AIR PROTECTION BRANCH

2017 Air Quality Report

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

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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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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.

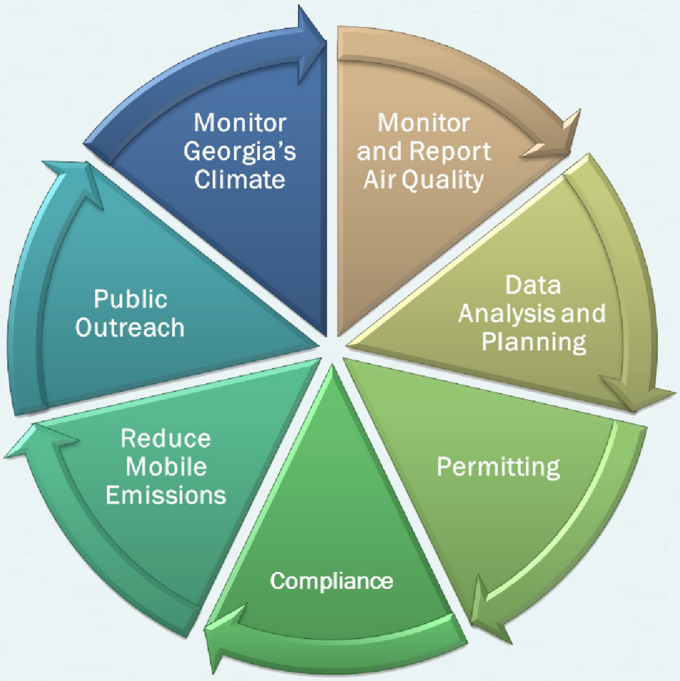
- The Air Protection Branch ensures clean air in Georgia in support of Georgia EPD's mission.

- 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: 2017

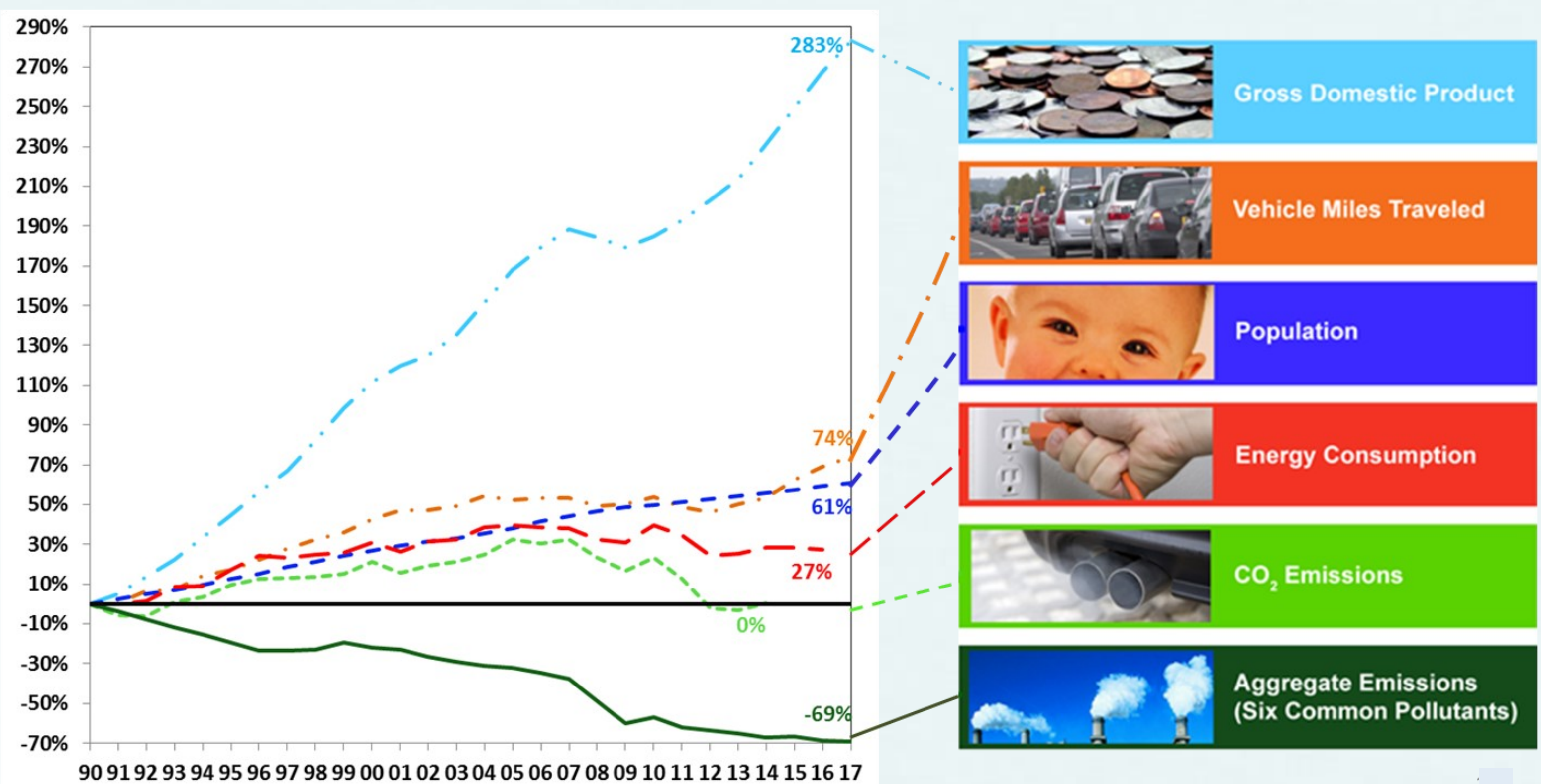
The Ambient Monitoring Program of the Georgia Environmental Protection Division's Air Protection Branch has been monitoring air quality in the State of Georgia for more than forty years. During that time, the list of monitored compounds has grown to more than 200 pollutants at 41 sites in 29 counties 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 2017 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 2017, total emissions of the six principal air pollutants dropped by 69 percent, while the gross domestic product increased by 283 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 over a specified amount of time and takes them to an approved laboratory for analysis.

How do we know the air quality data is accurate?

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

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

What is the Air Quality Index (AQI)?

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

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

What is the air quality like where I am?

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

Air Quality FAQs

What are National Ambient Air Quality Standards (NAAQS)?

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

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

What is 'attainment?'

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

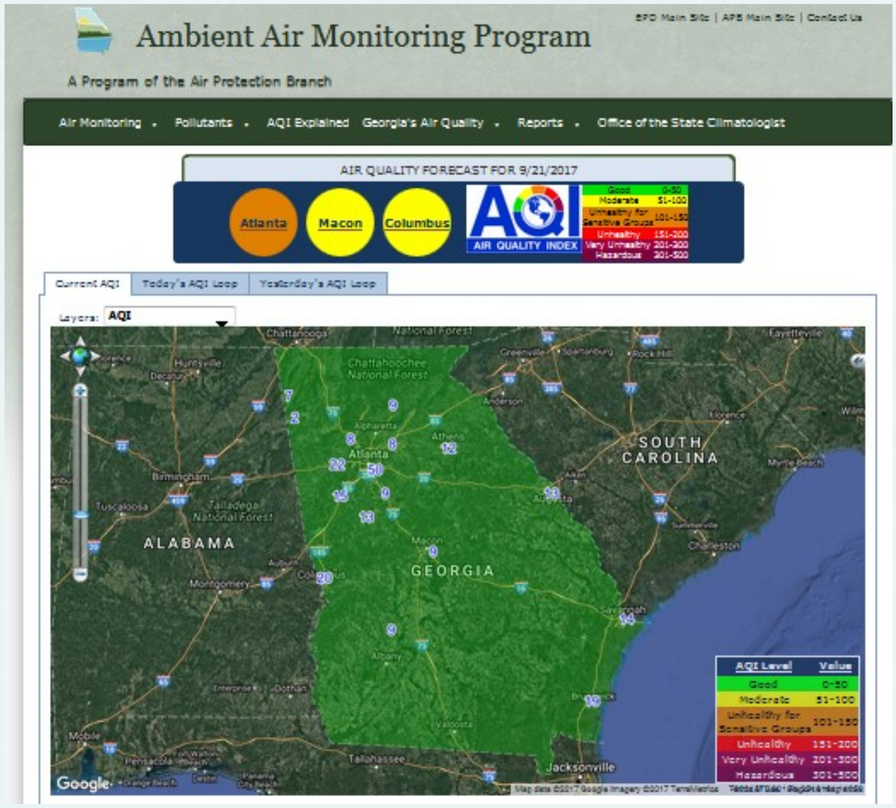
Where do we get emission inventory?

