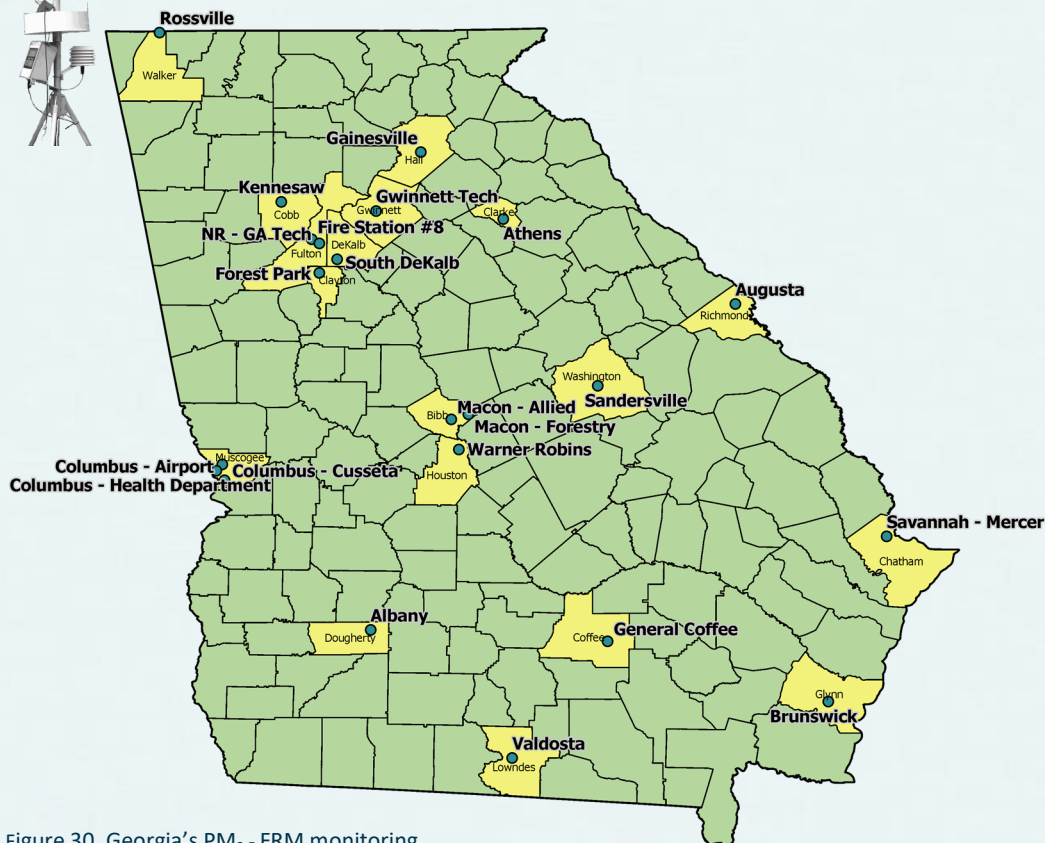
Figure 30. Georgia's PM$_{2.5}$ FRM monitoring sites
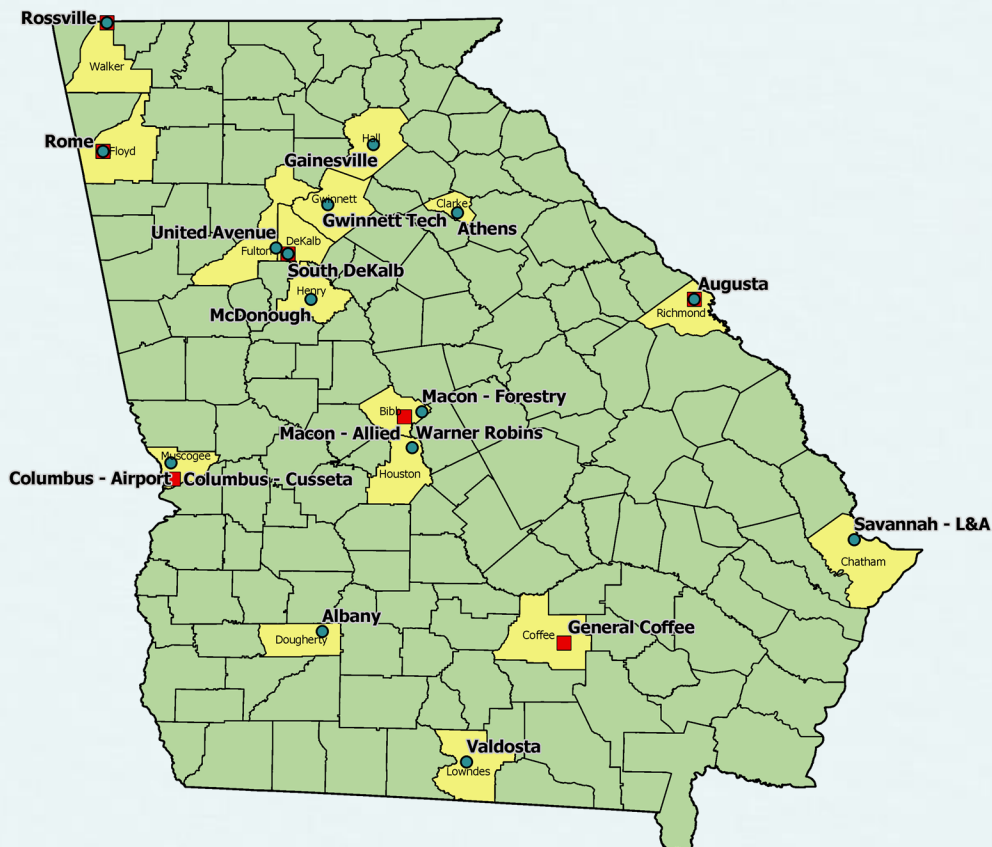
Figure 31. Georgia's PM$_{2.5}$ continuous (green circles) and PM$_{2.5}$ speciation (red squares) monitoring sites

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
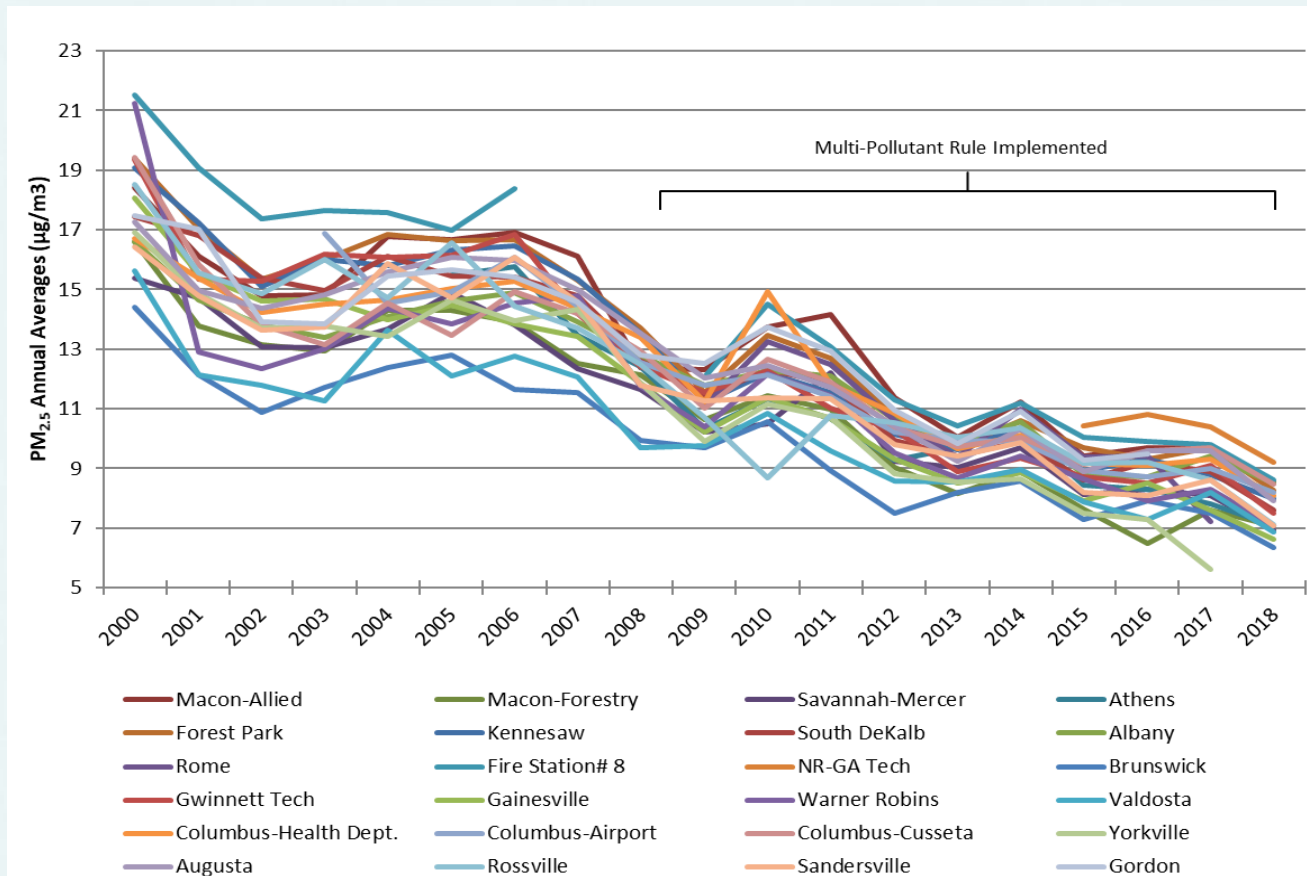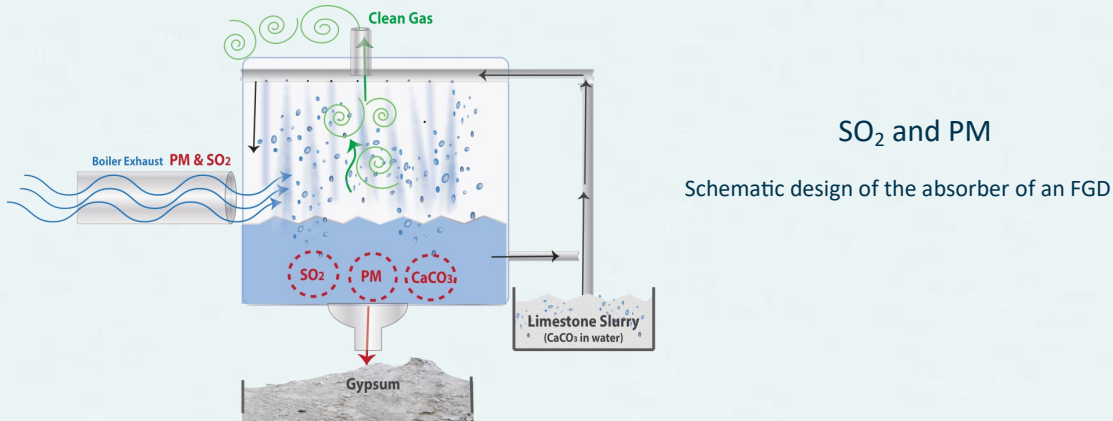
Figure 32. Implementation of PM Controls

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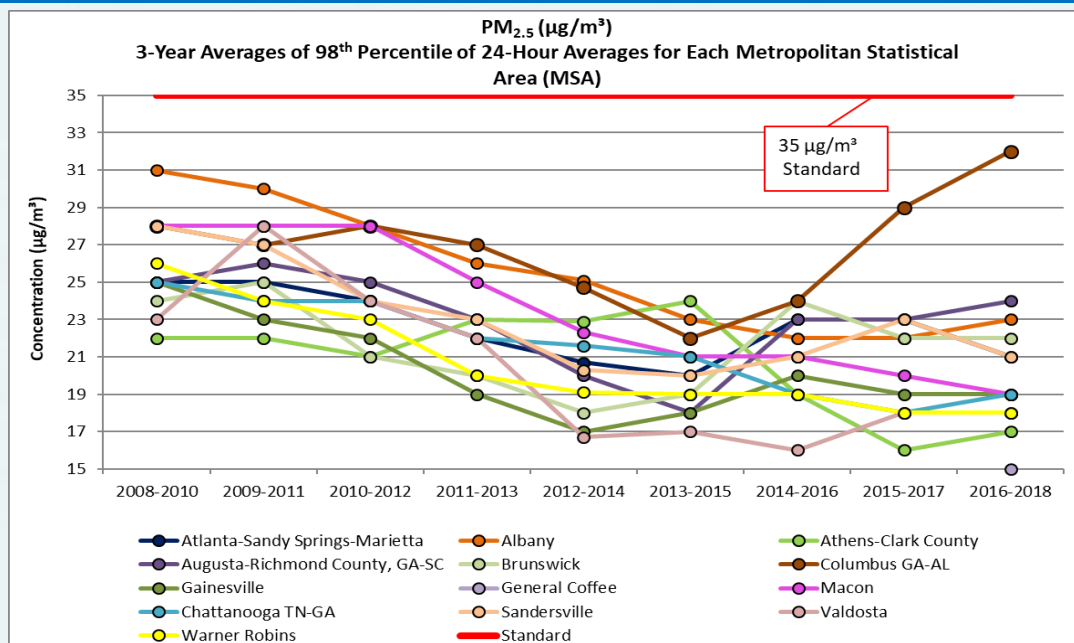
Figure 33. Comparison of the three-year averages of the 98th percentile of PM$_{2.5}$ 24-hour data

Note: Wildfires and prescribed fires in the Columbus, GA-AL MSA caused values to be higher than normally observed in this area.

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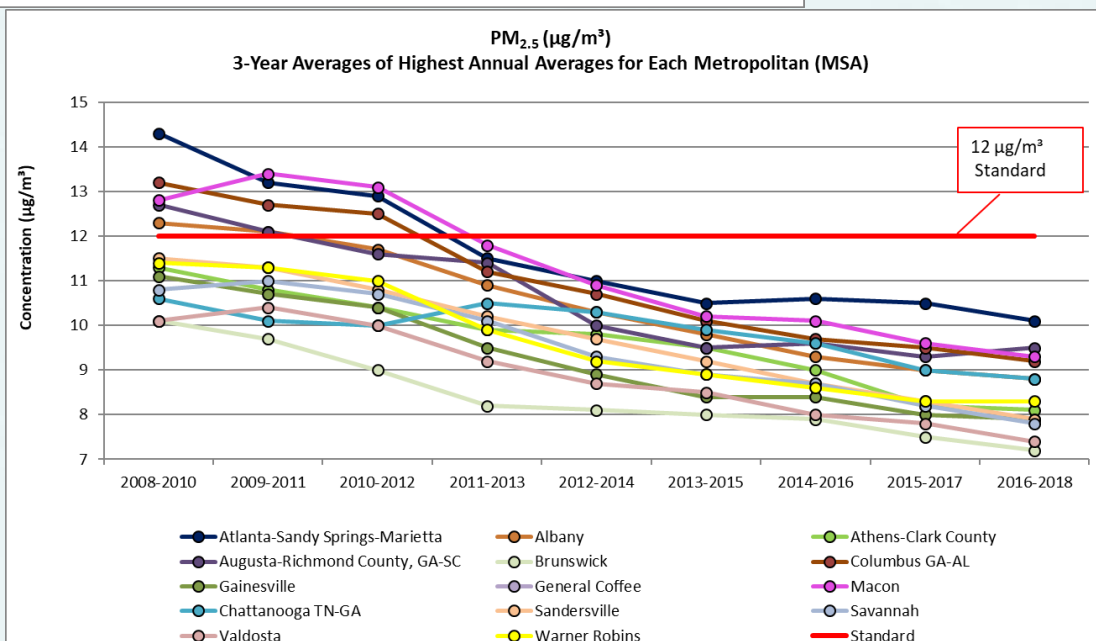
PM_{2.5} Speciation

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 35 compares the percent composition of PM_{2.5} for each site based on 2018 annual averages.