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

Examples of Air Monitors in Georgia

Communication and Partnerships

Georgia EPD's Ambient Air Monitoring Website



Air Quality Forecast

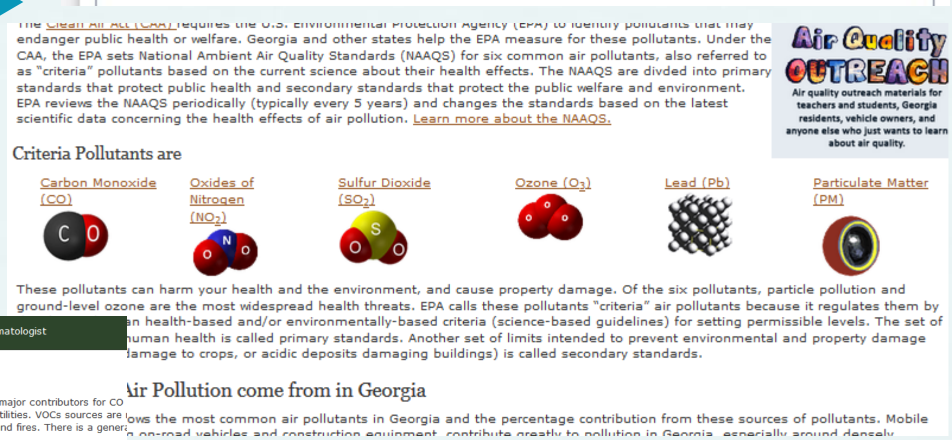
Site Information

Links to Annual Reports

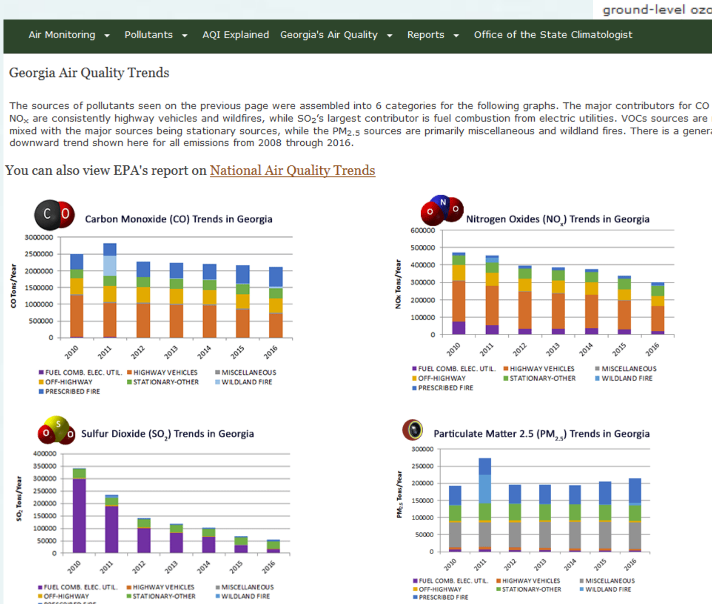
Trends in Georgia's Air

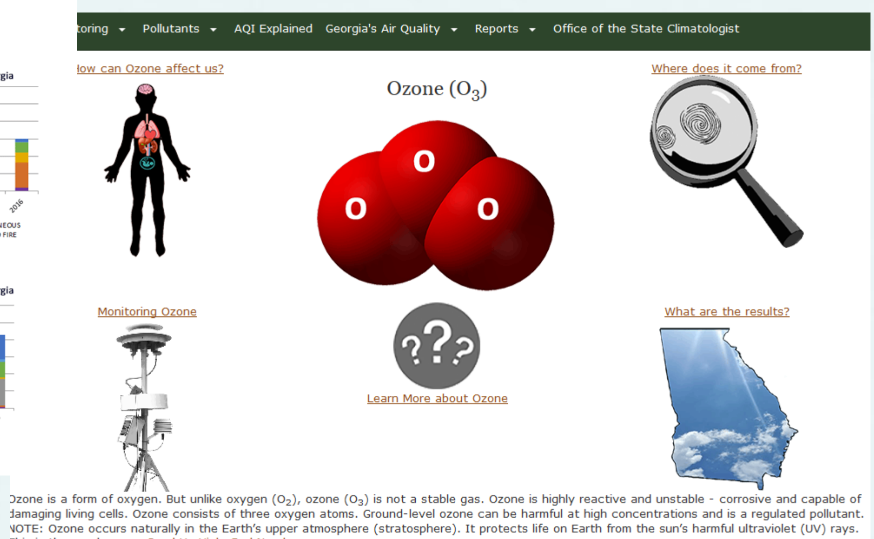
Pollutant Information

And So Much More…



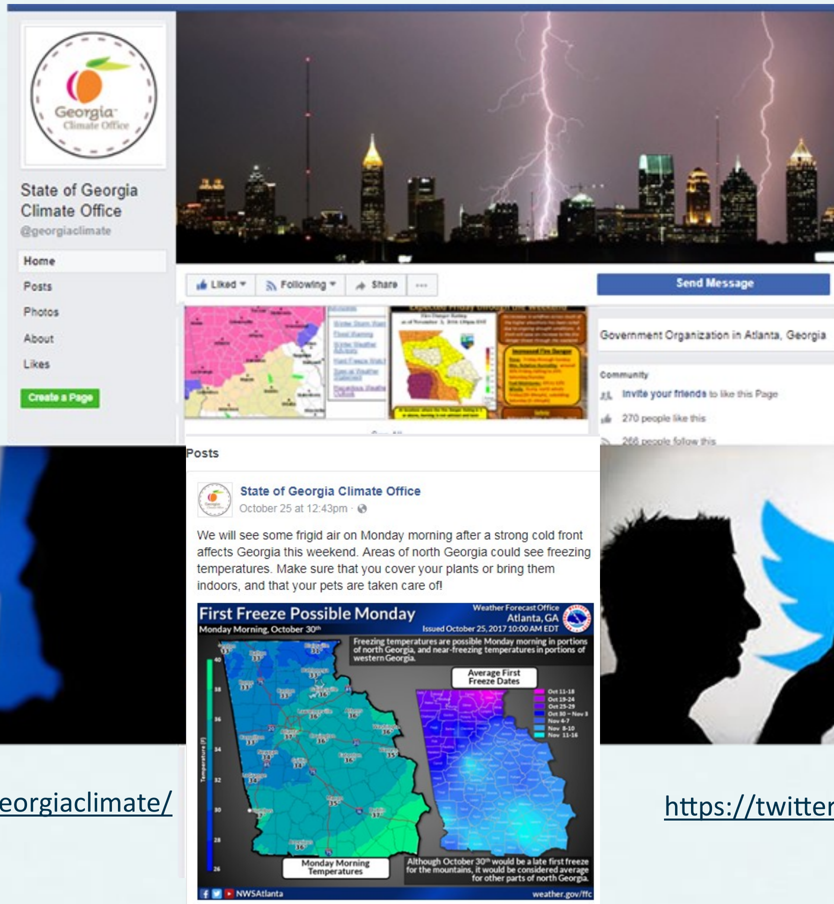
Visit us at https://airgeorgia.org/





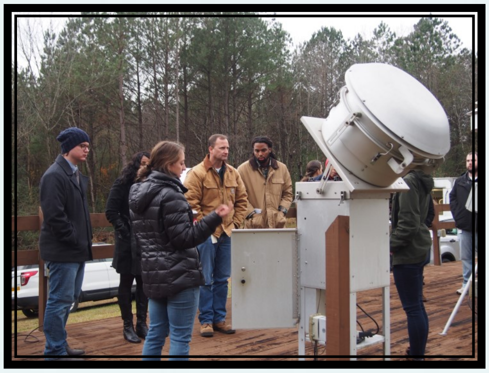
Social Media

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.

New Workshop

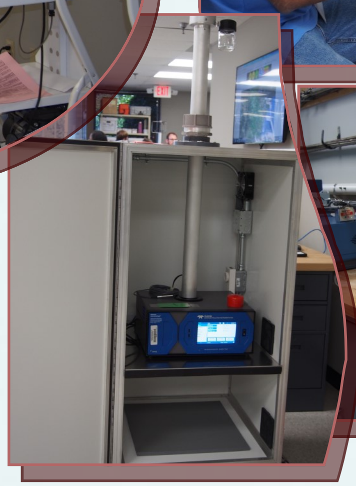
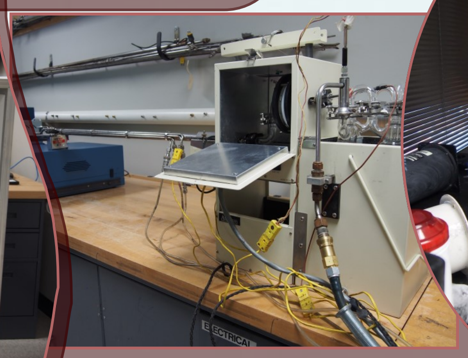
GA AMP has expanded its monitoring program over the years, and it was time for a bigger workshop and training area.



Monitoring Equipment

The workshop houses spare equipment and provides space to prepare for field collection and to learn new sampling techniques.




Workshop Tour

Open House and tour of the new workshop. Director's Office and many personnel in the Air Branch came to check it out.

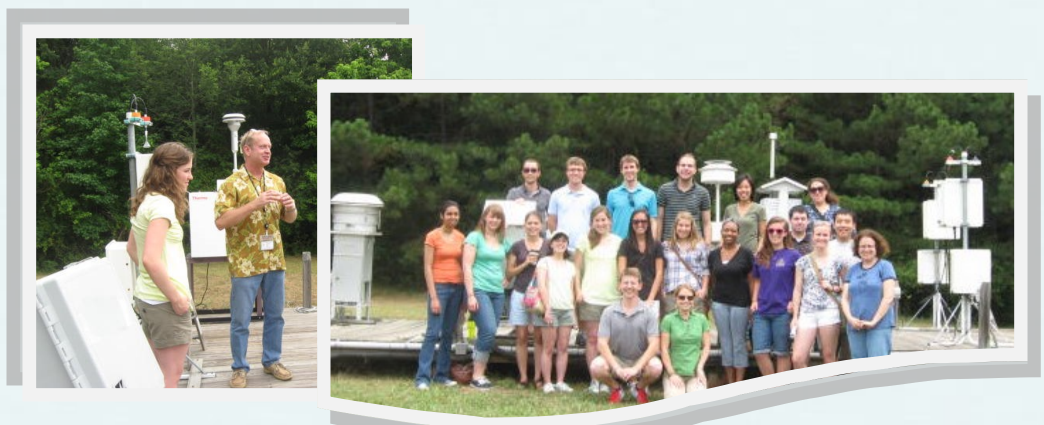



Reaching out into the Community

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.



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

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

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

Voluntary Emissions Reductions Programs– GA EPD Partners

Encouraging fewer vehicles on the road...

GEORGIACOMMUTEOPTIONS

Get More by Driving Less

http://gacommuteoptions.com/

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

GaDeR

Georgia Diesel Emissions Reduction Program

Taking a bite out of Georgia's diesel emissions SM

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

Helping schools afford cleaner school buses...

- Older diesel school buses are replaced early, 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...

NORFOLK SOUTHERN

26 LOCOMOTIVES CONVERTED INTO 13 MOTHER-SLUGS SETS

29 CONVERSIONS

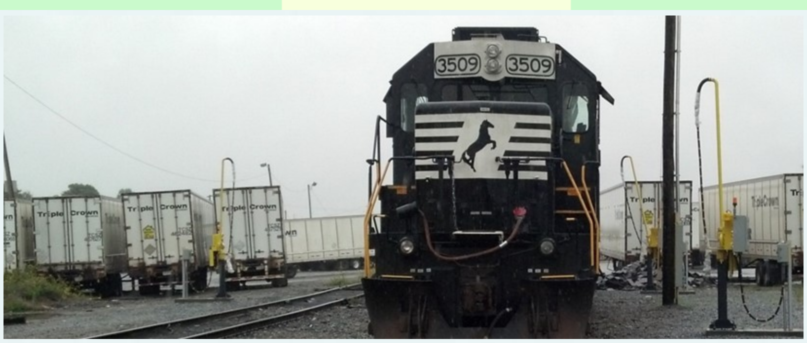
CSX TRANSPORTATION

6 CONVERSIONS

GADER
Georgia Diesel Emissions Reduction Program

ARGOS

1 LOCOMOTIVE CONVERTED INTO A TIER-4 GENSET



- Locomotives can be retrofitted with cleaner engines and technology that helps improve air quality.
- Smaller, more efficient modular diesel engines reduce emissions.
- 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 conversion 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.
- 26 locomotives have been converted to 13 Mother-Slug sets in Georgia as of July 2017.
- Electric plugin stations allow the diesel engine to be shut down when temperatures drop below freezing by maintaining the water temperature above freezing.

Air Quality in Georgia

Pollutants of Concern and Their Sources in Georgia

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

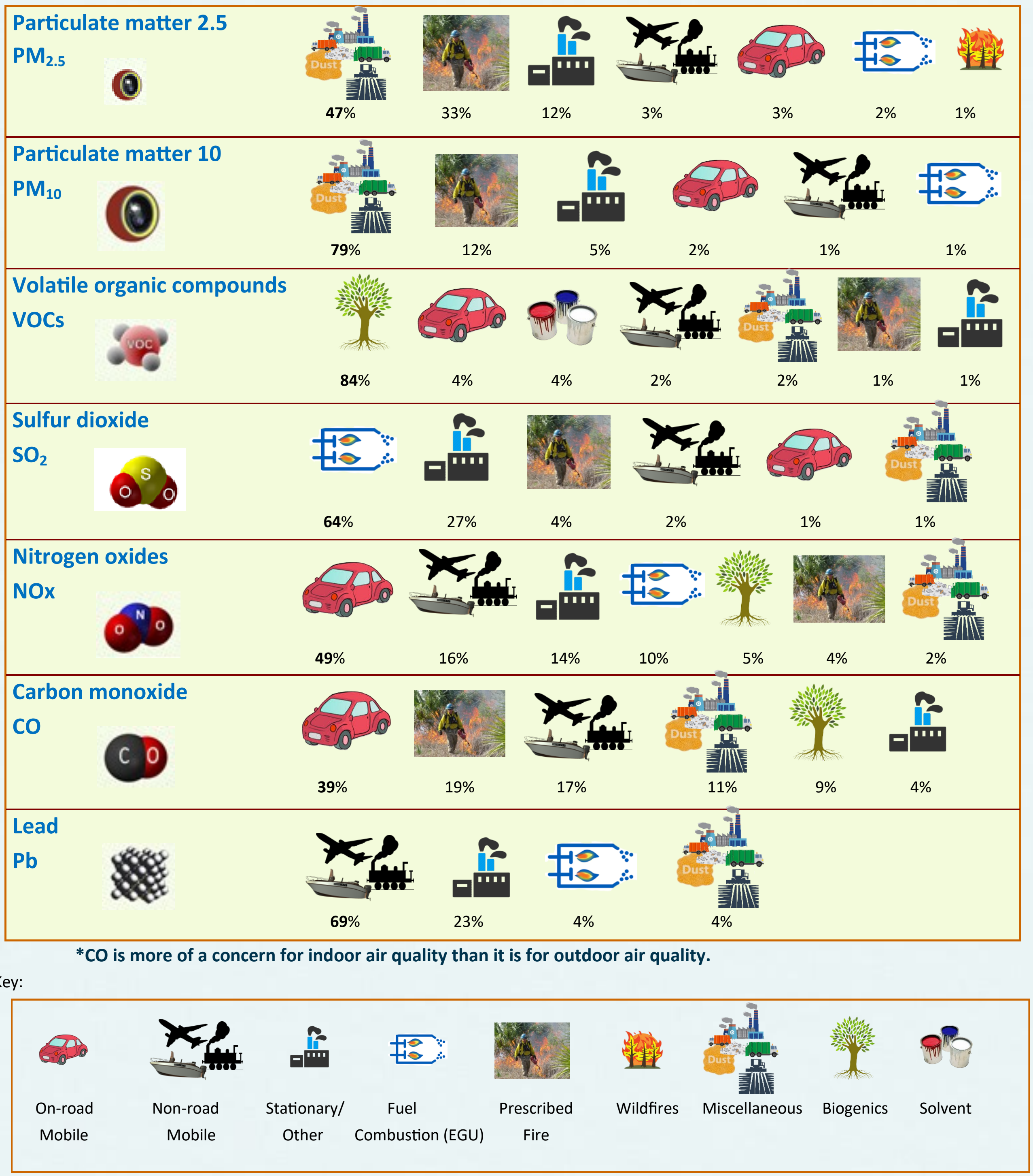


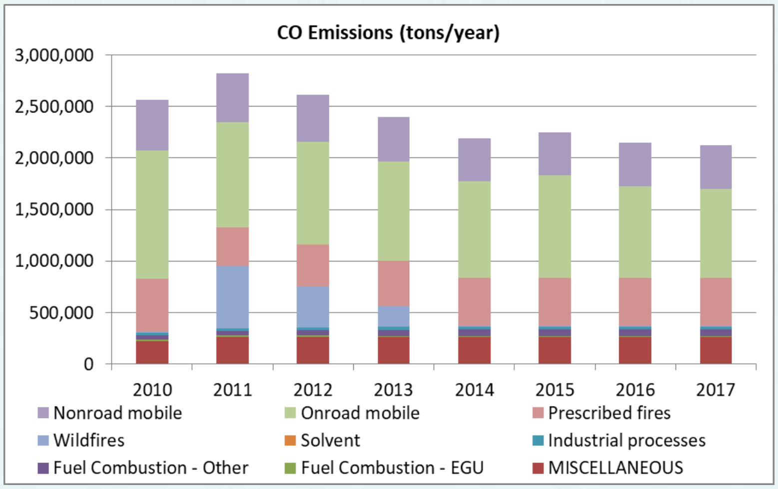
Figure 1: Pollutants of Concern and Their Sources in Georgia

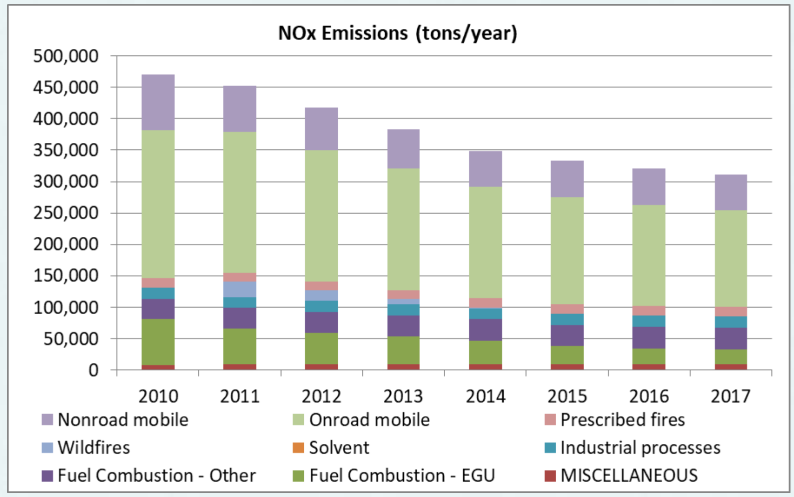
Source: 2014v2 National Emissions Inventory

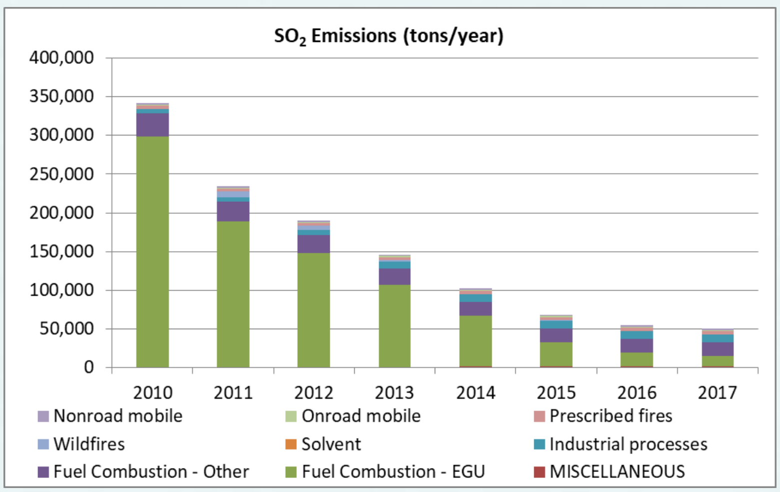
Emissions Trends in Georgia

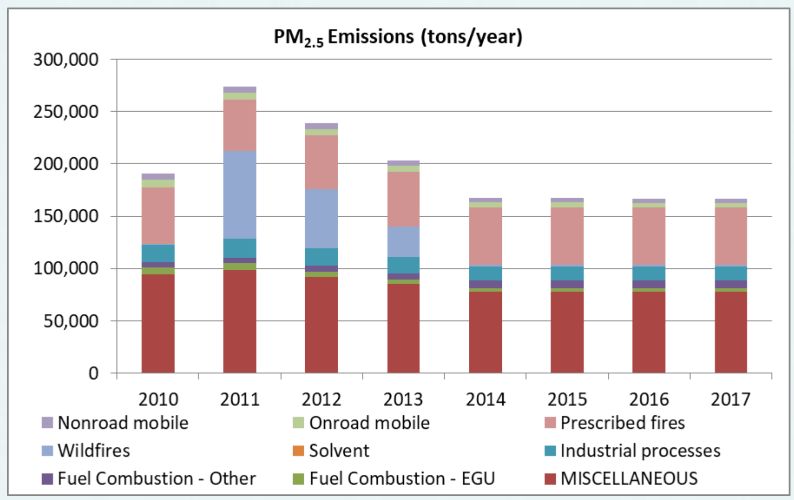
The sources of pollutants seen on the previous page were assembled into seven categories for the following graphs. The major contributors for CO and NO_x are highway vehicles, while the largest contributors of SO_2 are electric utilities. Wildland and prescribed fires can have a large impact on $PM_{2.5}$ emissions, and VOCs come from a variety of stationary sources. There is a downward trend shown here for all emissions from 2010 through 2017. In 2011, there was a wildfire in the Okefenokee Swamp area that showed an uptick in the data for that year.