- Organic carbon makes up 44-56% of PM_{2.5} for all sites with Columbus having the largest percentage.

- Sulfate is the second largest portion of PM_{2.5} for all sites and ranges from 15-17%.

- Nitrate, crustal, elemental carbon, and ammonium ion make up no more than 12% of PM_{2.5} for all sites.

- The chemical elements typical of the Earth's crust are grouped together as "crustal".
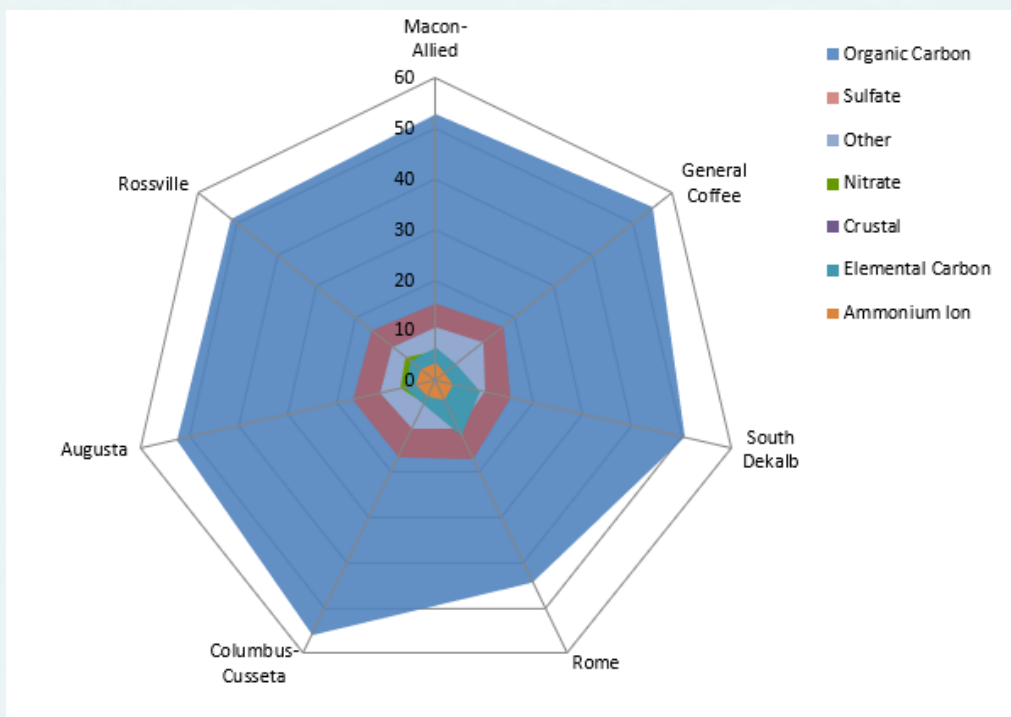
Figure 35. Percentages of 2018 Speciation Data

Measurement Techniques[20,21]

- 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
[20] http://www.urgcorp.com/index.php/systems/manual-sampling-systems/urg-3000n-carbon-sampler
[21] http://www.metone.com/?wpfb_dl=228

PREDOMINANT SPECIES FOUND IN PM$_{2.5}$
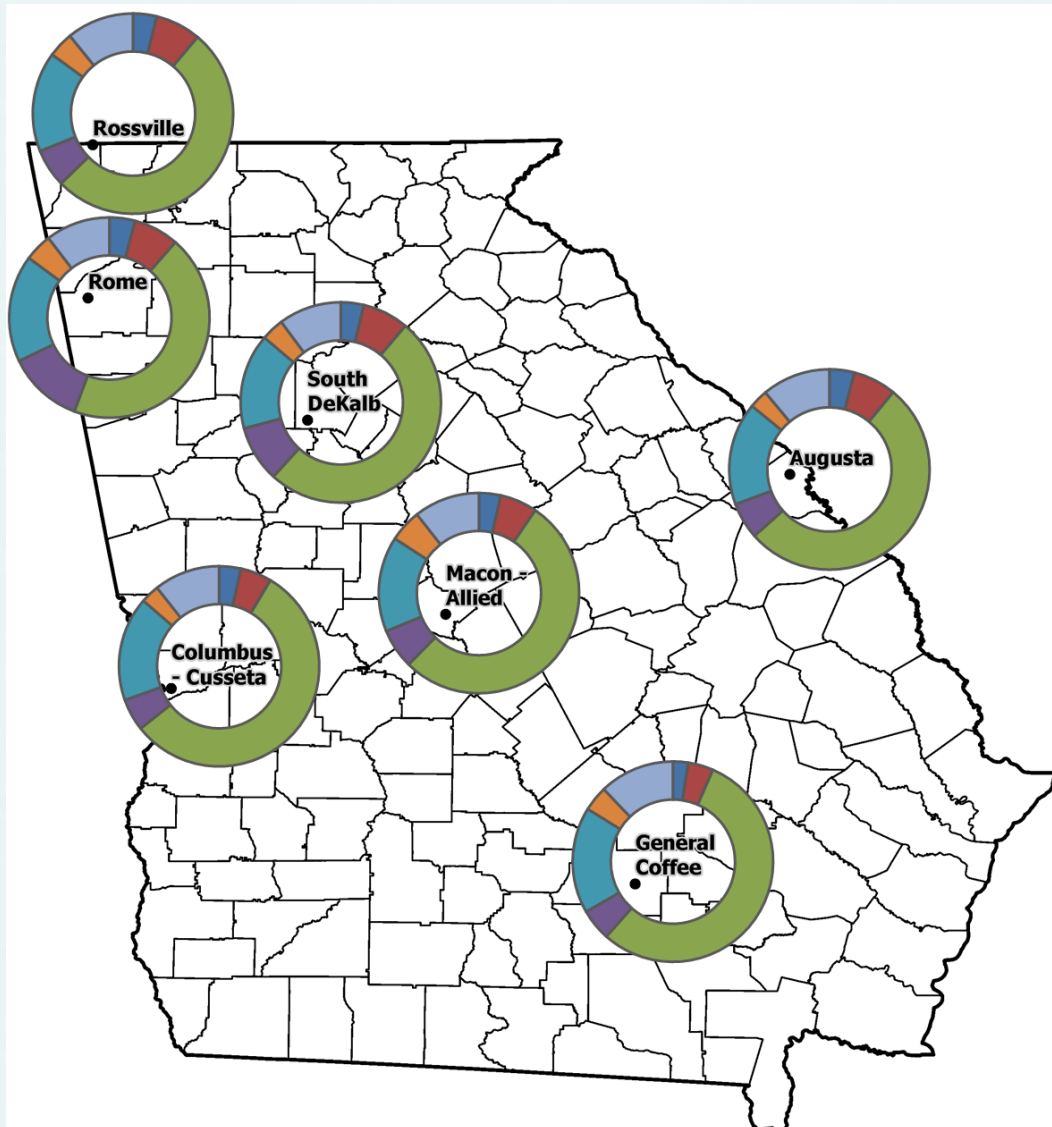
Figure 36 presents each site with all species making up the composition at each location.

Legend:
- Ammonium Ion
- Sulfate Products
- Nitrate Products
- Crustal Products
- Elemental Carbon
- Organic Carbon
- Other

Figure 36. 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 37 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 https://airgeorgia.org/.

Maximum Pollutant Concentration									
$PM_{2.5}$	PM_{10}	SO_2	O_3	O_3	CO	NO_2			
(24hr) µg/m³	(24hr) µg/m³	(1hr)* ppm	(8hr)^ ppm	(1hr) ppm	(8hr) ppm	(1hr) ppm	AQI Value	Descriptor	EPA Health Advisory
0.0– 12.0	0– 54	0– 0.035	0.000– 0.054	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	0.055– 0.070	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	0.071 – 0.085	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*	0.086– 0.105	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*	0.106– 0.2	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
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 37. 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

2018 AQI Values Summary for Georgia

Air Quality Index Summary by CBSA						
Number of Days						
Pollutants Monitored in 2017	**Good (0-50)**	**Moderate (51-100)**	**Unhealthy for Sensitive Groups (101-150)****	**Unhealthy (151-200)****	**Very Unheathy (201-300)****	**Hazardous (>300)****
Albany						
PM$_{2.5}$	292	63	1	-	-	-
Americus						
O$_3$	219	22	-	-	-	-
Athens-Clark County						
O$_3$, PM$_{2.5}$	262	68	2	-	-	-
Atlanta-Sandy Springs-Roswell						
O$_3$, NO$_2$, PM$_{2.5}$, CO, SO$_2$, PM$_{10}$	209	148	8	-	-	-
Augusta-Richmond County, GA-SC						
O$_3$, PM$_{2.5}$, PM$_{10}$	252	107	6	-	-	-
Brunswick						
O$_3$, PM$_{2.5}$	255	17	-	-	-	-
Chattanooga, TN-GA						
O$_3$, PM$_{2.5}$	252	112	1	-	-	-
Columbus, GA-AL						
O$_3$, PM$_{2.5}$	271	94	-	-	-	-
Dalton						
O$_3$	233	30	-	-	-	-
General Coffee						
PM$_{2.5}$	112	4	-	-	-	-
Gainesville						
PM$_{2.5}$	109	5	-	-	-	-
Macon						
O$_3$, SO$_2$, PM$_{2.5}$	285	78	2	-	-	-
Rome						
SO$_2$, PM$_{2.5}$	362	-	-	-	-	-
Savannah						
O$_3$, SO$_2$, PM$_{2.5}$	303	62	-	-	-	-
Summerville						
O$_3$	224	21	-	-	-	-
Valdosta						
PM$_{2.5}$	264	51	-	-	-	-
Warner Robins						
PM$_{2.5}$	259	61	2	-	-	-

Table 1. 2018 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 38 shows in more detail the AQI values for the Atlanta-Sandy Springs-Roswell MSA. There were 8 days with an AQI value above 100 in 2018. 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.
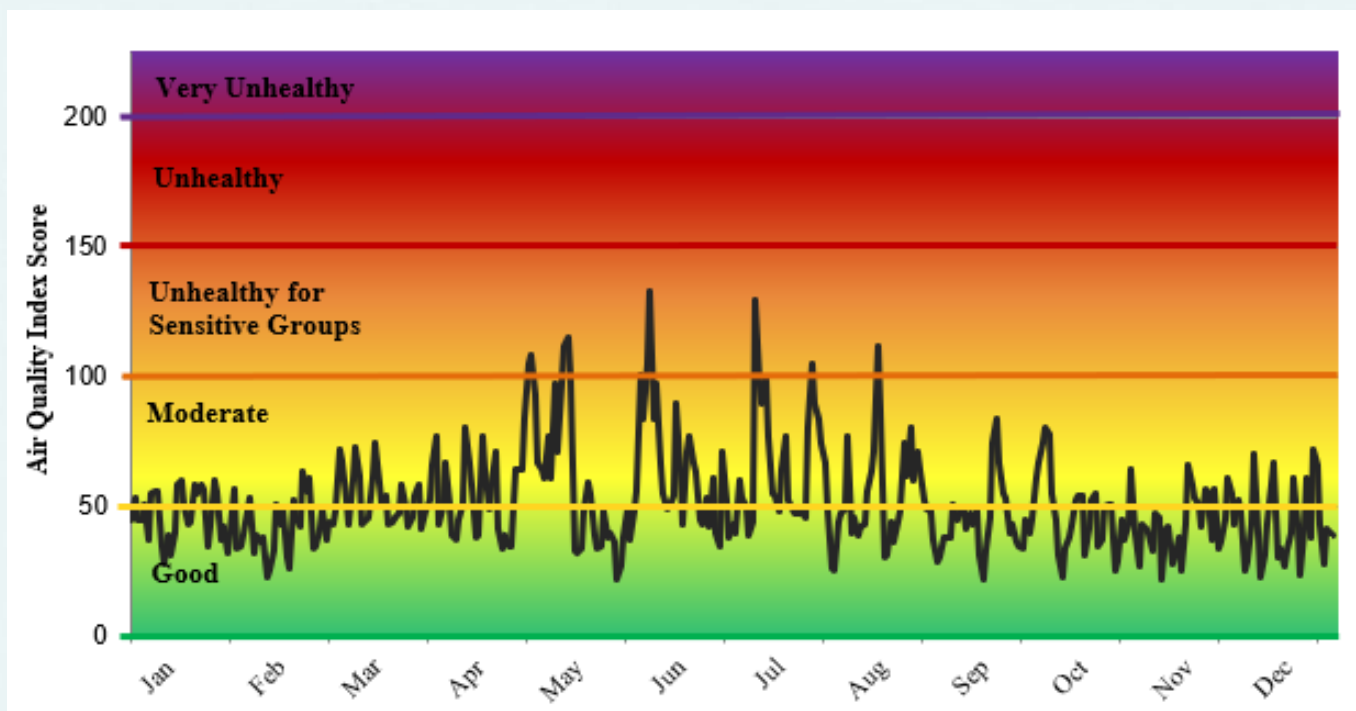
Figure 38. 2018 AQI Values for the Atlanta-Sandy Springs-Roswell MSA

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 39. Georgia's PAMS monitoring site

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

[22]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).

- In addition, historically 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). [22] However, this instrument was inoperable in 2018 and is being replaced.