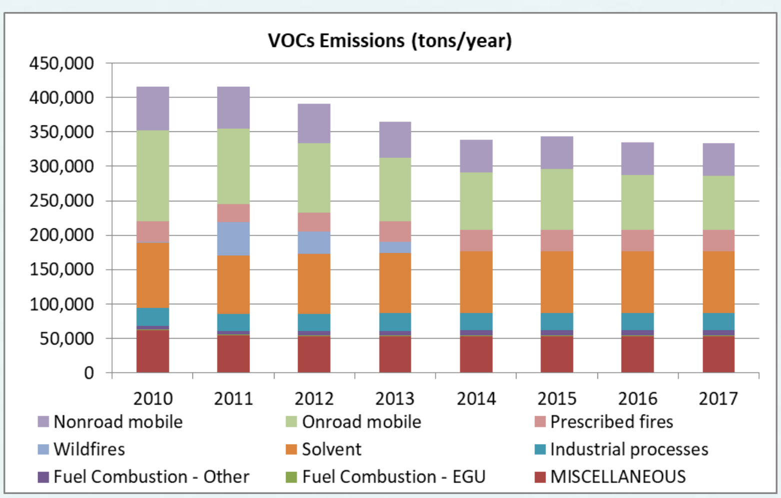
Georgia's air quality is improving...











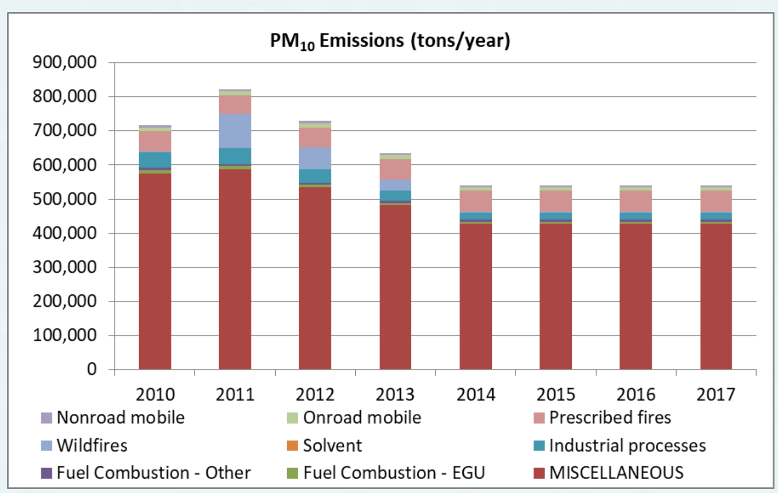


Figure 2: Emissions Trends in Georgia

Georgia's Ambient Air Monitoring Sites

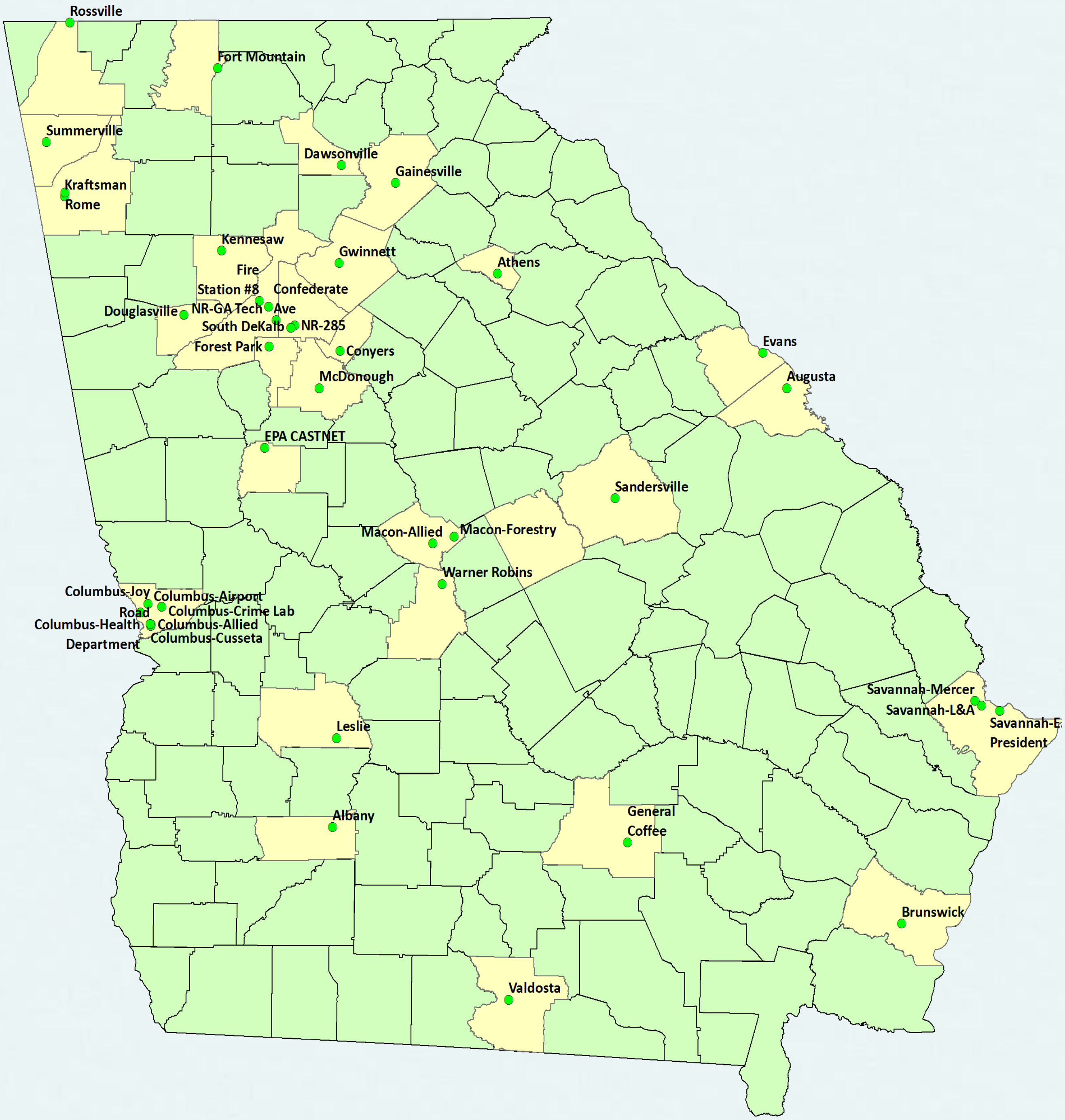


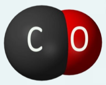
Figure 3. Georgia's ambient air monitoring sites

For more detailed site information, see page 71.

Criteria Pollutants (six most common regulated pollutants)

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

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

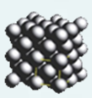


Carbon Monoxide (CO)

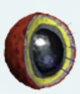
Oxides of Nitrogen (NO_2)

Sulfur Dioxide (SO_2)

Ozone (O_3)



Lead (Pb)



Particulate Matter (PM)

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

Carbon Monoxide (CO)

What is it?

- Carbon Monoxide is an odorless, colorless, and poisonous gas that is a by-product of incomplete burning.

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

Where does it come from?

- Carbon and oxygen can combine to form two different gases. When combustion of carbon is complete, in the presence of plenty of air, the product is mainly carbon dioxide (CO_2). Sources of carbon include; coal, coke, charcoal. When combustion of carbon is incomplete, *i.e.* there is a limited supply of air, only half as much oxygen adds to the carbon, and instead you form carbon monoxide (CO).
- In Georgia, 56% of the carbon monoxide comes from mobile sources including cars, construction equipment, aircraft, locomotives, and on the coast commercial marine vessels.

Health Impacts

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

Georgia Monitoring Information for CO

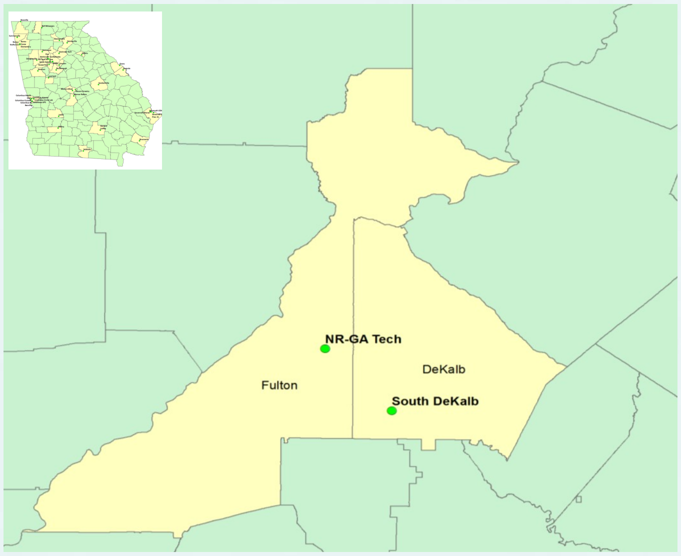


Figure 4. Georgia carbon monoxide monitoring sites

Measurement Technique

Measured continuously with infrared light[1]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

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

National Ambient Air Quality Standards for Carbon Monoxide

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

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

Secondary NAAQS: None

Attainment Designation

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

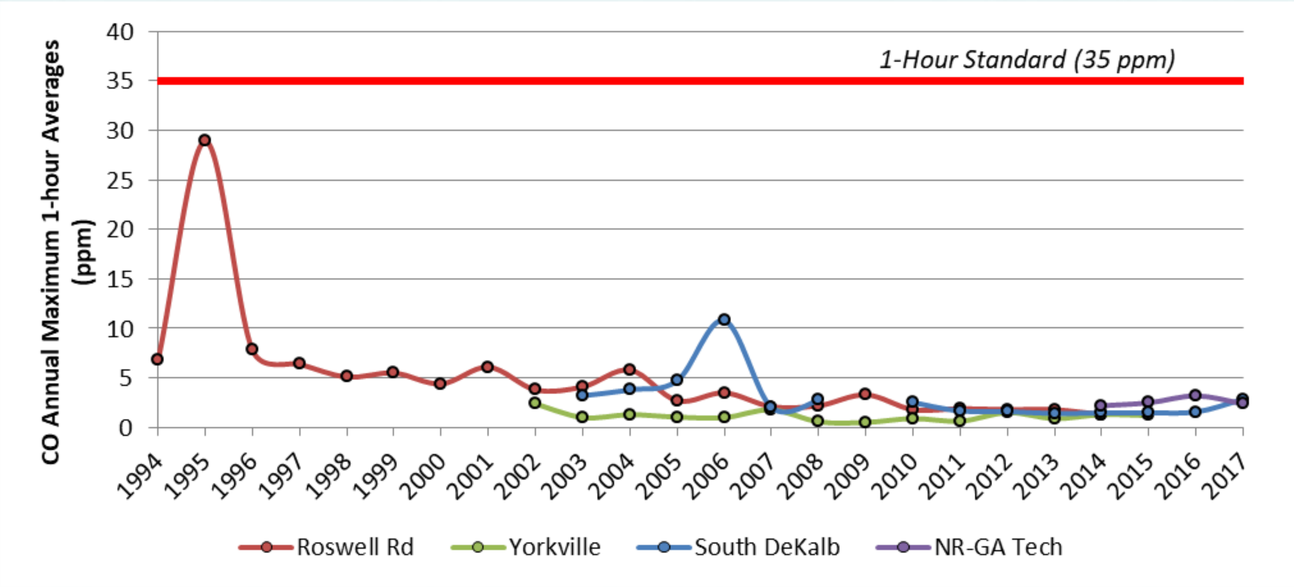


Figure 5. Carbon monoxide annual maximum 1-hour average compared to the 1-hour standard

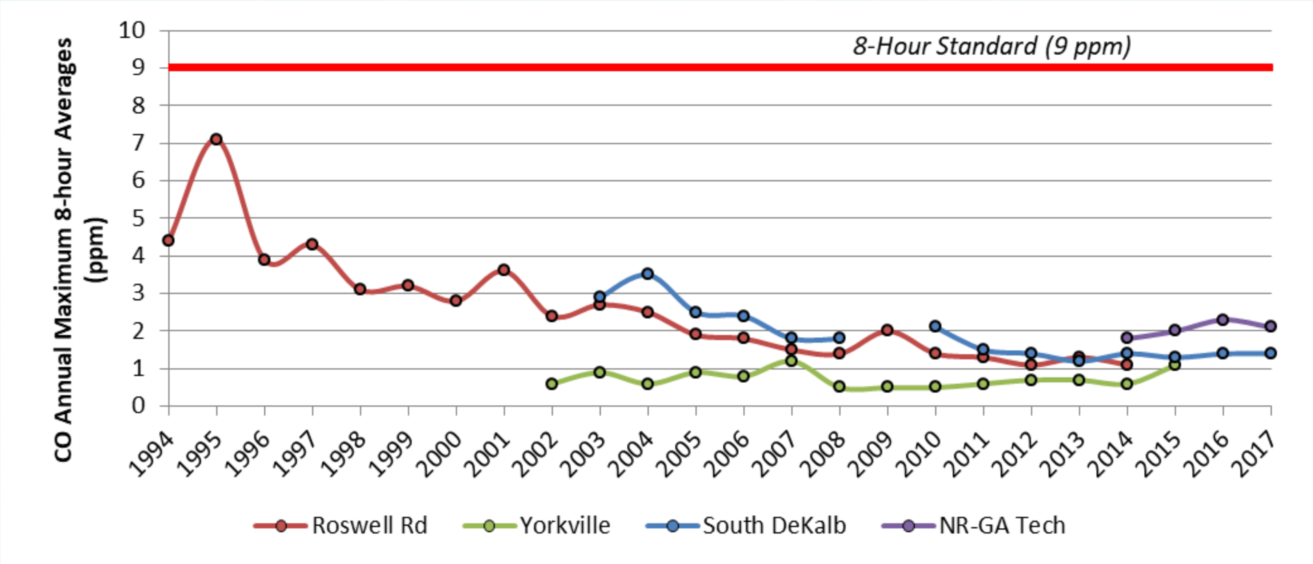
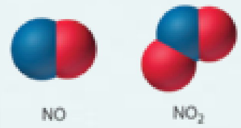


Figure 6. Carbon monoxide annual 8-hour average compared to the 8-hour standard

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

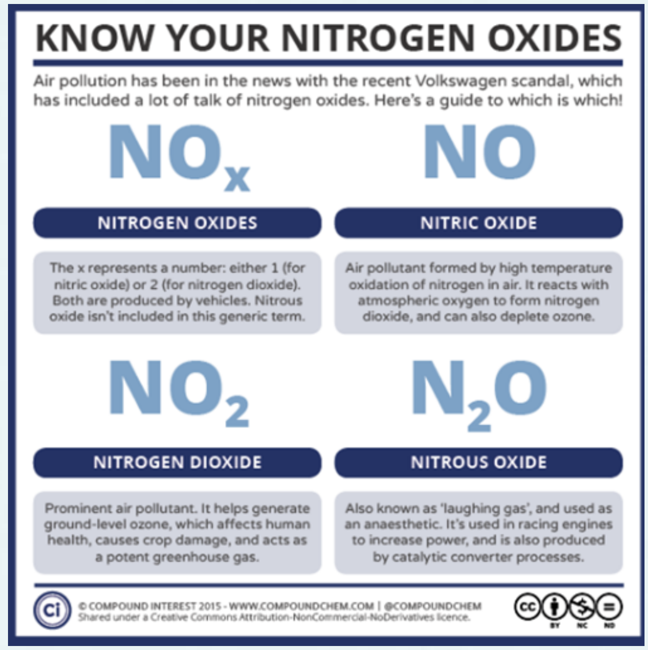


What is it?

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

Where does it come from?

- Nitrogen oxides (NO_x) are usually products of combustion from mobile sources such as vehicle engines and construction equipment engines. They also come from large industrial boilers, turbines, and kilns, as well as fires. In Georgia, 49% 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.



KNOW YOUR NITROGEN OXIDES

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

NO_x — NITROGEN OXIDES

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

NO — NITRIC OXIDE

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

NO_2 — NITROGEN DIOXIDE

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

N_2O — NITROUS OXIDE

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

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

Health Impacts

- Increases risk of respiratory infections, respiratory diseases and asthma

Georgia Monitoring Information for Oxides of Nitrogen

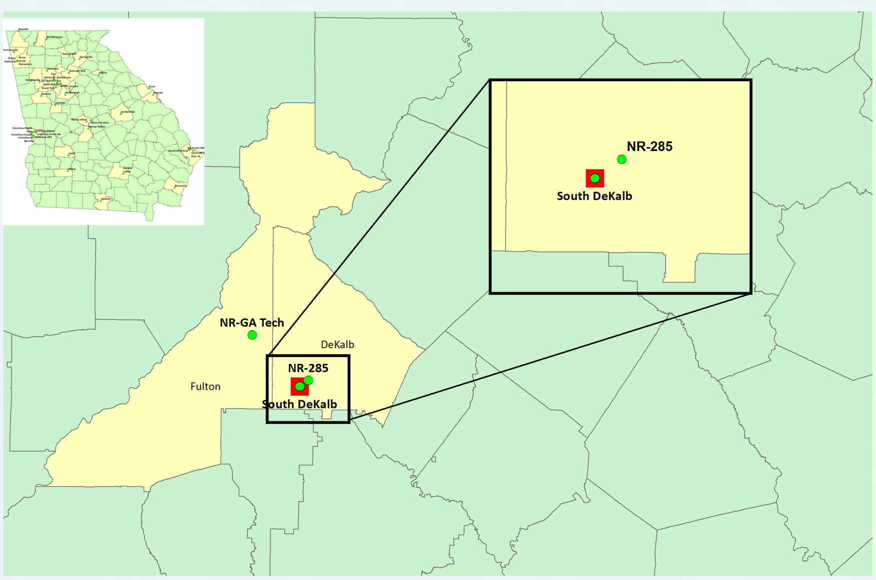


Figure 7. Georgia's $NO/NO_2/NO_x$ monitoring sites (green circles) and NO_Y site (red square)

Measurement Techniques

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

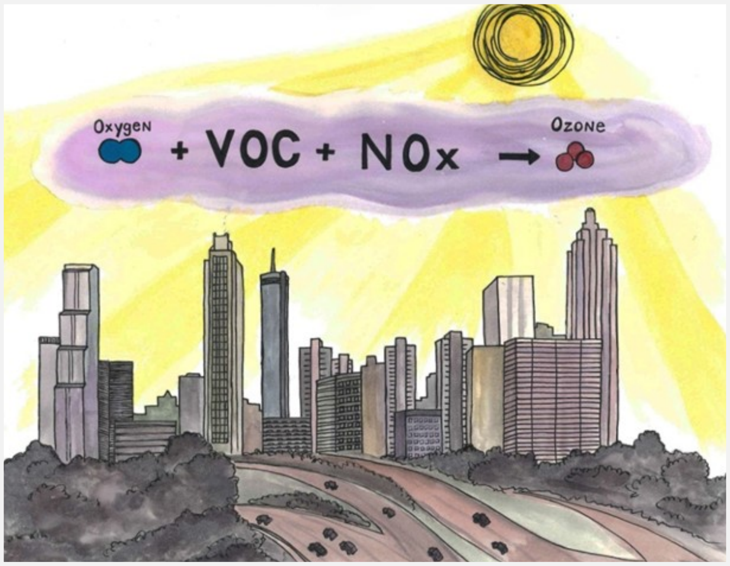
MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

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.