The amount of isoprene emissions from conifers varies seasonally, with emissions increasing as length of daylight and temperature increases (Figure 40).
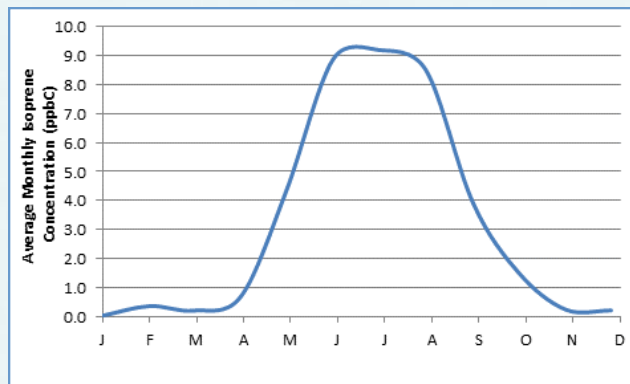
Figure 40. Average yearly profile of isoprene
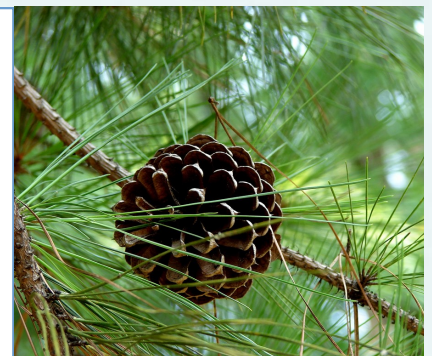
Toluene (generally the most abundant anthropogenic species in urban air) reaches the air from a variety of sources such as combustion of fossil fuels and evaporative emissions, motor vehicle fuel and is also used as a common solvent in many products such as paint. It is relatively constant throughout the year, suggesting a steady level of emissions year-round (Figure 41).
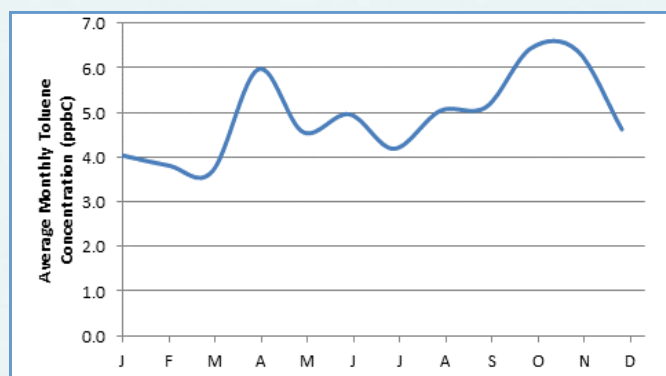
Figure 41. Toluene average annual occurrence

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.
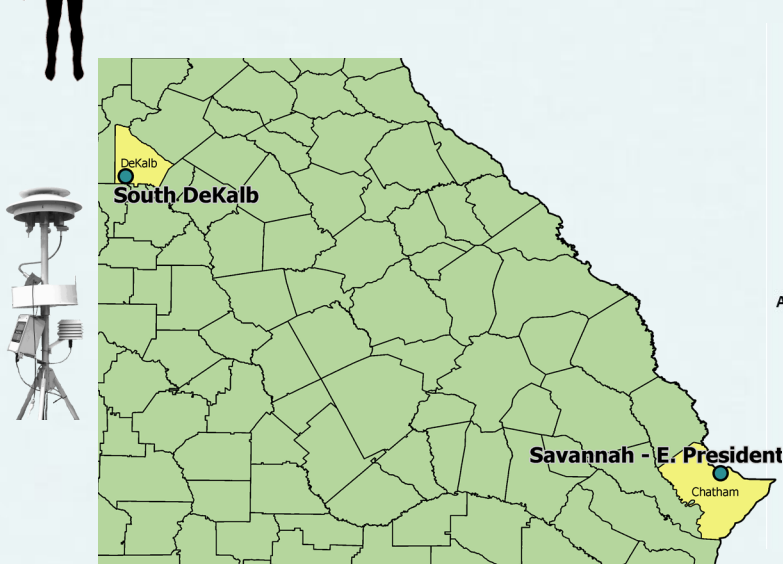
Figure 42. Georgia's carbonyls monitoring sites
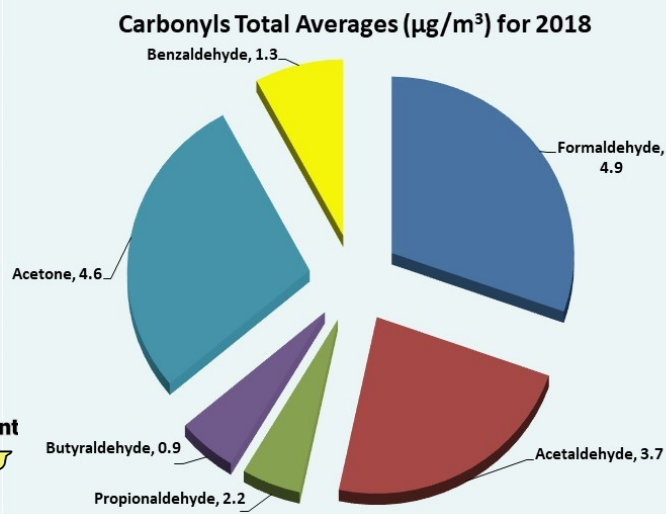
Figure 43. Total Average 24-hour carbonyl concentrations by species

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. [23]

- 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.
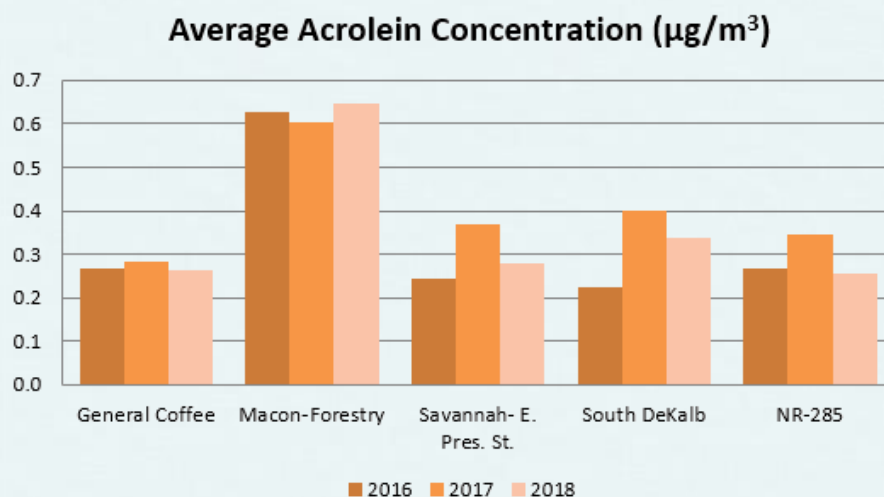
Figure 44. Acrolein concentrations, 2016-2018

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.

At the end of 2018, EPD ceased operation of the non-regulatory state air toxics network sites until such time as the Air Protection Branch drafts a new strategy for siting non-regulatory air toxics monitors. This strategy will include an evaluation of potential exposure to air toxics emissions prior to siting a monitor, and risk assessment and risk communication protocols for communicating the monitoring data.

EPD will continue to operate the National Air Toxics Trends Site at South DeKalb (discussed in more detail on the next page).

Monitoring Techniques

Three types of samplers are used at all locations: the HIVOL, PUF, and canister. [24]

- 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
[24] https://tisch-env.com/high-volume-air-samplers/
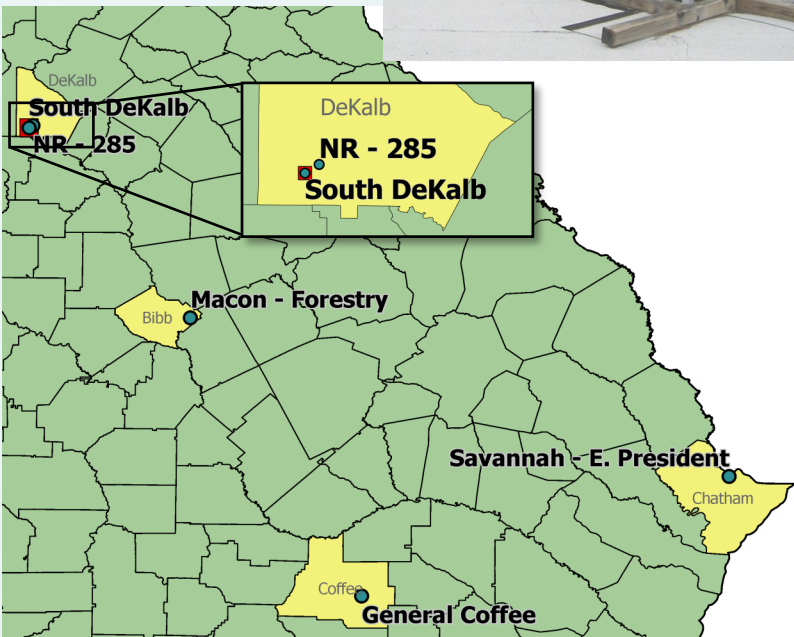
Figure 45. Air Toxics monitoring sites, NATTS site indicated by red box

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

samples collected half the year

■ Macon-Forestry ■ Savannah-E Pres St ■ General Coffee ■ South DeKalb

VOLATILE ORGANIC COMPOUNDS

■ Macon-Forestry ■ Savannah-E Pres St ■ General Coffee ■ South DeKalb ■ NR-285
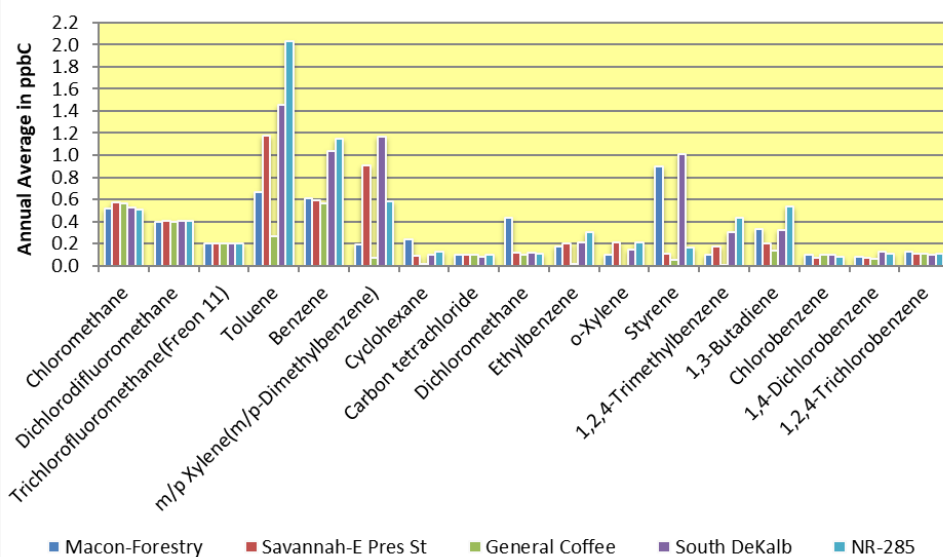
Sources include:
- various industrial, stationary and mobile sources

SEMI-VOLATILE ORGANIC COMPOUNDS

Sources include:

- burning of coal, oil, gas, and garbage

- found in dyes, cigarette smoke, coal tar, plastics, and pesticides

■ Macon-Forestry ■ Savannah-E Pres St ■ General Coffee ■ South DeKalb
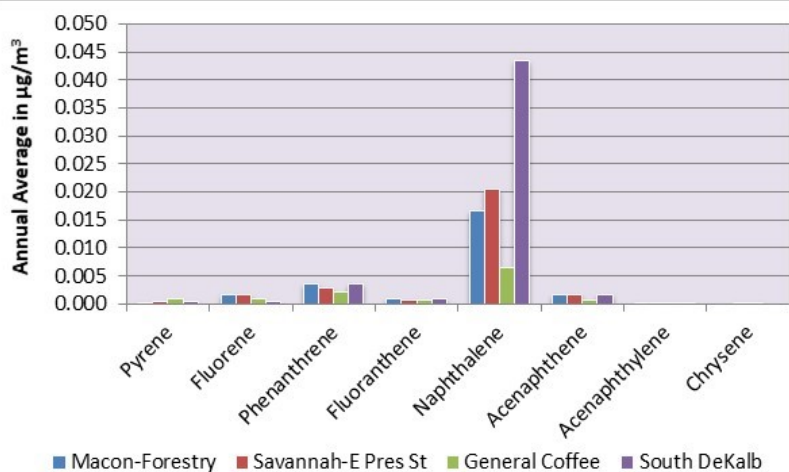
Figure 46. Air Toxics Data

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 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 NR-285 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 NR-285 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 NR-285 sites.
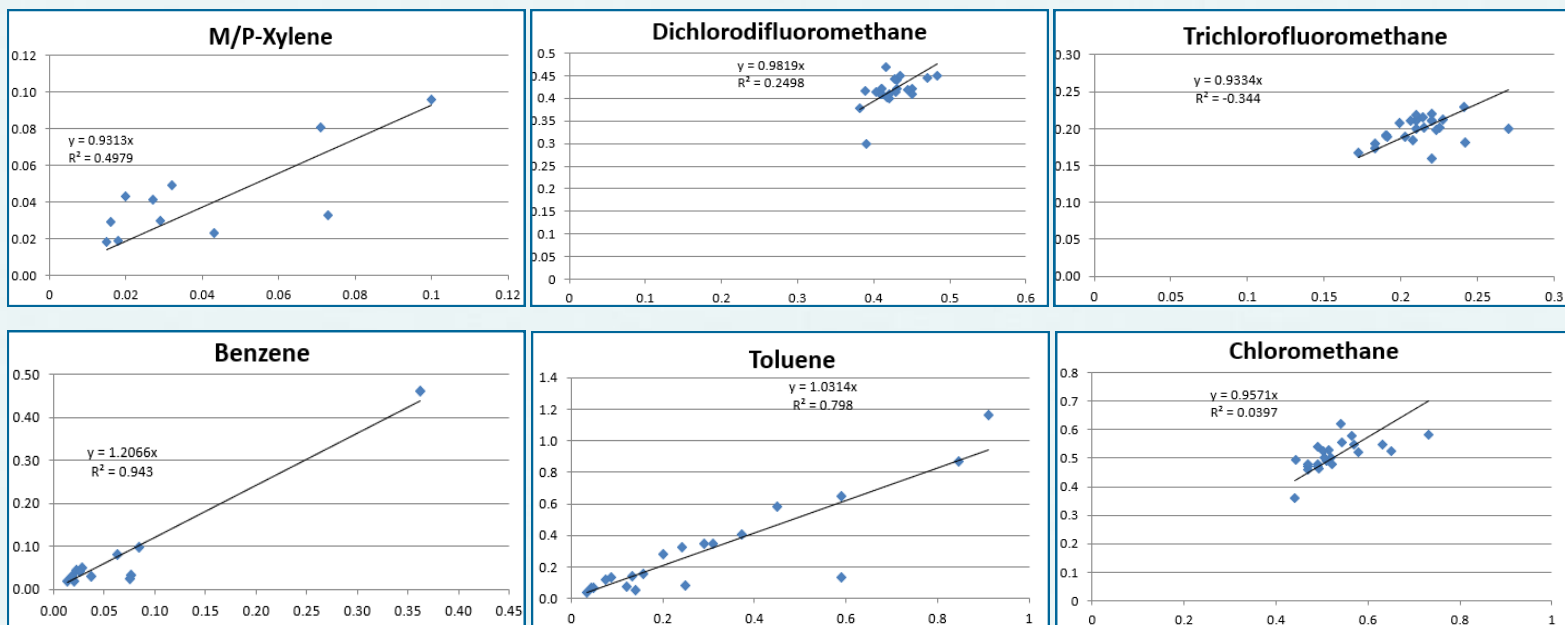
VOC	Correlation Coefficient (r)
Toluene	0.893
M/P Xylene	0.779
Chloromethane	0.641
Trichlorofluoromethane	0.446
Dicholrodifluoromethane	0.543
Benzene	0.973

Half of the correlations between the VOCs collected at the South DeKalb and NR-285 sites are relatively moderate (values around 0.50), and half the correlations of VOCs are stronger (values above 0.70). Weaker correlations suggest that these VOCs found in vehicle exhaust dissipate quickly in the air. The stronger correlations suggest that these VOCs found in vehicle exhaust can potentially remain in the air for longer periods of time and travel a longer distance from the source.

Figure 47. Comparison of select VOCs at the South DeKalb and NR-285 sites

RISK ASSESSMENT

The risk assessment is being prepared by the Risk Assessment Program of EPD and will be posted when completed.