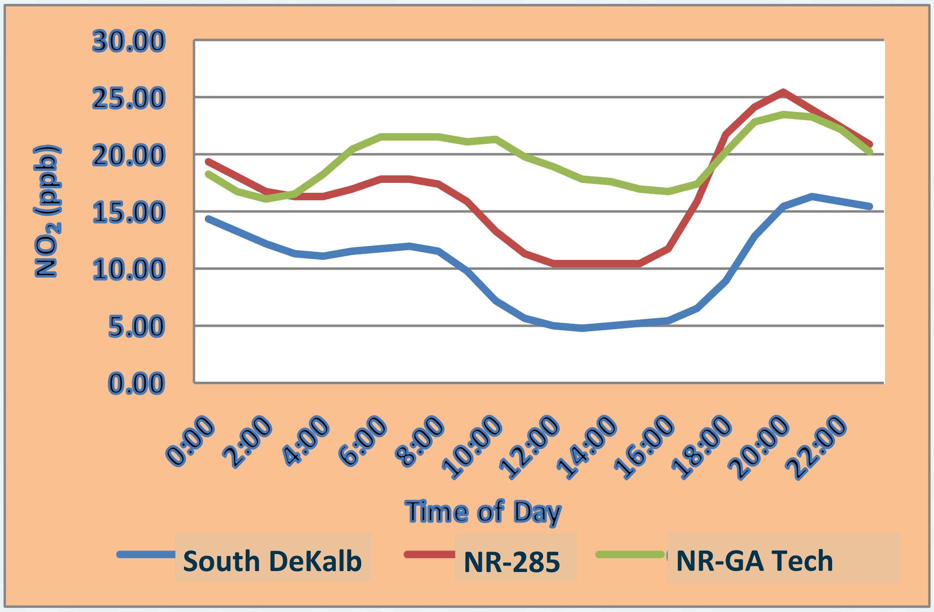


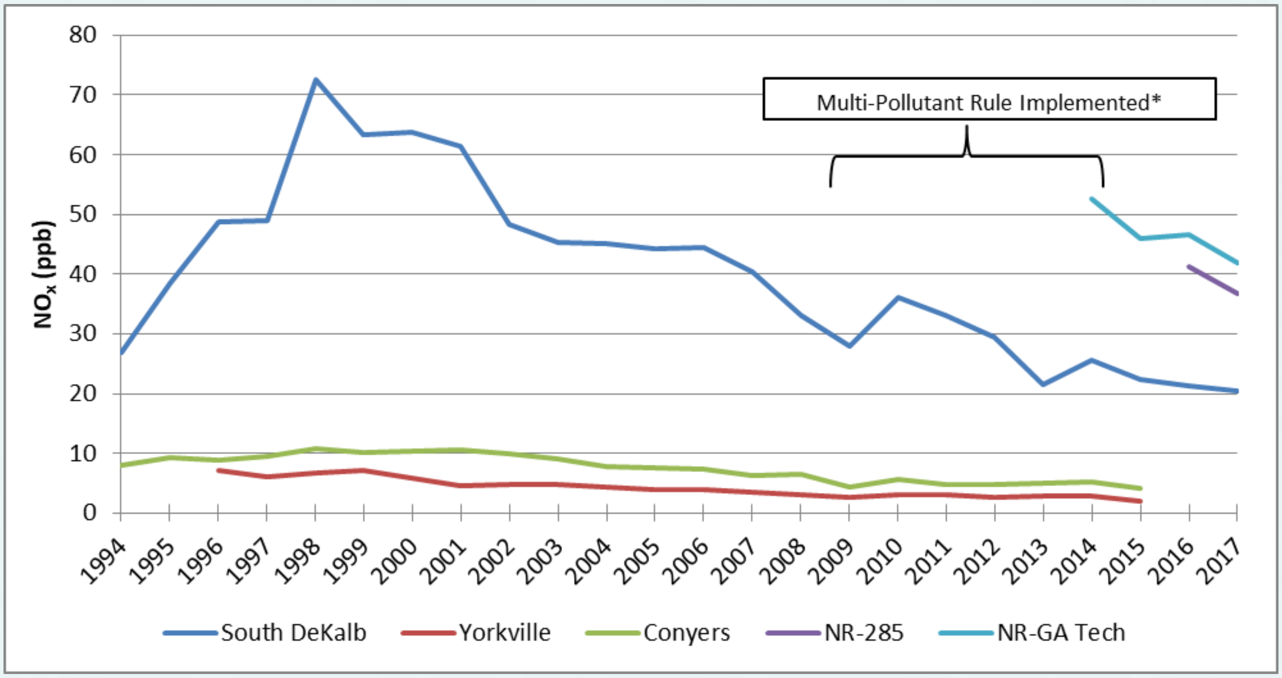
Figure 8. Diurnal Pattern of NO_2

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 2017. Annual average concentrations are well below the standard of 53 ppb.
- EPD operates two near-road monitoring sites (Georgia 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.

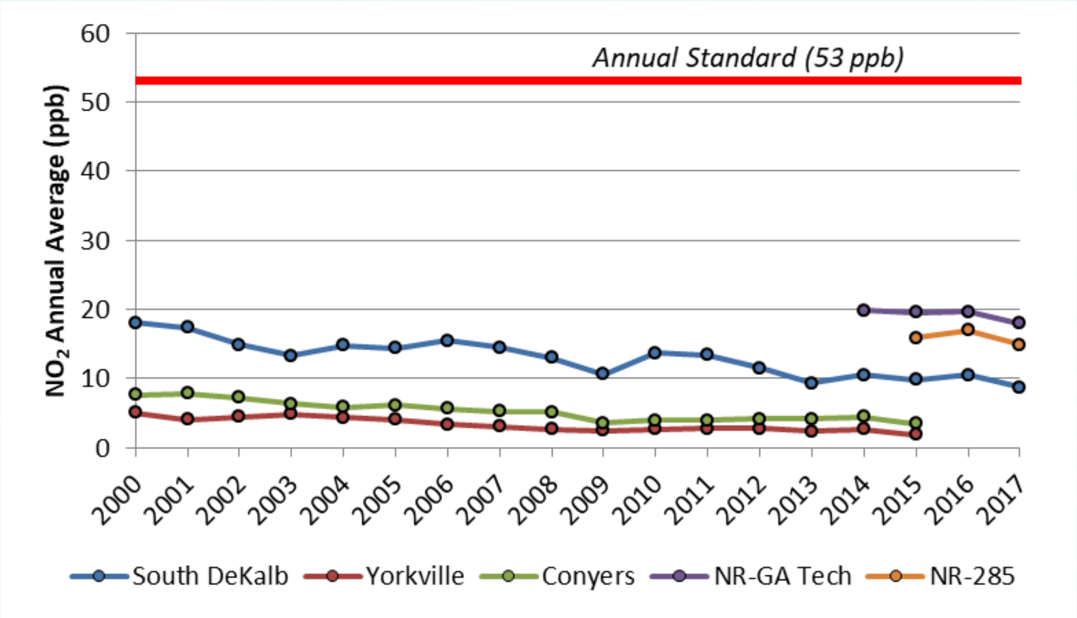


Figure 10. Nitrogen dioxide annual averages compared to the annual standard

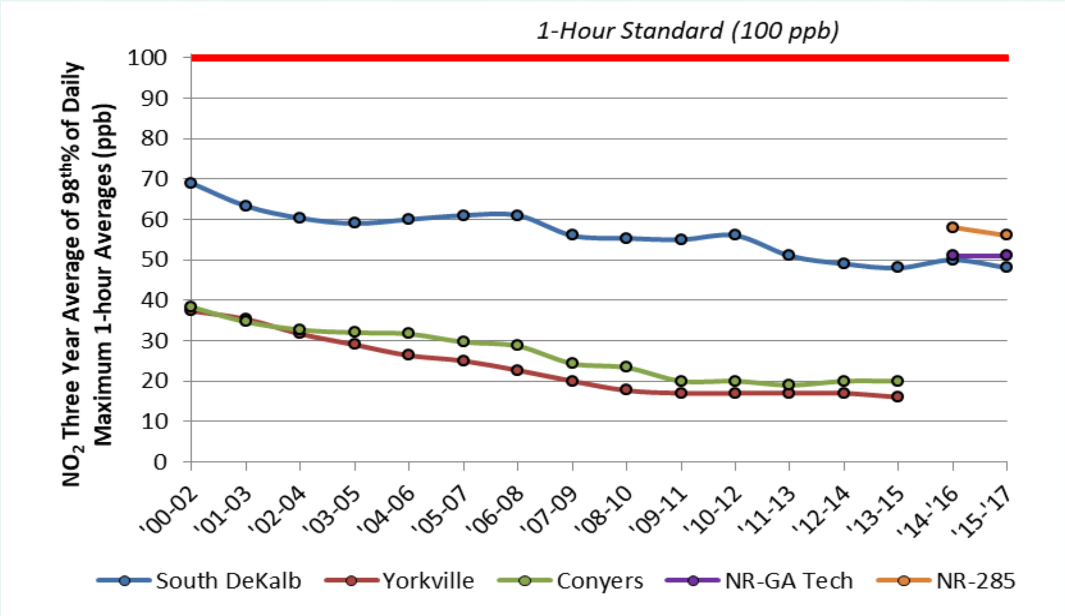
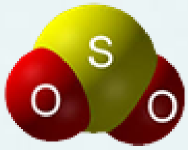


Figure 11. Nitrogen dioxide 1-hour design values compared to the 1-hour standard

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?

- 64% of SO_2 emissions in Georgia come from electric generation and large industrial boilers.
- SO_2 can be oxidized in the atmosphere into sulfuric acid, and form acid rain.
- Sulfur is oxidized to form SO_2 during combustion. SO_2 then can react with other pollutants to form aerosols, which are solid or liquid particles in a gas. SO_2 can also form sulfate particles, that contribute to the formation of fine particulate matter ($PM_{2.5}$).
- In liquid form, SO_2 may be found in clouds, fog, rain, aerosol particles, and in surface liquid films on these particles.

Environmental Impacts

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

Health Impacts

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

Georgia Monitoring Information for Sulfur Dioxide (SO_2)

Figure 12. Georgia's sulfur dioxide monitoring sites

Measurement Technique

Continuous ultraviolet fluorescence[4]