For questions, please contact:

Amy Potter
Program Manager
Risk Assessment Program
Land Protection Branch-Hazardous Waste Management
GA EPD
404.657.8658
Amy.Potter@dnr.ga.gov

METEOROLOGICAL REPORT

State Climatology and Meteorological Summary of 2018

- 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 B for details.
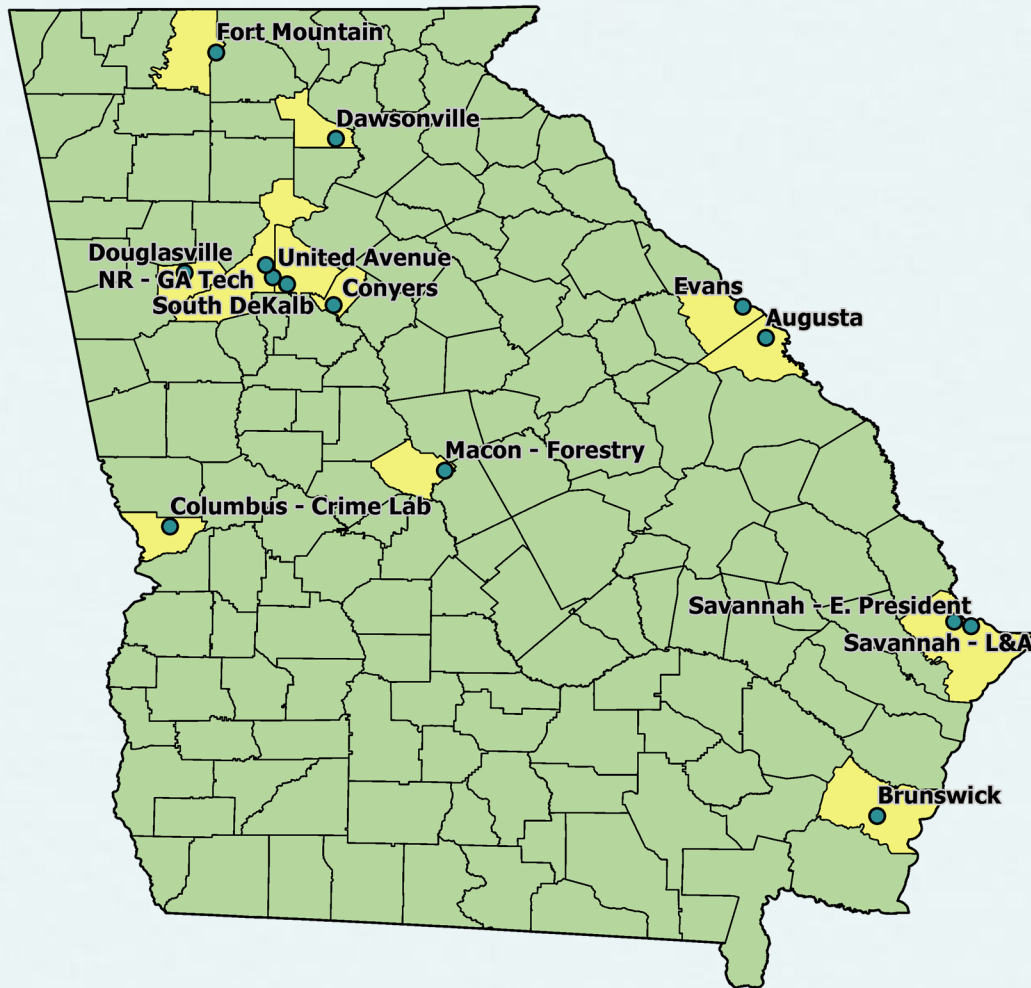
Figure 48. Meteorological Site Map

Figure 49. Sample meteorological instrumentation at EPD sites:
a) ceilometer, b) sonic anemometer, c) Temperature probe and relative humidity monitor, d) tipping bucket

2018 Climate Highlights

Hurricane Michael

- Michael made landfall near Panama City on October 10th as a category 5 hurricane, making it the strongest hurricane to make landfall along the Florida panhandle on record.

- As Michael weakened to category 3 strength and moved into southwest Georgia, it became the first major hurricane to directly impact the state since the 1890s.

- The highest wind gust in Georgia was 115 miles per hour recorded in Donalsonville.

- Michael's outer bands produced 1 EF-1 and 2 EF-0 tornadoes and widespread wind damage causing power outages and crop damage.

- Rainfall totals reached in excess of 5" in some locations leading to isolated instances of flooding, including a few roads that were washed out.

Location	Rainfall Total (in.)
7 NE Dallas	5.84
The Rock	5.35
4 NE Newnan	5.07
1 N Carrollton	4.83
1 ESE Sandersville	4.28
3 SW Americus	4.17
Jonesboro	4.15
1 NNE Dublin	3.98
3 S Peachtree City	3.92
3 S Rutland	3.76
Woodbury	3.71
1 N Cartersville	3.52
4 NNE Columbus	3.34
2 NNE Doraville	3.23
2 NNE Cumming	2.75
2 WSW Gainesville	2.50

Rainfall totals associated with Hurricane Michael.

This infrared satellite image was taken as Hurricane Michael entered southwest Georgia as it maintained a Category 3 intensity on the evening of October 10, 2018.
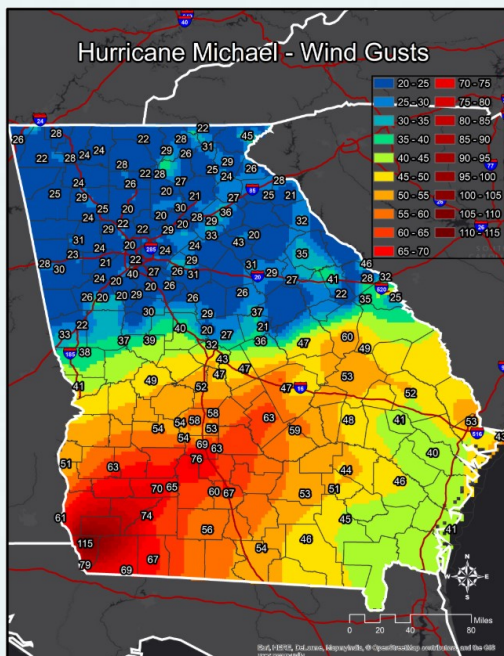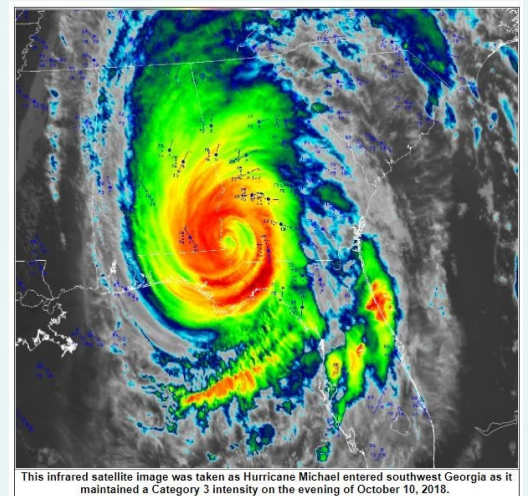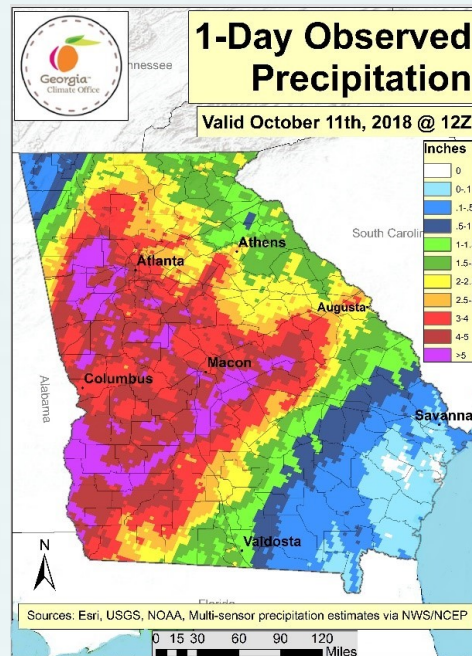
Maximum Observed Wind Gusts

Georgia Environmental Protection Division Meteorological Network

Site Name	County	Wind gust (mph)
Savannah-L&A	Chatham	48.54
Dawsonville	Dawson	42.95
Evans	Columbia	40.04
Douglasville	Douglas	34.40
Columbus-Crime Lab	Muscogee	28.18
NR-GA Tech	Fulton	22.81

Figure 50. Rainfall and Wind Gusts in Georgia during Hurricane Michael
(*images and information courtesy of National Weather Service – Peachtree City*)

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

2018 Drought Conditions for Georgia

- The year began with D0 (abnormally dry) conditions present in almost 89% of the state, D1 (moderate drought) conditions in the northeast and south, and D2 (severe drought) conditions in far southwest Georgia.
- D2 conditions expanded northward and a new area of D2 was briefly introduced into northeast Georgia until mid-February when conditions began to improve for all north Georgia.
- D1 and D2 conditions existed in southeast Georgia until late May.
- For nearly three months, from June 5th through September 4th, there were no drought conditions present.
- Small areas of D0 and D1 were then introduced in north, central, and southeast Georgia and conditions and fluctuated but showed overall improvement by the end of the year.
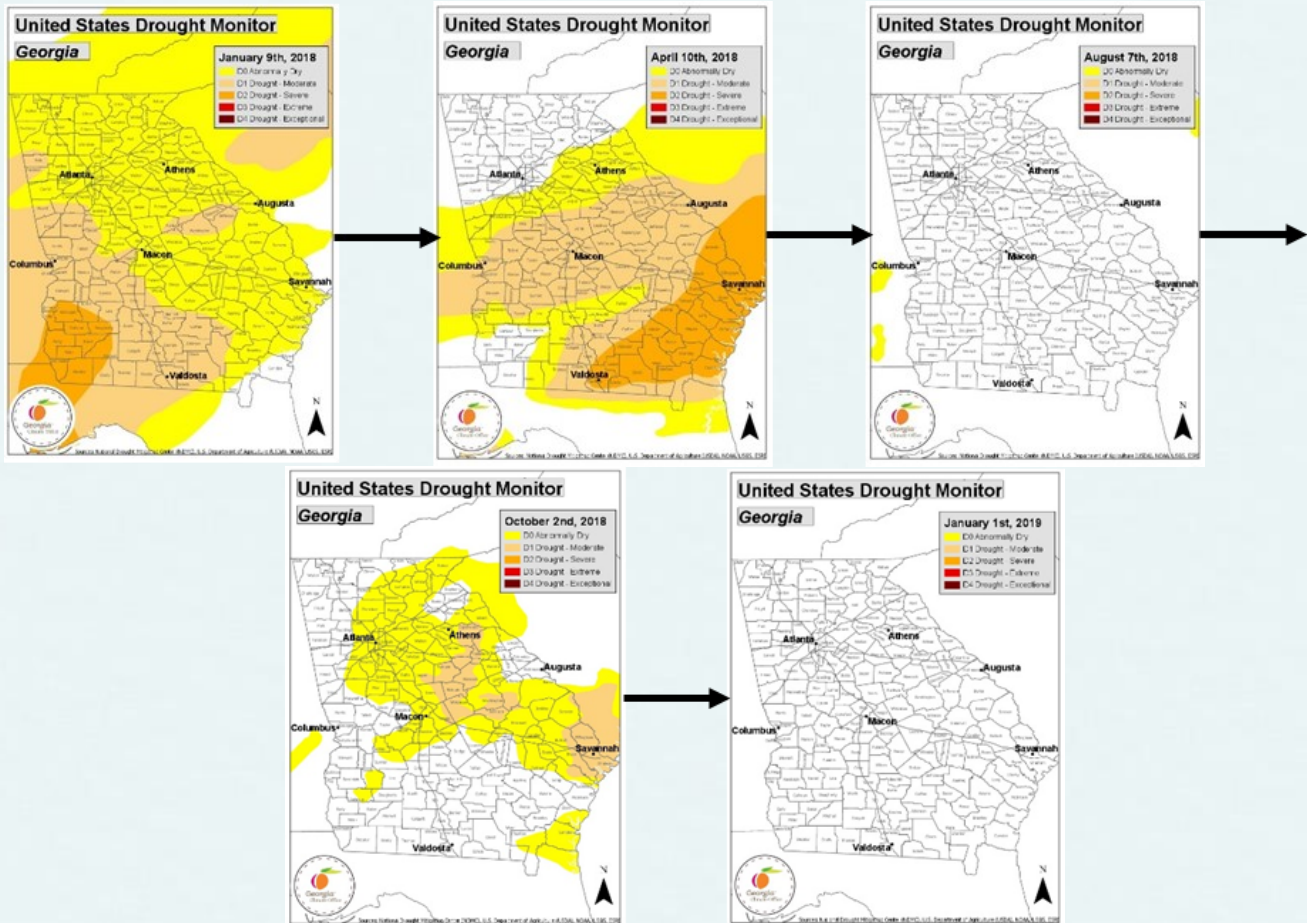
Figure 51. Drought Conditions in Georgia
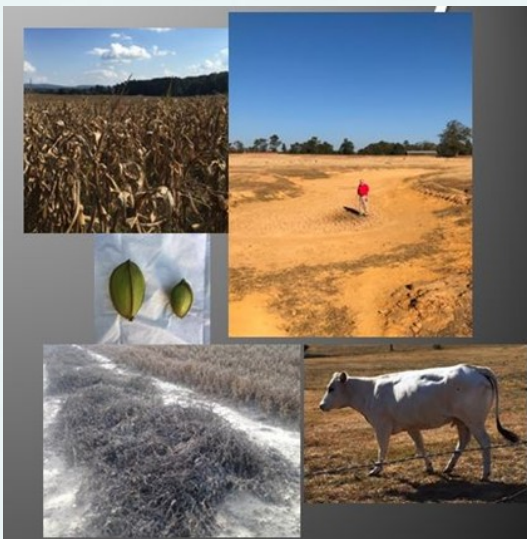
Agricultural Impacts

- Late season freezes in March slowed pasture growth, pasture green-up and corn growth and caused freeze damage on grains.
- Abundant rain in May stalled cutting of hay, slowed peanut and cotton planting, and created issues for pesticide applications.
- The lack of rain that began in September worsened pasture conditions and feed for livestock, and dry soils made for difficult peanut harvest conditions.
- Hurricane Michael moved through southwest Georgia as a category 3 storm on October 10th causing widespread damage to farms from winds and flooding.
- Compared to 2017, corn production increased while cotton, peanut, soybean, and tobacco production decreased during 2018.