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

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

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

Reducing SO_2 in Georgia

Georgia's Multi-Pollutant Rule

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

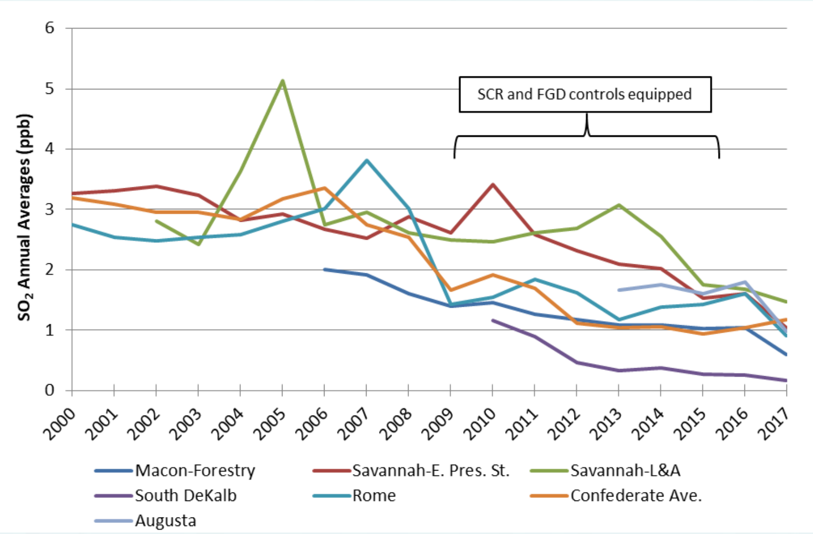


Figure 13. Implementation of SO_2 Controls

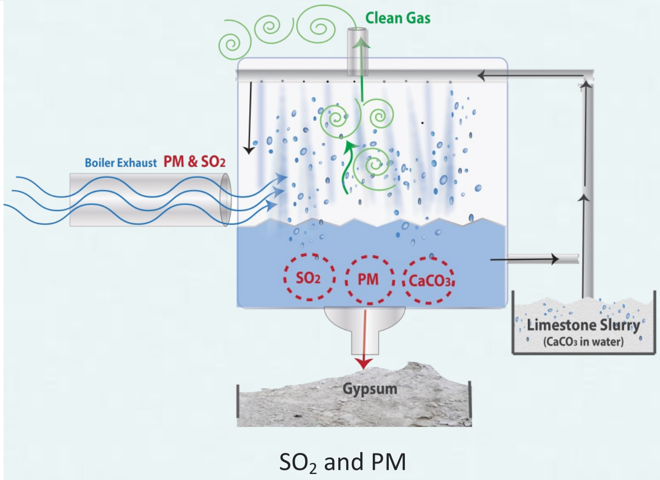


Figure 14. Schematic design of the absorber of an FGD

Statewide SO_2 Concentration Comparison from 2005 to 2014

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

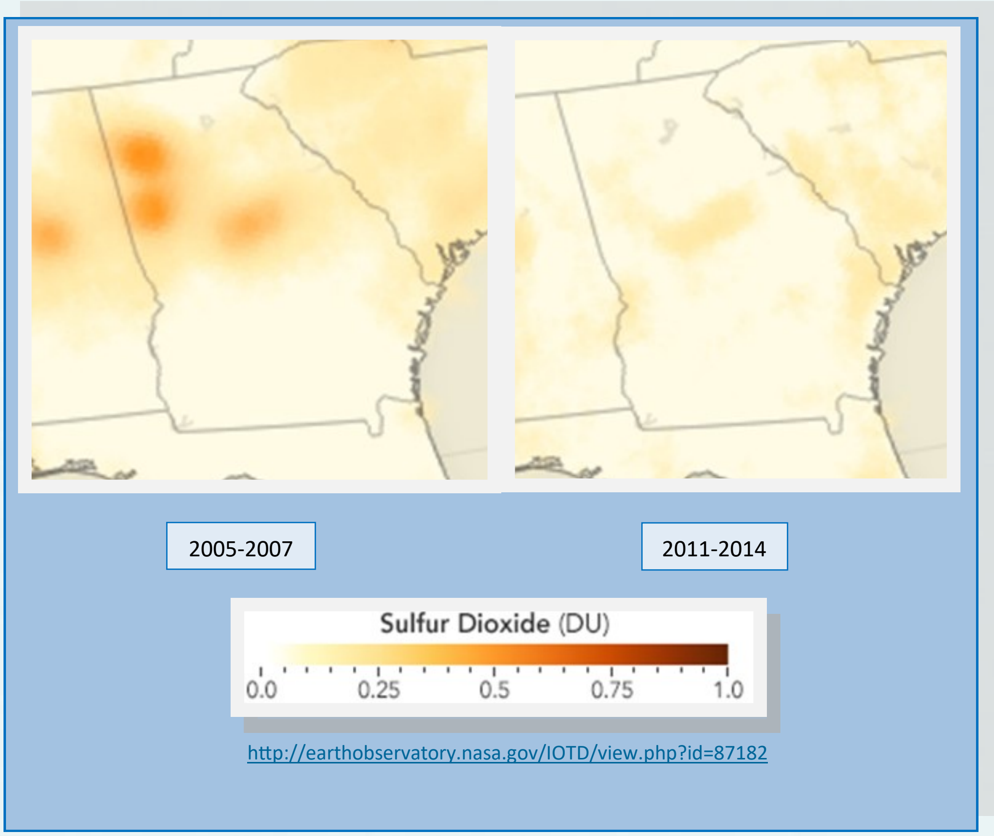


Figure 15.

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

National Ambient Air Quality Standards for Sulfur Dioxide

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

Attainment Designation

- EPA strengthened the SO_2 primary National Ambient Air Quality Standard (NAAQS) in 2010 and has developed a 4-phase process for designations. Please refer to EPA's information on the SO_2 data requirement rules for more details[6].
- All the SO_2 design[7] values, for 2015-2017 in Georgia, were below the 1-hour standard, with the highest design value occurring at the Augusta site (52 ppb).

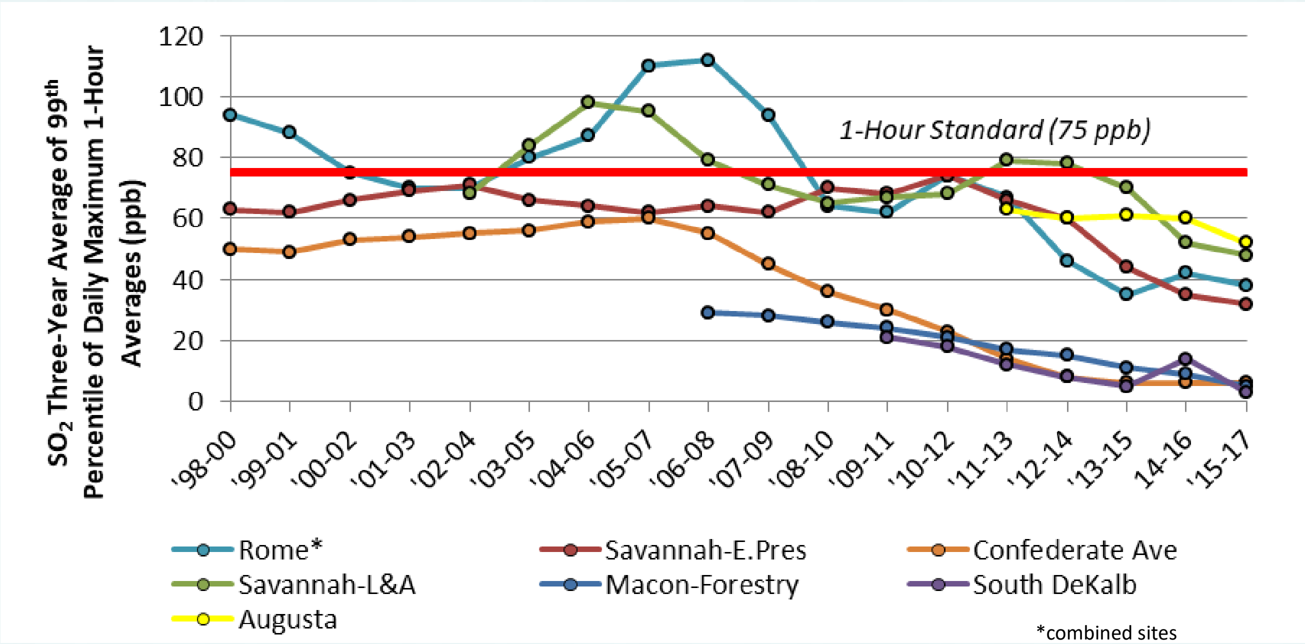
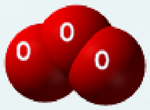


Figure 16. SO_2 three-year averages of the 99th percentile of annual daily max 1-hour averages

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

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

Ozone (O_3)

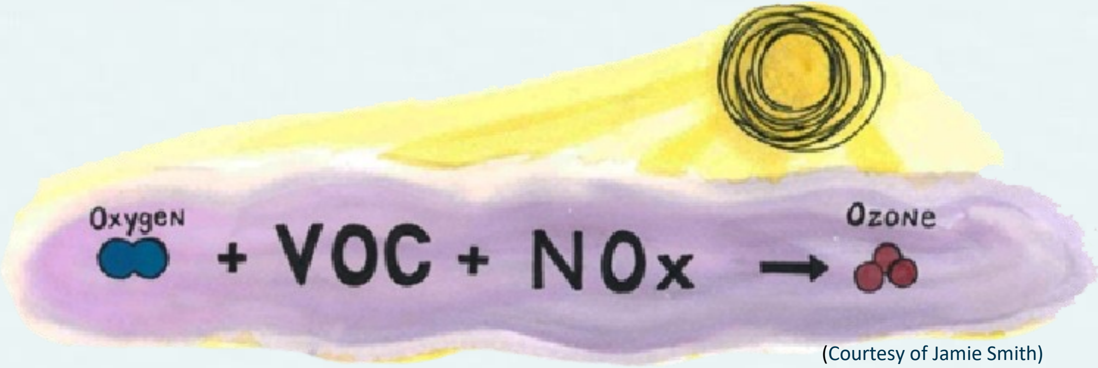


What is it?

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

Where does it come from?

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



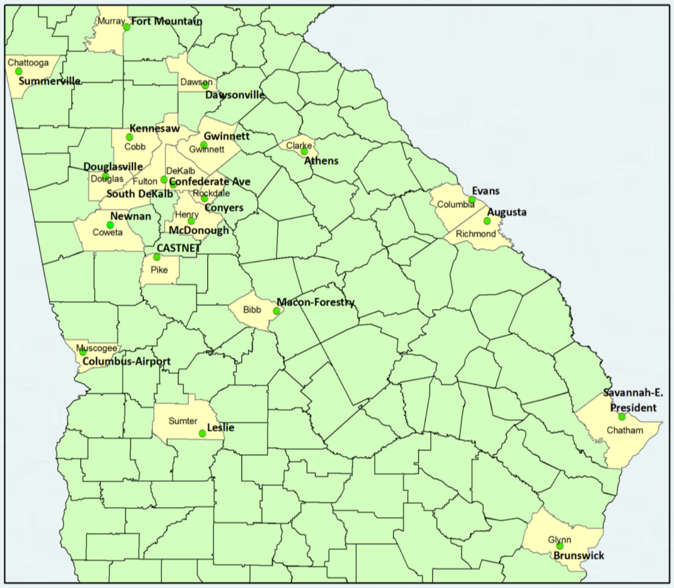
(Courtesy of Jamie Smith)

Figure 17. Ozone formation process

Health Impacts

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

Georgia Monitoring Information for Ozone



Measurement Technique

Continuous ultraviolet photometric method[8]

More information about measurement technique

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

Figure 18. Georgia's ozone monitoring sites

EPA's CASTNET Site

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

More Information about Ground Level Ozone

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

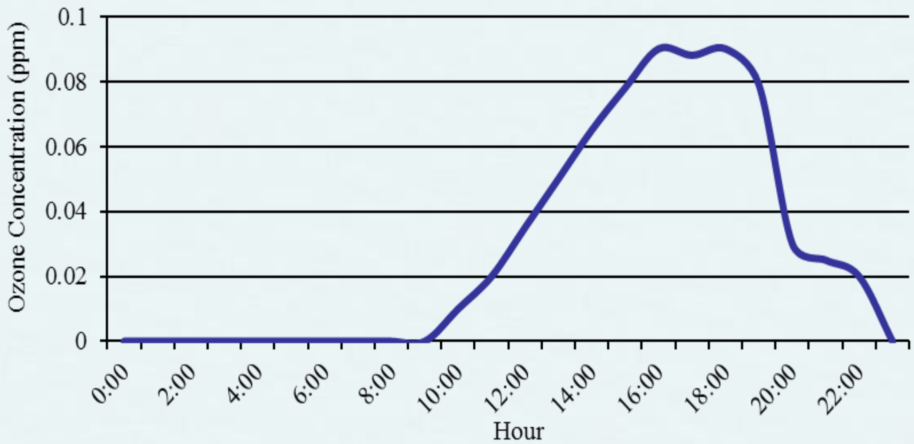


Figure 19. Typical urban 1-hour ozone diurnal pattern

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

- Examples of the most common reactive VOCs that contribute to ozone formation are: hydrocarbons found in automobile exhaust (benzene, propane, toluene); vapors from cleaning solvents (toluene); and biogenic emissions from plants and trees (isoprene). In Georgia, biogenic emissions account for 84% VOCs.
- With the exception of the South DeKalb and CASTNET sites, ozone in Georgia, unlike other pollutants previously discussed, is monitored March through October, complying with federal monitoring regulations (in 40CFR Part 58).
- Ozone is prevalent in urban areas in the summer but can appear in other areas due to weather patterns that can move air or many hundreds of miles.