Air Quality Forecasting Statistics

Table 2: Observed Air Quality in 2018

Metro Area and Pollutant	Total # of days in record	Observed # of Days in AQI Category			
		Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy
Atlanta Ozone	214	140	64	10	0
Macon Ozone	209	186	23	0	0
Atlanta PM$_{2.5}$	365	248	117	0	0
Columbus PM$_{2.5}$	365	305	60	0	0

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

Table 3: Predicted Air Quality in 2018

	Hits	Misses	False Alarms	Bias	Gross Error	Correlation	% Accurate 2 categories	% Accurate 5 categories
Atlanta Ozone	4	6	6	1.1 ppbv	6.0 ppbv	0.81	94	82
Macon Ozone	0	0	0	1.9 ppbv	5.8 ppbv	0.78	100	90
Atlanta PM$_{2.5}$	0	0	0	0.0 mg/m^3	2.2 mg/m^3	0.70	100	78
Columbus PM$_{2.5}$	0	0	0	-0.5 mg/m^3	2.4 mg/m^3	0.60	100	86

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:
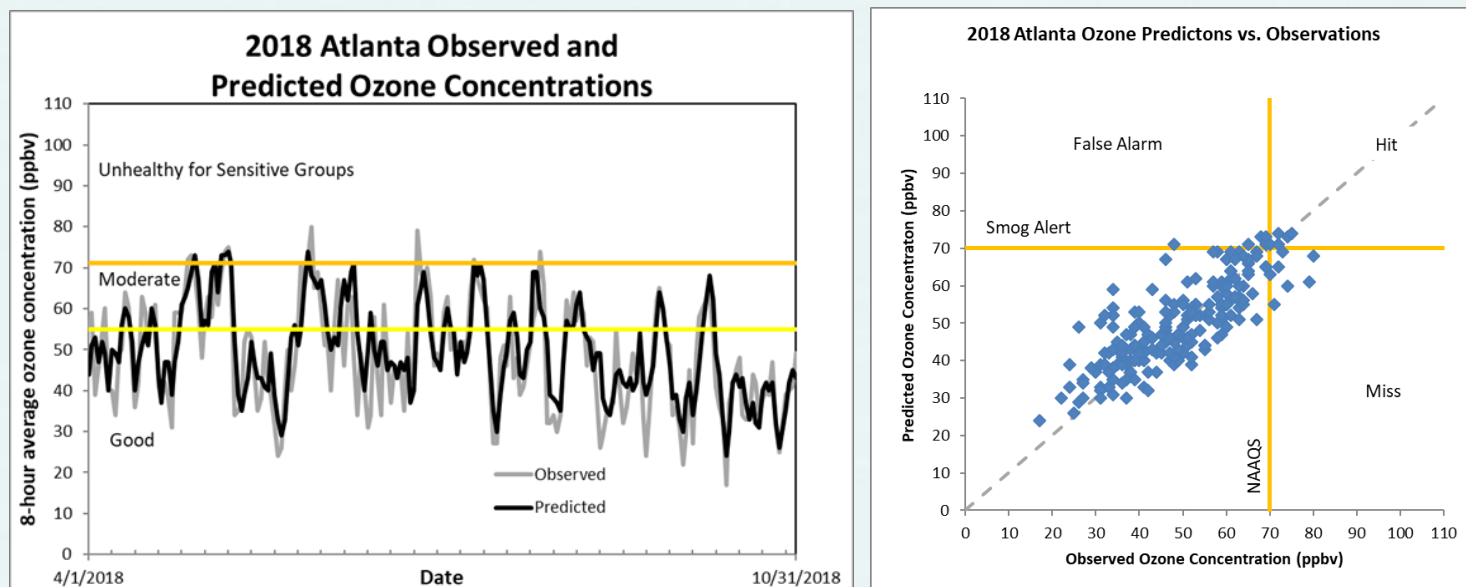
Figure 52. Atlanta observed and predicted ozone, 2018
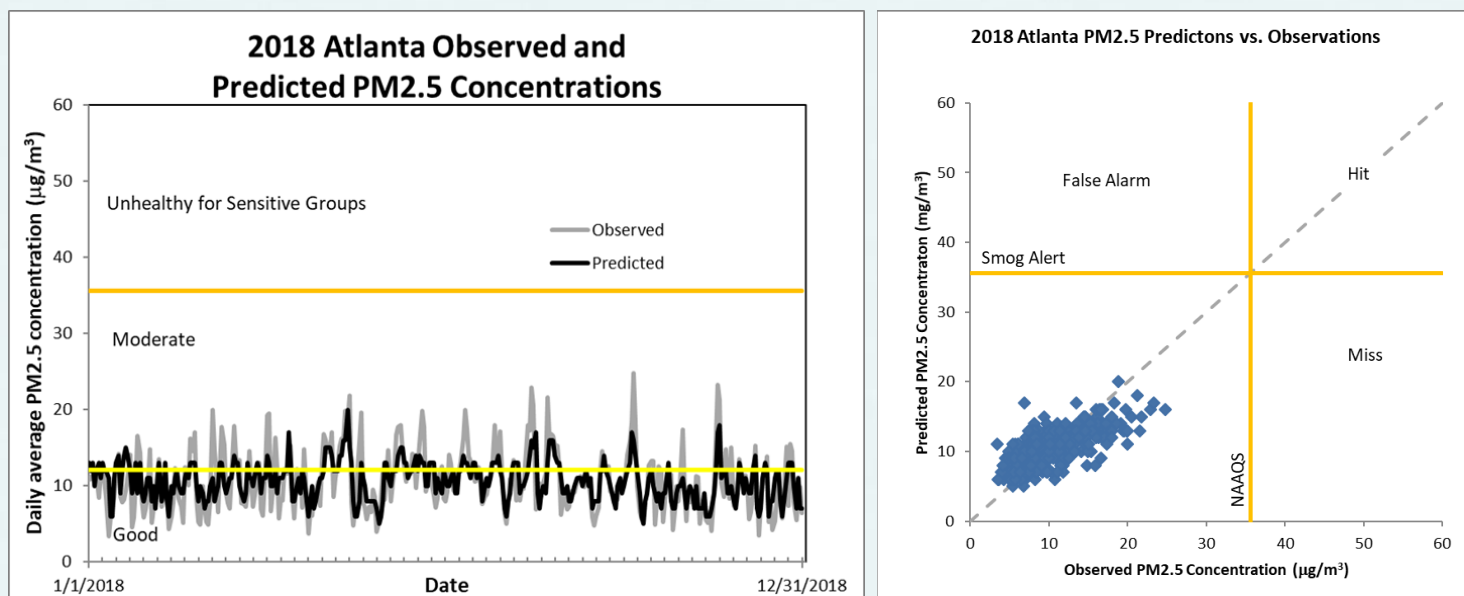
Figure 53. Atlanta observed and predicted PM$_{2.5}$, 2018

Observed and Predicted Air Quality:
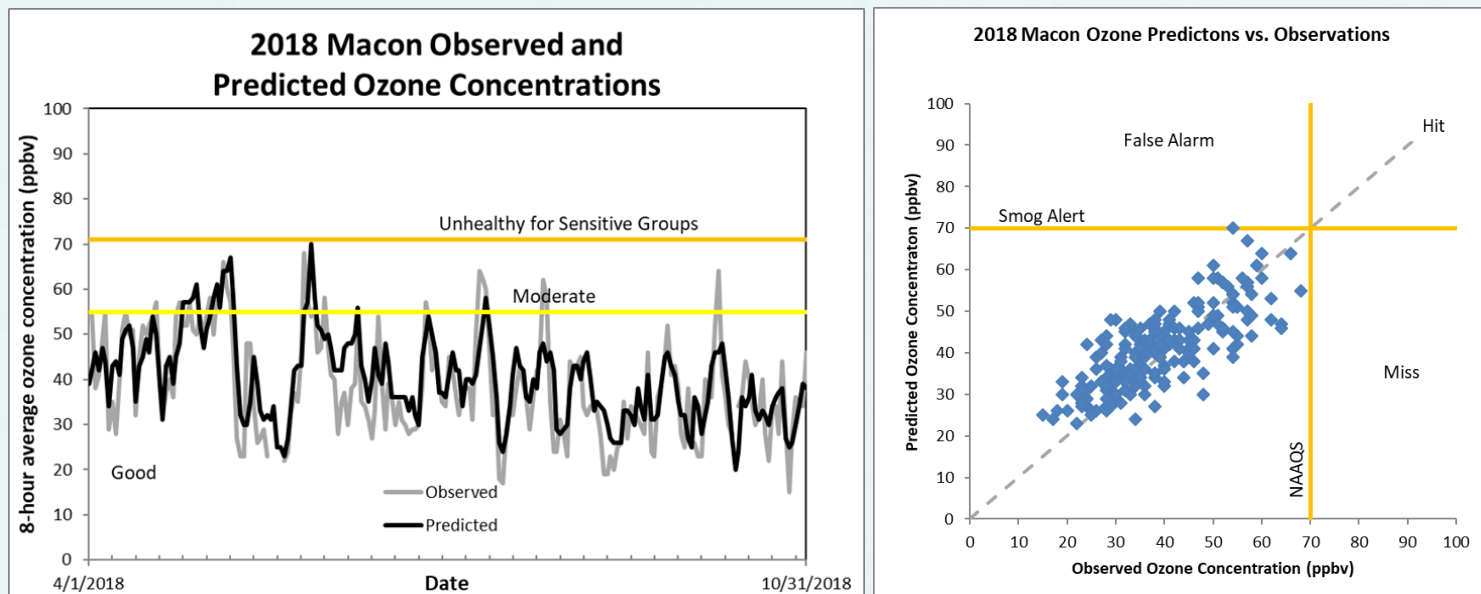
Figure 54. Macon observed and predicted ozone, 2018
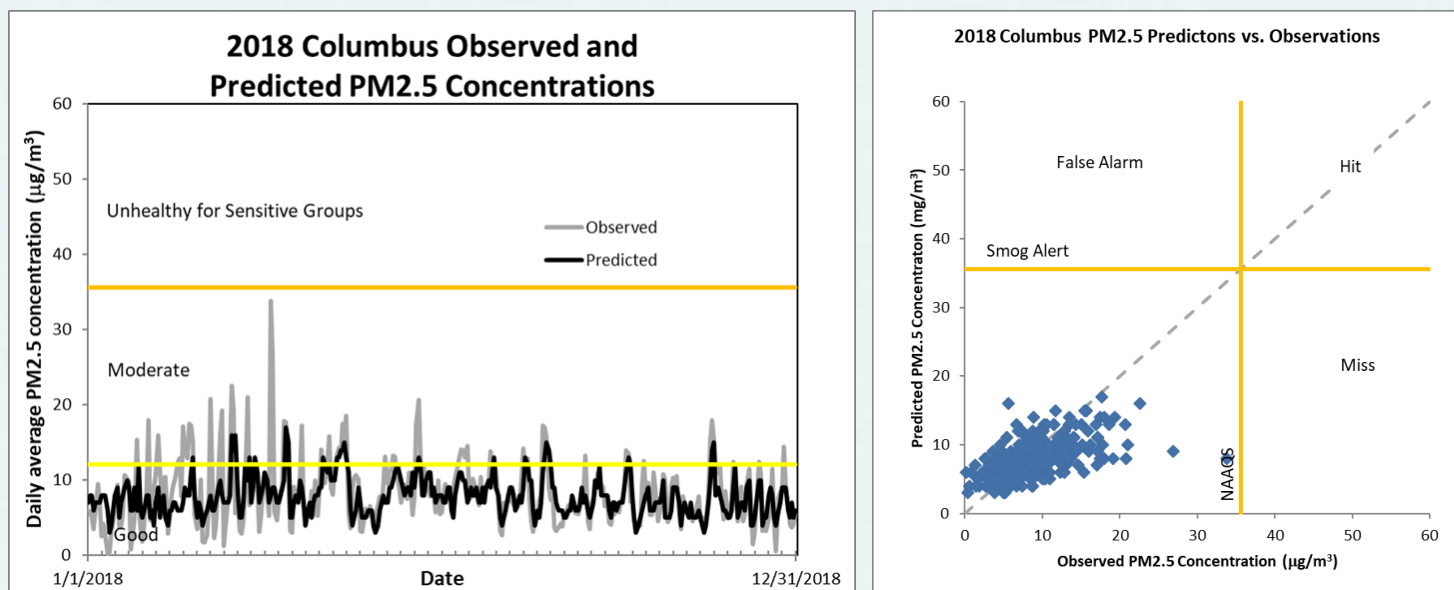
Figure 55. Columbus observed and predicted PM$_{2.5,}$ 2018

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:

- Instrument performance audits
- Monitor siting evaluations
- Precision and span checks
- Bias determinations
- Flow rate determinations
- 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 Organization (PQAO) 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.

The two following graphs show how GA EPD's criteria audit data compare to EPA's target limits. Each target limit is shown in the box below each graph for each pollutant.

Accuracy Levels

Pollutant	CO	NO2	O3	SO2
Lower (25%) Confidence Limit	-12.06%	-1.20%	-3.91%	-2.55%
Median Confidence Limit	-8.41%	2.63%	-2.82%	1.57%
Mean Confidence Limit	-8.41%	0.36%	-2.67%	1.67%
Upper (75%) Upper Confidence Limit	-4.76%	3.05%	-1.49%	8.48%
Targeted Percent Difference	±15%	±15%	±15%	±15%
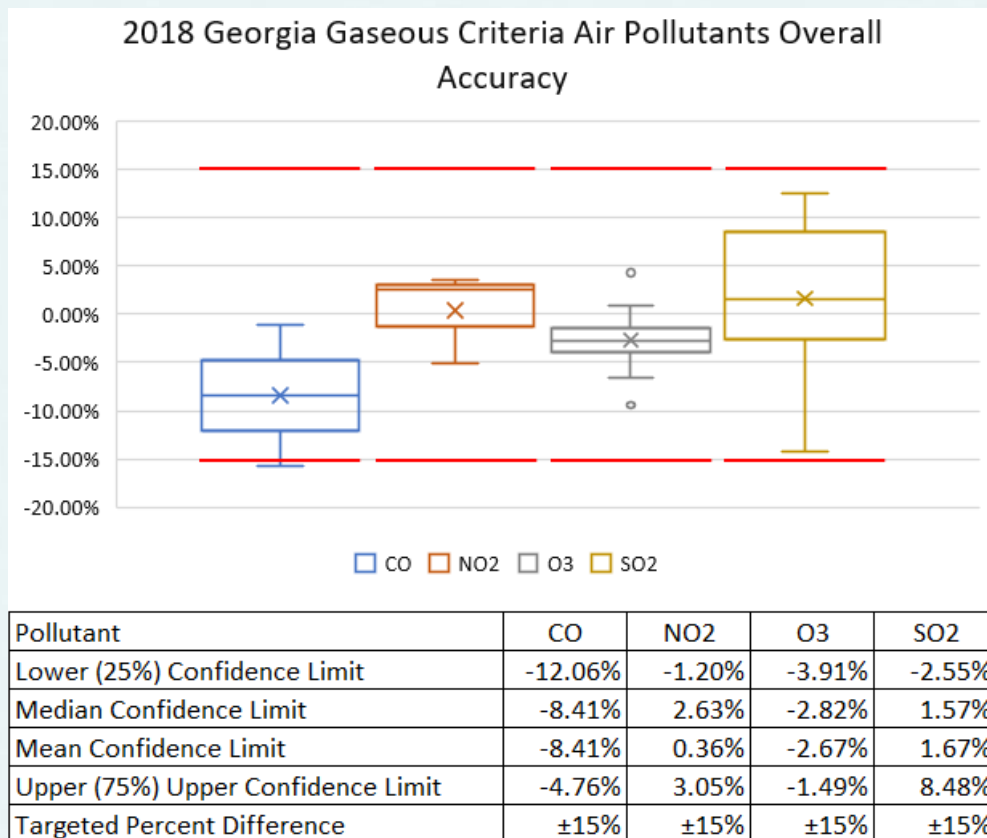
Figure 56. Gaseous Air Pollutants 2018 Accuracy Data

Accuracy Levels

2018 Georgia Particulate Criteria Air Pollutants Overall Accuracy

Pollutant	PM2.5	PM10	Pb
Lower (25%) Confidence Limit	-0.14%	-0.70%	-1.35%
Median Confidence Limit	1.09%	0.09%	-1.09%
Mean Confidence Limit	0.64%	0.03%	-0.34%
Upper (75%) Upper Confidence Limit	1.56%	0.74%	0.29%
Targeted Percent Difference	±4%	±7%	±7%
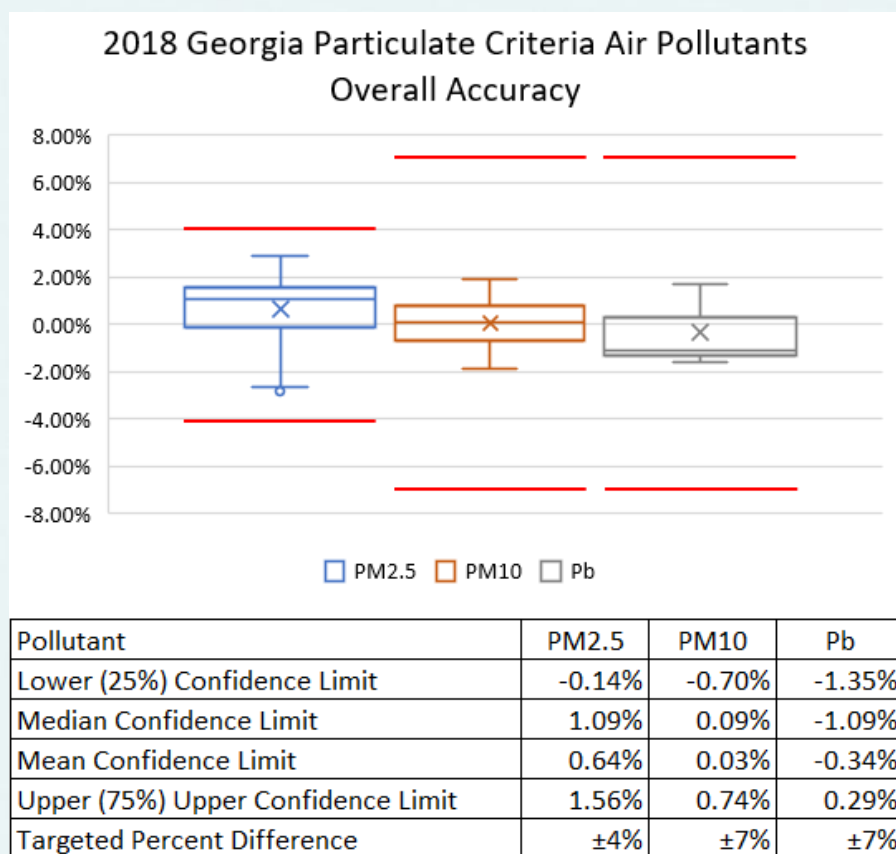
Figure 57. Particulate Air Pollutants 2018 Accuracy Data

Appendix Section

Appendix A: Georgia Air Monitoring Network

SITE ID	Site Name	COUNTY	O₃	CO	PM2.5 FRM	PM2.5 Cont.	PM2.5 Spec.	PM Coarse	NOx	NO₂	NOy	SO₂	Pb	PM₁₀	PM₁₀ Cont.	PAMS VOC	VOC	SVOC	Carbonyls	Met	Black Carbon	Metals
Rome MSA																						
131150003	Rome	Floyd				S	X															
131150005	Kraftsman	Floyd										S								NR		
Brunswick MSA																						
131270006	Brunswick	Glynn	S		S															NR		
Valdosta MSA																						
131850003	Valdosta	Lowndes			S	S																
Warner Robins MSA																						
131530001	Warner Robins	Houston			S	S																
Dalton MSA																						
132130003	Fort Mountain	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-Forestry	Bibb	S		S	S						S					NR^	NR^		NR		NR^
Columbus Georgia- Alabama MSA																						
132150001	Columbus-Health Dept.	Muscogee			S																	
132150008	Columbus-Airport	Muscogee	S		S	S																
132150009	Columbus-Allied	Muscogee											S*									
132150010	Columbus-Joy Rd^	Muscogee											S^									
132150011	Columbus-Cusseta	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-Mercer	Chatham			S																	
130511002	Savannah-L&A	Chatham				S						S								NR		
Augusta Georgia-South Carolina MSA																						
130730001	Evans	Columbia	S																	NR		
132450091	Augusta	Richmond	S		S^	S	X					S		S^	S					NR		

^closed in 2018; *QA monitor located at site

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

SITE ID	Site Name	COUNTY	O₃	CO	PM₂.₅ FRM	PM₂.₅ Cont.	PM₂.₅ Spec.	PM Coarse	NO/NOx	NO₂	NOy	SO₂	Pb	PM₁₀	PM₁₀ Cont	PAMS VOC	VOC	SVOC	Carbonyls	Met	Black Car-	Metals
Atlanta-Sandy Springs-Roswell MSA																						
130630091	Forest Park	Clayton			S																	
130670003	Kennesaw	Cobb	S		S																	
130850001	Dawsonville	Dawson	S																	NR		
130890002	South DeKalb	DeKalb	S/P/C	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	NR-285	DeKalb							R	R							R					R
130970004	Douglasville	Douglas	S																	NR		
131210039	Fire Station	Fulton			S									S*								
131210055	United Ave.	Fulton	S			S							S							NR		
131210056	NR-GA Tech	Fulton		R	R	R			R	R										R	R	
131350002	Gwinnett	Gwinnett	S		S^	S																
131510002	McDonough	Henry	S			S																
132319991	EPA CAST-NET	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			S		X										NR^	NR^				NR^
132611001	Leslie	Sumter	S																			
133030001	Sandersville	Washing-			S																	

^closed in 2018; *QA monitor located at site

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: Meteorological Instruments Used in 2018

PARAMETER	COMPANY	INSTRUMENT	MODEL	LOCATION													
				Augusta	Brunswick	Col Cr Lab	United Ave.	Conyers	Dawsonville	S. DeKalb	Sav. E. Pres	Macon Forestry	Douglasville	Ft. Mtn	Evans	NR-GT	Sav L&A
Wind Speed/Wind Direction	R.M. Young	Ultrasonic Anemometer	81000	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ambient Temperature/ Relative Humidity	R.M. Young	TEMP/RH SENSOR, DEG C	41382VC	X		X		X		X	X			X	X		
Barometric Pressure	R.M. Young	Barometric Pressure Sensor	61302V	X		X		X		X	X						
Precipitation	Novalynx	Tipping Bucket Rain Gauge	260-2501	X		X		X		X							
Solar Radiation	Eppley Lab	Standard Precision Pyranometer	PSP/SPP 38380F3						X								
Total Ultraviolet Radiation	Eppley Lab	Total Ultraviolet Radiometer	TUVR 38020						X								
Data Logger	ESC	Data System Controller	8832	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Towers	Aluma Tower Inc.	Crank-Up Tower	T-135	X	X	X	X	X		X	X	X	X			X	X
Towers	Aluma Tower Inc.	Fold-Over Tower	FOT-10						X					X	X		

Appendix C: 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 - 2018

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	8399	1.848	1.835	0	1.3	1.2	0
131210056	Atlanta	Fulton	NR-GA Tech	8625	2.7	2.2	0	2.0	1.6	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 - 2018

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	8275	39.2	49.4	44.7	7.76
130890003	Decatur	DeKalb	NR-285	7947	46.6	53.8	53.1	14.72
131210056	Atlanta	Fulton	NR-GA Tech	8528	41.2	45.5	44.5	16.27

Pollutant Summary Report - 2018

Pollutant: NO

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	8275	306.7	256.5	8.20
130890003	Decatur	DeKalb	NR-285	7947	294.6	260.0	21.23
131210056	Atlanta	Fulton	NR-GA Tech	8528	242.5	181.2	23.32

Pollutant Summary Report - 2018

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	8275	355.9	297.9	15.97
130890003	Decatur	DeKalb	NR-285	7947	327.2	297.5	35.97
131210056	Atlanta	Fulton	NR-GA Tech	8528	271.0	211.6	39.63

Pollutant Summary Report - 2018

Pollutant: NOy

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	7862	214.0	213.0	17.09

Criteria Pollutant Summary Report - 2018

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	243	0.068	0.066	0.064	0.064	0
130510021	Savannah	Chatham	Savannah-E. Pres. St.	228	0.061	0.059	0.059	0.058	0
130550001	Summerville	Chattooga	Summerville	245	0.066	0.066	0.06	0.059	0
130590002	Athens	Clarke	Athens	245	0.072	0.072	0.067	0.065	2
130670003	Kennesaw	Cobb	Kennesaw	245	0.070	0.067	0.067	0.065	0
130730001	Evans	Columbia	Evans	244	0.067	0.061	0.060	0.060	0
130850001	Dawsonville	Dawson	Dawsonville	245	0.073	0.072	0.068	0.065	2
130890002	Decatur	DeKalb	South DeKalb	358	0.070	0.069	0.069	0.067	0
130970004	Douglasville	Douglas	Douglasville	240	0.068	0.065	0.064	0.064	0
131210055	Atlanta	Fulton	United Ave.	241	0.080	0.079	0.074	0.072	4
131270006	Brunswick	Glynn	Brunswick	237	0.062	0.061	0.060	0.060	0
131350002	Lawrenceville	Gwinnett	Gwinnett Tech	244	0.066	0.066	0.065	0.065	0
131510002	McDonough	Henry	McDonough	241	0.075	0.072	0.071	0.069	3
132130003	Chatsworth	Murray	Fort Mountain	225	0.070	0.067	0.064	0.064	0
132150008	Columbus	Muscogee	Columbus-Airport	244	0.062	0.061	0.06	0.059	0
132319991	Williamson	Pike	CASTNET	167	0.075	0.067	0.066	0.065	1
132450091	Augusta	Richmond	Augusta	242	0.085	0.064	0.064	0.063	1
132470001	Conyers	Rockdale	Conyers	239	0.074	0.071	0.070	0.069	2
132611001	Leslie	Sumter	Leslie	240	0.064	0.064	0.063	0.062	0

Criteria Pollutant Summary Report - 2018

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	245	0.081	0.077
130510021	Savannah	Chatham	Savannah-E. Pres. St.	229	0.079	0.074
130550001	Summerville	Chattooga	Summerville	245	0.076	0.069
130590002	Athens	Clarke	Athens	244	0.079	0.077
130670003	Kennesaw	Cobb	Kennesaw	245	0.078	0.074
130730001	Evans	Columbia	Evans	244	0.082	0.070
130850001	Dawsonville	Dawson	Dawsonville	245	0.083	0.080
130890002	Decatur	DeKalb	South DeKalb	362	0.082	0.080
130970004	Douglasville	Douglas	Douglasville	242	0.079	0.073
131210055	Atlanta	Fulton	United Ave.	243	0.092	0.086
131270006	Brunswick	Glynn	Brunswick	238	0.066	0.066
131350002	Lawrenceville	Gwinnett	Gwinnett Tech	244	0.079	0.077
131510002	McDonough	Henry	McDonough	241	0.088	0.081
132130003	Chatsworth	Murray	Fort Mountain	232	0.073	0.073
132150008	Columbus	Muscogee	Columbus- Airport	244	0.067	0.066
132319991	Williamson	Pike	CASTNET	172	0.083	0.077
132450091	Augusta	Richmond	Augusta	242	0.098	0.086
132470001	Conyers	Rockdale	Conyers	242	0.095	0.086
132611001	Leslie	Sumter	Leslie	242	0.069	0.069

Criteria Pollutant Summary Report - 2018

Pollutant: Sulfur Dioxide

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

Site ID	City	County	Site Name	Hours Measured	Max 24 - Hour		Max 3 - Hour		Max 1-Hour		99th Pctl 1- Hr	Maximum 5- Minute	Annual Arithmetic Mean
					1st	2nd	1st	2nd	1st	2nd			
130210012	Macon	Bibb	Macon-Forestry	8457	1.7	1.6	2.8	2.8	3.6	3.1	2.7	5.0	0.72
130510021	Savan-nah	Chat-ham	Savannah-E. Pres. St	8488	12.9	10.6	41.6	32.6	61.8	55	32.1	107.0	0.43
130511002	Savan-nah	Chat-ham	Savannah-L&A	8681	19.4	17.3	38.2	31.4	50.3	44.8	40.7	109.4	1.28
130890002	Decatur	DeKalb	South DeKalb	8472	1.3	0.9	3.2	2.2	5.0	4.1	2.4	7.0	0.11
131150006	Rome	Floyd	Kraftsman	8641	4.7	3.3	25.1	11.2	28.0	22.2	15.0	63.9	1.00
131210055	Atlanta	Fulton	United Ave.	8578	2.7	2.3	4.0	4.0	6.6	5.1	4.3	13.0	0.81
132450091	Augusta	Rich-mond	Augusta	8529	9.3	8.3	56.8	35.1	93.9	90.2	63.9	292.4	0.93

Criteria Pollutant Summary Report - 2018

Pollutant: Particulate Matter PM$_{2.5}$

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

98th% and Annual Arithmetic Mean

Integrated Sampling (midnight to midnight) Using Federal Reference Method

Site ID	City	County	Site Name	Days Meas-ured	98th Percen-tile	Values Exceeding Applicable Daily Standard	Annual Arith-metic Mean
130210007	Macon	Bibb	Macon-Allied	117	16.8	0	8.54
130210012	Macon	Bibb	Macon-Forestry	97	15.4	0	7.06
130510091	Savannah	Chatham	Savannah-Mercer	117	17.4	0	6.94
130590002	Athens	Clarke	Athens	116	13.5	0	7.09
130630091	Forest Park	Clayton	Forest Park	120	18.5	0	8.26
130670003	Kennesaw	Cobb	Kennesaw	120	15.7	0	8.00
130690002	General Coffee	Douglas	General Coffee	115	13.0	0	5.86
130890002	Decatur	DeKalb	South DeKalb	120	16.7	0	7.61
130950007	Albany	Dougherty	Albany	122	23.8	1	8.49
131210039	Atlanta	Fulton	Fire Station #8	121	18.0	0	8.62
131210056	Atlanta	Fulton	NR-GA Tech	121	16.8	0	9.19
131270006	Brunswick	Glynn	Brunswick	99	14.1	0	6.35

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

Criteria Pollutant Summary Report - 2018

Pollutant: Particulate Matter PM$_{2.5}$

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

98th% and Annual Arithmetic Mean

Integrated Sampling (midnight to midnight) Using Federal Reference Method

Site ID	City	County	Site Name	Days Measured	98th Percentile	Values Exceeding Applicable Daily Standard	Annual Arithmetic-Mean
131350002	Lawrenceville	Gwinnett	Gwinnett Tech	96	16.1	0	7.51
131390003	Gainesville	Hall	Gainesville	98	15.0	0	6.62
131530001	Warner Robins	Houston	Warner Robins	117	16.5	0	7.09
131850003	Valdosta	Lowndes	Valdosta	119	17.3	0	6.88
132150001	Columbus	Muscogee	Columbus-Health Dept.	107	17.7	0	8.08
132150008	Columbus	Muscogee	Columbus Airport	121	16.5	0	8.19
132150011	Columbus	Muscogee	Columbus-Cusseta	120	27.8	0	8.47
132450091	Augusta	Richmond	Augusta	100	18.0	0	7.90
132950002	Rossville	Walker	Rossville	95	14.9	0	7.11
133030001	Sandersville	Washington	Sandersville	121	14.3	0	7.08

Pollutant Summary Report - 2018

Pollutant: Particulate Matter PM$_{2.5}$

Data Interval: 1-Hour   **Units:**   Micrograms per cubic meter (µg/m^3)

Hourly Averages of PM$_{2.5}$ with Federal Equivalent Method (FEM)

Site ID	City	County	Site Name	Days Measured	98th Percentile	Values Exceeding Applicable Daily Standard	Annual Arithmetic Mean
130210012	Macon	Bibb	Macon-Forestry	316	18.6	0	8.11
130511002	Savannah	Chatham	Savannah-L&A	345	15.5	0	8.45
130590002*	Athens	Clarke	Athens	267	19.0	0	9.03
130890002	Decatur	DeKalb	South DeKalb	343	18.3	0	9.06
130950007	Albany	Dougherty	Albany	307	22.2	1	6.59
131350002	Lawrenceville	Gwinnett	Gwinnett Tech	355	21.2	0	10.03
131390003	Gainesville	Hall	Gainesville	318	16.8	0	7.83
131530001*	Warner Robins	Houston	Warner Robins	261	20.1	2	10.65
132450091	Augusta	Richmond	Augusta	346	28.5	3	9.91
132950002	Rossville	Walker	Rossville	345	17.0	0	9.08

*partial year of data, as method changed

Pollutant Summary Report - 2018

Pollutant: Particulate Matter PM$_{2.5}$

Data Interval: 1-Hour   Units: Micrograms per cubic meter (µg/m^3)

Hourly Averages of PM$_{2.5}$ with Non-FEM Method

Site ID	City	County	Site Name	Hours Measured	1st Max	2nd Max	Annual Arithmetic Mean
130590002*	Athens	Clarke	Athens	273	27.6	16.7	4.48
131150003	Rome	Floyd	Rome	8639	137.2	122.4	10.57
131210055	Atlanta	Fulton	United Ave.	8574	54.2	52.1	10.57
131510002	McDonough	Henry	McDonough	8371	41.1	35.5	6.85
131530001*	Warner Robins	Houston	Warner Robins	920	53.0	48.0	8.58
131850003	Valdosta	Lowndes	Valdosta	7060	574.0	123.0	9.48
132150008	Columbus	Muscogee	Columbus-Airport	8384	150.0	76.0	6.75

*partial year of data, as method changed

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 - 2018

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 Measured	1st Max	Number Values ≥150	Annual Arithmetic Mean
131210039	Atlanta	Fulton	Fire Station #8	61	33	0	15
132450091	Augusta	Richmond	Augusta	10*	27	0	14

*partial year of data, as method changed

Site ID	City	County	Site Name	Hours Measured	1st Max	Annual Arithmetic Mean
130890002	Decatur	DeKalb	South DeKalb	8271	46	17.1
132450091	Augusta	Richmond	Augusta	8517	35	12.6

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 - 2018

Pollutant: Lead

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

Site ID	132150009	132150010	132150011
City	Columbus	Columbus	Columbus
County	Muscogee	Muscogee	Muscogee
Site Name	Columbus-Allied	Columbus-Joy Road	Columbus-Cusseta
Number of Obs.	57	30	54
Nov 2017-Jan 2018	0.0273	0.0233	0.0056
Dec 2017-Feb 2018	0.0183	0.0247	0.004
Jan 2018-Mar 2018	0.0316	0.0249	0.0044
Feb 2018-Apr 2018	0.0341	0.0453	0.0045
Mar 2018-May 2018	0.0377	0.0533	0.0060
Apr 2018-Jun 2018	0.0245	0.0538	0.0063
May 2018-Jul 2018	0.0254		0.0056
Jun 2018-Aug 2018	0.0229		0.0040
Jul 2018-Sep 2018	0.0178		0.0024
Aug 2018-Oct 2018	0.0202		0.0052
Sep 2018-Nov 2018	0.0241		0.0067
Oct 2018-Dec 2018	0.0332		0.0068
# of Values $\geq$ 0.15	0	0	0

PAMS 2018 24-hour Canister Hydrocarbons					
(concentrations in parts per billion Carbon (ppbC))					
Name	Site	#Samples	Avg.	1st Max	2nd Max
PAMSHC	S. DeKalb	40	83.05	220.0	180.0
TNMOC	S. DeKalb	40	185.85	520.0	500.0
Ethane	S. DeKalb	40	6.28	14.0	11.0
Ethylene	S. DeKalb	40	0	0	0
Propane	S. DeKalb	40	4.79	9.4	9.3
Propylene	S. DeKalb	40	0.67	2.4	1.6
Acetylene	S. DeKalb	37	1.59	7.1	3.2
n-Butane	S. DeKalb	40	3.10	13.0	7.2
Isobutane	S. DeKalb	40	1.13	4.0	2.6
trans-2-Butene	S. DeKalb	40	0.02	0.6	0.3
cis-2-Butene	S. DeKalb	40	0	0	0
n-Pentane	S. DeKalb	40	5.71	31.0	23.0
Isopentane	S. DeKalb	40	8.66	44.0	41.0
1-Pentene	S. DeKalb	40	0.35	2.6	2.4

PAMS 2018 24-hour Canister Hydrocarbons (continued)					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
trans-2-Pentene	S. DeKalb	40	0.06	1.1	0.4
cis-2-Pentene	S. DeKalb	40	0.46	3.9	2.6
3-Methylpentane	S. DeKalb	40	0.85	3.3	2.2
n-Hexane	S. DeKalb	40	0.77	2.5	1.9
n-Heptane	S. DeKalb	40	0.41	1.2	1.0
n-Octane	S. DeKalb	40	0.12	0.5	0.5
n-Nonane	S. DeKalb	40	0.11	1.0	0.6
n-Decane	S. DeKalb	40	0.11	0.5	0.5
Cyclopentane	S. DeKalb	40	0.28	1.6	1.4
Isoprene	S. DeKalb	40	4.25	24.0	17.0
2,2-Dimethylbutane	S. DeKalb	40	0.07	0.5	0.4
2,4-Dimethylpentane	S. DeKalb	40	0.18	0.6	0.5
Cyclohexane	S. DeKalb	40	0.31	0.9	0.9
3-Methylhexane	S. DeKalb	40	0.60	3.1	2.5

PAMS 2018 24-hour Canister Hydrocarbons (continued)					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
2,2,4-Trimethylpentane	S. DeKalb	40	0.73	3.1	1.8
2,3,4-Trimethylpentane	S. DeKalb	40	0.11	0.7	0.5
3-Methylheptane	S. DeKalb	40	0.04	0.4	0.3
Methylcyclohexane	S. DeKalb	40	0.14	0.8	0.6
Methylcyclopentane	S. DeKalb	40	0.44	1.5	1.2
2-Methylhexane	S. DeKalb	40	0.35	1.3	1.0
1-Butene	S. DeKalb	40	0.14	0.7	0.7
2,3-Dimenthylbutane	S. DeKalb	40	0.24	0.9	0.8
2-Methylpentane	S. DeKalb	40	0.98	4.6	3.1
2,3-Dimethylpentane	S. DeKalb	40	0.22	1.3	0.7
n-Undecane	S. DeKalb	40	0.41	2.1	1.8
2-Methylheptane	S. DeKalb	40	0.06	0.5	0.4
m & p Xylenes	S. DeKalb	40	1.04	3.3	2.7
Benzene	S. DeKalb	40	1.32	3.1	2.7

PAMS 2018 24-hour Canister Hydrocarbons (continued)					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Toluene	S. DeKalb	40	2.33	7.3	5.3
Ethylbenzene	S. DeKalb	40	0.40	1.1	1.0
o-Xylene	S. DeKalb	40	0.45	1.5	1.1
1,3,5-Trimethylbenzene	S. DeKalb	40	0.08	0.7	0.6
1,2,4-Trimethylbenzene	S. DeKalb	40	24.83	54.0	46.0
n-Propylbenzene	S. DeKalb	40	0.01	0.3	0.2
Isopropylbenzene	S. DeKalb	40	0.01	0.2	0.0
o-Ethyltoluene	S. DeKalb	40	0.25	1.3	0.7
m-Ethyltoluene	S. DeKalb	40	0.31	1.1	0.8
p-Ethyltoluene	S. DeKalb	40	0.42	1.4	1.0
m-Diethylbenzene	S. DeKalb	40	0.21	2.4	1.7
p-Diethylbenzene	S. DeKalb	40	0.03	0.3	0.3
Styrene	S. DeKalb	40	3.27	15.0	13.0
1,2,3-Trimethylbenzene	S. DeKalb	40	0.11	0.5	0.5

2018 Metals					
(concentrations in micrograms per cubic meter ($\mu g/m^3$))					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Antimony	Macon-Forestry	25	0.0007	0.0020	0.0010
	Savannah-E. Pres. St.	26	0.0009	0.0020	0.0020
	General Coffee	29	0.0002	0.0010	0.0010
	South DeKalb*	52	0.0022	0.0010	0.0009
Arsenic	Macon-Forestry	24	0.0003	0.0010	0.0010
	Savannah-E. Pres. St.	26	0.0005	0.0040	0.0030
	General Coffee	29	0.0006	0.0030	0.0010
	South DeKalb*	52	0.0006	0.0024	0.0018
Beryllium	Macon-Forestry	23	0.0000	0.0001	0.0001
	Savannah-E. Pres. St.	25	0.0000	0.0004	0.0002
	General Coffee	29	0.0000	0.0001	0.0001
	South DeKalb*	52	0.0000	0.0001	0.0001
Cadmium	Macon-Forestry	25	0.0000	0.0000	0.0000
	Savannah-E. Pres. St.	25	0.0002	0.0010	0.0010
	General Coffee	29	0.0000	0.0000	0.0000
	South DeKalb*	46	0.0001	0.0002	0.0002
Chromium	Macon-Forestry	22	0.0024	0.0160	0.0030
	Savannah-E. Pres. St.	22	0.0030	0.0130	0.0060
	General Coffee	24	0.0043	0.0310	0.0310
	South DeKalb*	52	0.0023	0.0041	0.0039
Cobalt	Macon-Forestry	25	0.0000	0.0000	0.0000
	Savannah-E. Pres. St.	25	0.0004	0.0080	0.0010
	General Coffee	29	0.0000	0.0010	0.0000
	South DeKalb*	52	0.0001	0.0002	0.0002

2018 Metals (continued)					
(concentrations in µg/m^3)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Lead	Macon-Forestry	25	0.0016	0.0048	0.0046
	Savannah-E. Pres. St.	25	0.0058	0.0435	0.0371
	General Coffee	29	0.0023	0.0400	0.0022
	South DeKalb*	53	0.0023	0.0440	0.0050
Manganese	Macon-Forestry	25	0.0075	0.0380	0.0230
	Savannah-E. Pres. St.	26	0.0142	0.0740	0.0500
	General Coffee	29	0.0060	0.0680	0.0130
	South DeKalb*	50	0.0035	0.0100	0.0076
Nickel	Macon-Forestry	25	0.0013	0.0120	0.0020
	Savannah-E. Pres. St.	25	0.0014	0.0080	0.0030
	General Coffee	29	0.0011	0.0030	0.0020
	South DeKalb*	52	0.0007	0.0011	0.0010
Selenium	Macon-Forestry	25	0.0006	0.0040	0.0040
	Savannah-E. Pres. St.	21	0.0001	0.0010	0.0010
	General Coffee	28	0.0001	0.0010	0.0010
	South DeKalb*	46	0.0002	0.0007	0.0007
Zinc	Macon-Forestry	5	0.0800	0.2250	0.1290
	Savannah-E. Pres. St.	3	0.0547	0.0690	0.0640
	General Coffee	5	0.0284	0.0640	0.0280
	South DeKalb*	9	0.0241	0.0518	0.0431

*Sample collected every 6 days.

2018 Semi-Volatile Compounds					
(concentrations in µg/m^3)					
Name	Site	#Samples	Avg.**	1st Max	2nd Max
Acenaphthene	Macon-Forestry	20	0.0017	0.0051	0.0048
	Savannah-E. Pres. St.	14	0.0017	0.0042	0.0033
	General Coffee	14	0.0007	0.0026	0.0018
	South DeKalb*	51	0.0016	0.0055	0.0049
Acenaphthylene	Macon-Forestry	19	0.0001	0.0003	0.0003
	Savannah-E. Pres. St.	14	0.0002	0.0005	0.0005
	General Coffee	14	0.0002	0.0006	0.0006
	South DeKalb*	52	0.0003	0.0029	0.0021
Anthracene	Macon-Forestry	20	0.0000	0.0001	0.0001
	Savannah-E. Pres. St.	14	0.0000	0.0002	0.0002
	General Coffee	15	0.0001	0.0002	0.0002
	South DeKalb*	55	0.0001	0.0003	0.0002
Benzo(a)anthracene	Macon-Forestry	20	0.0000	0.0001	0.0000
	Savannah-E. Pres. St.	14	0.0000	0.0001	0.0001
	General Coffee	15	0.0001	0.0004	0.0002
	South DeKalb*	55	0.0000	0.0003	0.0002
Benzo(a)pyrene	Macon-Forestry	20	0.0001	0.0020	0.0001
	Savannah-E. Pres. St.	14	0.0000	0.0001	0.0001
	General Coffee	15	0.0000	0.0001	0.0001
	South DeKalb*	55	0.0000	0.0003	0.0002
Benzo(b)fluoranthene	Macon-Forestry	20	0.0002	0.0018	0.0002
	Savannah-E. Pres. St.	14	0.0001	0.0003	0.0003
	General Coffee	15	0.0001	0.0003	0.0002
	South DeKalb*	55	0.0001	0.0009	0.0007
Benzo(e)pyrene	Macon-Forestry	20	0.0002	0.0019	0.0002
	Savannah-E. Pres. St.	14	0.0001	0.0002	0.0002
	General Coffee	15	0.0001	0.0001	0.0001
	South DeKalb*	55	0.0001	0.0005	0.0003

Name	Site	#Samples	Avg.**	1st Max	2nd Max
2018 Semi-Volatile Compounds (continued)					
(concentrations in μg/m^3)					
Benzo(g,h,i)perylene	**Macon-Forestry**	20	0.0000	0.0002	0.0001
	Savannah-E. Pres. St.	14	0.0001	0.0001	0.0001
	General Coffee	15	0.0000	0.0001	0.0001
	South DeKalb*	55	0.0001	0.0008	0.0006
Benzo(k)fluoranthene	**Macon-Forestry**	20	0.0000	0.0002	0.0001
	Savannah-E. Pres. St.	14	0.0000	0.0001	0.0001
	General Coffee	15	0.0000	0.0001	0.0001
	South DeKalb*	55	0.0000	0.0002	0.0001
Chrysene	**Macon-Forestry**	20	0.0000	0.0002	0.0001
	Savannah-E. Pres. St.	14	0.0001	0.0003	0.0003
	General Coffee	15	0.0003	0.0011	0.0007
	South DeKalb*	55	0.0000	0.0003	0.0001
Dibenzo(a,h)anthracene	**Macon-Forestry**	20	0.0000	0.0002	0.0000
	Savannah-E. Pres. St.	14	0.0000	0.0001	0.0001
	General Coffee	15	0.0000	0.0000	0.0000
	South DeKalb*	55	0.0000	0.0001	0.0001
Fluoranthene	**Macon-Forestry**	20	0.0008	0.0026	0.0022
	Savannah-E. Pres. St.	14	0.0007	0.0015	0.0014
	General Coffee	15	0.0007	0.0020	0.0017
	South DeKalb*	54	0.0008	0.0021	0.0018
Fluorene	**Macon-Forestry**	20	0.0016	0.0041	0.0033
	Savannah-E. Pres. St.	14	0.0017	0.0029	0.0027
	General Coffee	14	0.0010	0.0018	0.0016
	South DeKalb*	52	0.0005	0.0027	0.0026
Indeno(1,2,3-cd)pyrene	**Macon-Forestry**	20	0.0000	0.0002	0.0001
	Savannah-E. Pres. St.	14	0.0001	0.0002	0.0001
	General Coffee	14	0.0000	0.0001	0.0001
	South DeKalb*	55	0.0001	0.0004	0.0004

2018 Semi-Volatile Compounds (continued)					
(concentrations in µg/m³)					
Name	Site	#Samples	Avg.**	1st Max	2nd Max
Naphthalene	Macon-Forestry	21	0.0167	0.0379	0.0274
	Savannah-E. Pres. St.	14	0.0205	0.0400	0.0333
	General Coffee	14	0.0065	0.0230	0.0110
	South DeKalb*	52	0.0434	0.1242	0.1166
Phenanthrene	Macon-Forestry	20	0.0035	0.0123	0.0097
	Savannah-E. Pres. St.	14	0.0029	0.0057	0.0052
	General Coffee	15	0.0020	0.0037	0.0036
	South DeKalb*	54	0.0035	0.0092	0.0080
Pyrene	Macon-Forestry	20	0.0003	0.0008	0.0007
	Savannah-E. Pres. St.	14	0.0004	0.0007	0.0006
	General Coffee	15	0.0009	0.0029	0.0022
	South DeKalb*	55	0.0004	0.0009	0.0008
Perylene	South DeKalb*	54	0.0000	0.0000	0.0000

*Sample collected every 6 days.

2018 Volatile Organic Compounds					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Freon 113	Macon-Forestry	28	0.14	0.2	0.2
	Savannah-E. Pres. St.	26	0.13	0.3	0.2
	General Coffee	29	0.13	0.2	0.2
	South DeKalb*	58	0.13	0.3	0.2
	NR-285	27	0.13	0.2	0.2
Freon 114	Macon-Forestry	28	0.04	0.1	0.1
	Savannah-E. Pres. St.	26	0.04	0.2	0.1
	General Coffee	29	0.03	0.1	0.1
	South DeKalb*	58	0.04	0.2	0.1
	NR-285	27	0.03	0.1	0.1
1,3-Butadiene	Macon-Forestry	28	0.33	0.8	0.7
	Savannah-E. Pres. St.	26	0.20	1.0	0.5
	General Coffee	29	0.14	0.4	0.3
	South DeKalb*	58	0.32	2.3	1.4
	NR-285	27	0.54	4.1	2.5
Cyclohexane	Macon-Forestry	16	0.24	1.0	0.9
	Savannah-E. Pres. St.	17	0.09	0.3	0.2
	General Coffee	16	0.02	0.1	0.1
	South DeKalb*	34	0.10	0.5	0.3
	NR-285	15	0.13	0.5	0.3
Chloromethane	Macon-Forestry	25	0.52	0.6	0.6
	Savannah-E. Pres. St.	23	0.57	0.8	0.7
	General Coffee	26	0.56	0.8	0.7
	South DeKalb*	50	0.53	0.7	0.7
	NR-285	23	0.51	0.6	0.6
Dichloromethane	Macon-Forestry	12	0.43	2.2	0.9
	Savannah-E. Pres. St.	13	0.12	0.2	0.2
	General Coffee	13	0.10	0.1	0.1
	South DeKalb*	24	0.12	0.2	0.2
	NR-285	12	0.11	0.2	0.2

2018 Volatile Organic Compounds (continued)					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Chloroform	Macon-Forestry	27	0.01	0.1	0.1
	Savannah-E. Pres. St.	25	0.00	0.1	0.0
	General Coffee	28	0.02	0.1	0.1
	South DeKalb*	54	0.01	0.1	0.1
	NR-285	25	0.00	0.1	0.00
Carbon tetrachloride	Macon-Forestry	25	0.10	0.1	0.1
	Savannah-E. Pres. St.	23	0.10	0.1	0.1
	General Coffee	26	0.10	0.1	0.1
	South DeKalb*	51	0.08	0.1	0.1
	NR-285	24	0.10	0.1	0.1
Trichlorofluoromethane	Macon-Forestry	28	0.20	0.2	0.2
	Savannah-E. Pres. St.	26	0.20	0.3	0.2
	General Coffee	29	0.20	0.3	0.2
	South DeKalb*	57	0.20	0.3	0.3
	NR-285	26	0.20	0.2	0.2
Chloroethane	Macon-Forestry	27	0.04	0.1	0.1
	Savannah-E. Pres. St.	25	0.02	0.2	0.1
	General Coffee	28	0.04	0.1	0.1
	South DeKalb*	55	0.02	0.2	0.1
	NR-285	25	0.02	0.1	0.1
1,1-Dichloroethane	Macon-Forestry	25	0.01	0.1	0.1
	Savannah-E. Pres. St.	23	0.01	0.2	0.0
	General Coffee	26	0.00	0.0	0.0
	South DeKalb*	52	0.01	0.1	0.1
	NR-285	23	0.00	0.0	0.0
Methyl chloroform	Macon-Forestry	25	0.02	0.1	0.1
	Savannah-E. Pres. St.	23	0.02	0.2	0.1
	General Coffee	26	0.01	0.1	0.1
	South DeKalb*	51	0.02	0.2	0.1
	NR-285	24	0.01	0.1	0.1

Name	Site	#Samples	Avg.	1st Max	2nd Max

Name	Site	#Samples	Avg.	1st Max	2nd Max
Ethylene dichloride	Macon-Forestry	29	0.09	1.0	0.2
	Savannah-E. Pres. St.	27	0.04	0.2	0.1
	General Coffee	30	0.03	0.1	0.1
	South DeKalb*	61	0.04	0.2	0.1
	NR-285	29	0.03	0.1	0.1
Tetrachloroethylene	Macon-Forestry	29	0.02	0.1	0.1
	Savannah-E. Pres. St.	27	0.01	0.2	0.1
	General Coffee	30	0.01	0.1	0.1
	South DeKalb*	61	0.02	0.1	0.1
	NR-285	29	0.02	0.1	0.1
1,1,2,2-Tetrachloroethane	Macon-Forestry	29	0.00	0.1	0.0
	Savannah-E. Pres. St.	27	0.00	0.1	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	61	0.00	0.1	0.1
	NR-285	29	0.00	0.0	0.0
Bromomethane	Macon-Forestry	26	0.00	0.0	0.0
	Savannah-E. Pres. St.	24	0.01	0.1	0.1
	General Coffee	27	0.00	0.0	0.0
	South DeKalb*	55	0.00	0.1	0.0
	NR-285	26	0.00	0.0	0.0
1,1,2-Trichloroethane	Macon-Forestry	29	0.00	0.1	0.0
	Savannah-E. Pres. St.	27	0.01	0.2	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	61	0.00	0.1	0.0
	NR-285	29	0.00	0.0	0.0
Dichlorodifluoromethane	Macon-Forestry	25	0.40	0.5	0.4
	Savannah-E. Pres. St.	23	0.41	0.5	0.5
	General Coffee	26	0.40	0.4	0.4
	South DeKalb*	52	0.41	0.5	0.5
	NR-285	24	0.41	0.5	0.5

2018 Volatile Organic Compounds (continued)
(concentrations in ppbC)

2018 Volatile Organic Compounds (continued)					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Trichloroethylene	Macon-Forestry	28	0.00	0.1	0.0
	Savannah-E. Pres. St.	26	0.01	0.2	0.0
	General Coffee	29	0.00	0.1	0.0
	South DeKalb*	59	0.00	0.1	0.0
	NR-285	28	0.00	0.0	0.0
1,1-Dichloroethylene	Macon-Forestry	26	0.01	0.1	0.1
	Savannah-E. Pres. St.	24	0.09	0.3	0.2
	General Coffee	27	0.01	0.1	0.1
	South DeKalb*	55	0.01	0.2	0.1
	NR-285	26	0.00	0.1	0
1,2-Dichloropropane	Macon-Forestry	29	0.03	0.1	0.1
	Savannah-E. Pres. St.	27	0.03	0.3	0.1
	General Coffee	30	0.03	0.1	0.1
	South DeKalb*	61	0.03	0.2	0.1
	NR-285	29	0.02	0.1	0.1
trans-1,3-Dichloropropene	Macon-Forestry	21	0.00	0.0	0.0
	Savannah-E. Pres. St.	21	0.00	0.1	0.0
	General Coffee	21	0.00	0.0	0.0
	South DeKalb*	43	0.00	0.1	0.0
	NR-285	19	0.00	0.0	0.0
cis-1,3-Dichloropropene	Macon-Forestry	18	0.01	0.1	0.0
	Savannah-E. Pres. St.	18	0.01	0.1	0.0
	General Coffee	18	0.00	0.0	0.0
	South DeKalb*	38	0.00	0.1	0.0
	NR-285	16	0.00	0.0	0.0
cis-1,2-Dichloroethene	Macon-Forestry	29	0.00	0.1	0.0
	Savannah-E. Pres. St.	27	0.00	0.1	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	61	0.00	0.1	0.0
	NR-285	29	0.00	0.0	0.0

2018 Volatile Organic Compounds (continued)					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Ethylene dibromide	Macon-Forestry	28	0.00	0.1	0.0
	Savannah-E. Pres. St.	27	0.01	0.2	0.0
	General Coffee	29	0.00	0.0	0.0
	South DeKalb*	59	0.00	0.1	0.0
	NR-285	27	0.00	0.0	0.0
Hexachlorobutadiene	Macon-Forestry	27	0.03	0.1	0.1
	Savannah-E. Pres. St.	26	0.03	0.2	0.1
	General Coffee	29	0.02	0.1	0.1
	South DeKalb*	57	0.03	0.2	0.1
	NR-285	29	0.02	0.1	0.1
Vinyl chloride	Macon-Forestry	27	0.00	0.1	0
	Savannah-E. Pres. St.	25	0.01	0.1	0.1
	General Coffee	28	0.01	0.1	0.1
	South DeKalb*	57	0.01	0.1	0.1
	NR-285	26	0.00	0.0	0.0
m/p Xylene	Macon-Forestry	13	0.19	0.2	0.2
	Savannah-E. Pres. St.	14	0.91	10.4	0.4
	General Coffee	14	0.07	0.1	0.1
	South DeKalb*	26	1.17	3.3	2.4
	NR-285	13	0.58	3.7	0.8
Benzene	Macon-Forestry	28	0.61	1.0	0.9
	Savannah-E. Pres. St.	27	0.59	1.0	0.9
	General Coffee	29	0.56	1.3	1.0
	South DeKalb*	59	1.04	2.6	2.5
	NR-285	27	1.15	2.9	2.8
Toluene	Macon-Forestry	22	0.67	1.6	1.4
	Savannah-E. Pres. St.	21	1.18	3.3	3.0
	General Coffee	22	0.27	0.5	0.5
	South DeKalb*	44	1.46	6.4	5.9
	NR-285	21	2.03	8.1	6.1

2018 Volatile Organic Compounds (continued)					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Ethylbenzene	Macon-Forestry	22	0.17	0.5	0.4
	Savannah-E. Pres. St.	22	0.20	1.8	0.3
	General Coffee	23	0.02	0.1	0.1
	South DeKalb*	44	0.21	0.8	0.8
	NR-285	24	0.30	1.0	0.8
o- Xylene	Macon-Forestry	14	0.10	0.3	0.1
	Savannah-E. Pres. St.	15	0.21	2.4	0.2
	General Coffee	15	0.00	0.0	0.0
	South DeKalb*	29	0.15	1.1	0.3
	NR-285	14	0.21	1.4	0.3
1,3,5-Trimethylbenzene	Macon-Forestry	18	0.01	0.1	0.0
	Savannah-E. Pres. St.	19	0.03	0.1	0.1
	General Coffee	19	0.00	0.0	0.0
	South DeKalb*	36	0.04	0.3	0.3
	NR-285	18	0.06	0.4	0.2
1,2,4-Trimethylbenzene	Macon-Forestry	21	0.10	0.4	0.4
	Savannah-E. Pres. St.	22	0.17	0.5	0.5
	General Coffee	22	0.01	0.1	0.1
	South DeKalb*	42	0.30	1.2	1.2
	NR-285	23	0.43	1.6	1.2
Styrene	Macon-Forestry	23	0.90	3.9	2.5
	Savannah-E. Pres. St.	22	0.11	0.5	0.3
	General Coffee	25	0.05	0.2	0.2
	South DeKalb*	50	1.01	3.7	3.3
	NR-285	25	0.16	0.7	0.6
Benzene,1-ethenyl-4-methyl	Macon-Forestry	22	0.02	0.1	0.1
	Savannah-E. Pres. St.	22	0.03	0.1	0.1
	General Coffee	23	0.00	0.0	0.0
	South DeKalb*	44	0.05	0.2	0.2
	NR-285	23	0.10	0.3	0.3

2018 Volatile Organic Compounds (continued)					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Chlorobenzene	Macon-Forestry	29	0.10	0.7	0.2
	Savannah-E. Pres. St.	27	0.07	0.6	0.2
	General Coffee	30	0.10	0.2	0.2
	South DeKalb*	61	0.10	0.5	0.2
	NR-285	29	0.08	0.2	0.2
1,2-Dichlorobenzene	Macon-Forestry	21	0.04	0.1	0.1
	Savannah-E. Pres. St.	21	0.04	0.2	0.1
	General Coffee	23	0.04	0.1	0.1
	South DeKalb*	45	0.04	0.2	0.1
	NR-285	21	0.03	0.1	0.1
1,3-Dichlorobenzene	Macon-Forestry	22	0.05	0.1	0.1
	Savannah-E. Pres. St.	22	0.03	0.2	0.1
	General Coffee	24	0.03	0.1	0.1
	South DeKalb*	48	0.09	0.3	0.2
	NR-285	23	0.02	0.1	0.1
1,4-Dichlorobenzene	Macon-Forestry	19	0.08	0.1	0.1
	Savannah-E. Pres. St.	19	0.07	0.2	0.1
	General Coffee	21	0.06	0.1	0.1
	South DeKalb*	41	0.13	0.5	0.3
	NR-285	19	0.11	0.3	0.2
Benzyl chloride	Macon-Forestry	16	0.06	0.7	0.1
	Savannah-E. Pres. St.	16	0.02	0.1	0.1
	General Coffee	17	0.02	0.1	0.1
	South DeKalb*	35	0.04	0.2	0.1
	NR-285	18	0.01	0.1	0
1,2,4-Trichlorobenzene	Macon-Forestry	23	0.13	0.3	0.2
	Savannah-E. Pres. St.	23	0.11	0.3	0.2
	General Coffee	24	0.11	0.2	0.2
	South DeKalb*	46	0.10	0.2	0.2
	NR-285	24	0.11	0.2	0.2

*Sample collected every 6 days

2018 Carbonyl Compounds, 8-hour					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Formaldehyde	South DeKalb	62	2.26	7.0	6.7
Acetaldehyde	South DeKalb	62	2.2	9.5	8.7
Butyraldehyde	South DeKalb	62	0.7980	4.387	4.126

2018 Carbonyl Compounds, 24-hour					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Formaldehyde	Savannah-E. Pres. St.	21	0.17	0.8	0.4
	South DeKalb*	53	3.47	13.4	11.9
Acetaldehyde	Savannah-E. Pres. St.	21	0.14	0.6	0.5
	South DeKalb*	56	3.63	18.3	14.1
Propionaldehyde	Savannah-E. Pres. St.	21	0.03	0.2	0.1
	South DeKalb*	58	0.96	5.0	4.4
Butyraldehyde	Savannah-E. Pres. St.	21	0.0550	0.546	0.223
	South DeKalb*	56	0.9908	4.120	3.779
Acetone	Savannah-E. Pres. St.	21	0.45	2.2	0.9
	South DeKalb*	57	4.78	23.2	19.2
Benzaldehyde	Savannah-E. Pres. St.	21	0.03	0.2	0.2
	South DeKalb*	57	1.84	9.7	8.2
Acrolein (with canister method)	Savannah-E. Pres. St.	13	0.38	0.7	0.5
	NR-285	12	0.33	1.0	0.6
	Macon	12	0.84	1.2	1.1
	General Coffee	13	0.35	0.5	0.5
	South DeKalb*	25	0.45	0.7	0.6

* Sample collected every 6 days