National Ambient Air Quality Standards for Ozone

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

Secondary NAAQS: Same as the Primary Standards

Attainment Designation

- Ozone monitoring has been in place in the Atlanta area since the 1970's.
- Currently the Atlanta-Sandy Springs-Roswell MSA ozone network includes ten monitors located in ten counties.
- On March 27, 2008 the ozone primary standard level was lowered to 0.075 ppm for the 8-hour averaging time, fourth maximum value, averaged over three years (Federal Register, Vol. 73, No. 60, page 16436).
- With the implementation of this ozone standard, the boundary of the Atlanta nonattainment area was defined as a 15-county area.
- With the 2013-2015 ozone data, the entire state of Georgia (including Atlanta) met the 2008 ozone standard of 0.075 ppm for ozone.

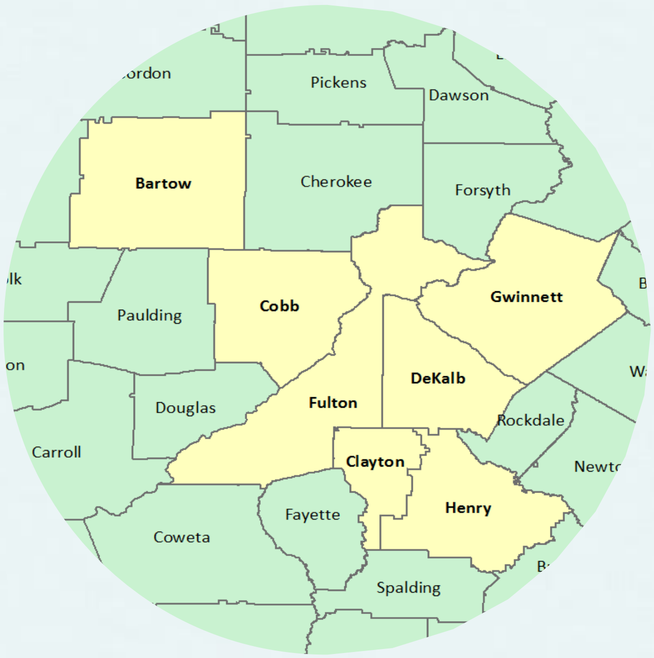


Figure 20. Georgia's 8-hour ozone nonattainment area (NAA) map for the 2015 standard

- 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).

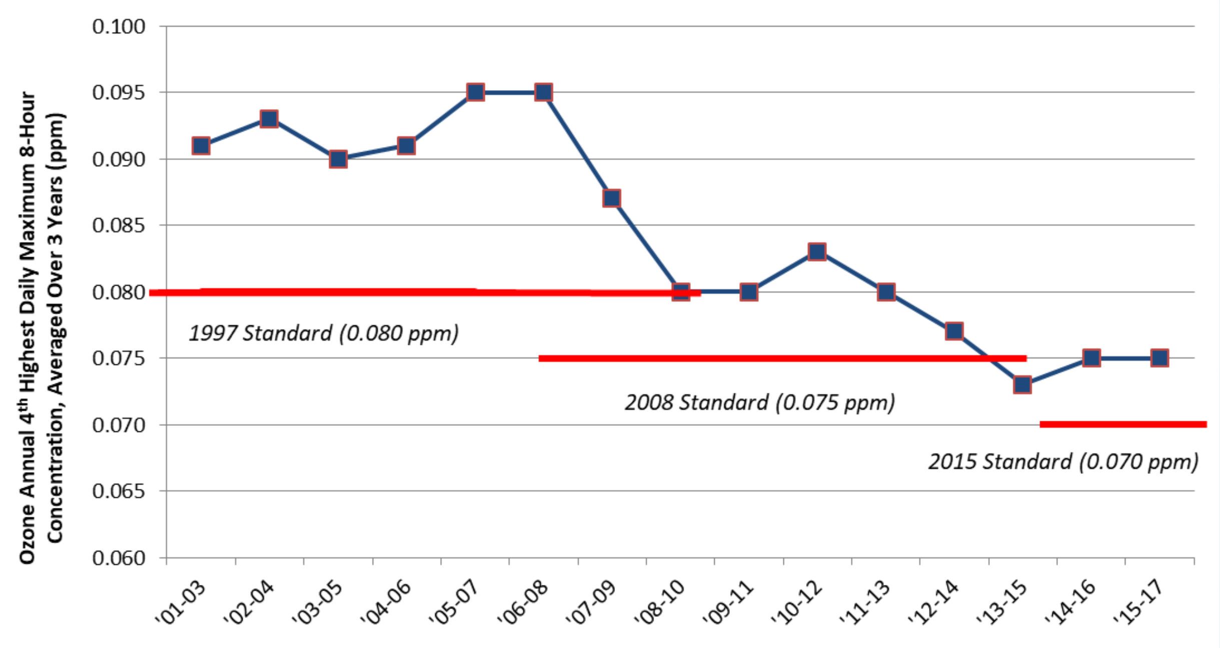


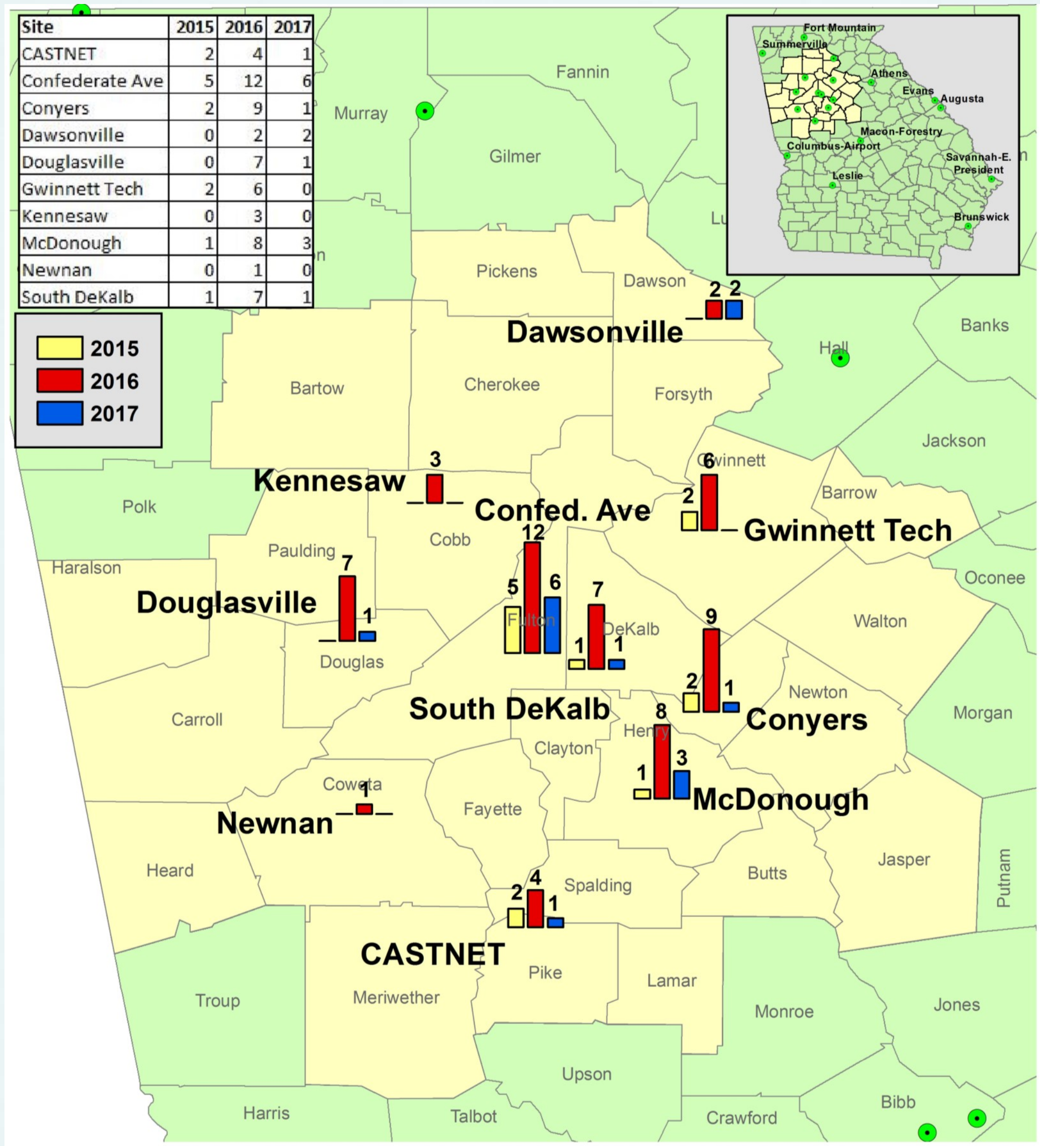
Figure 21. Ozone design values for Atlanta-Sandy Springs-Roswell MSA

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

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

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



Site	2015	2016	2017
CASTNET	2	4	1
Confederate Ave	5	12	6
Conyers	2	9	1
Dawsonville	0	2	2
Douglasville	0	7	1
Gwinnett Tech	2	6	0
Kennesaw	0	3	0
McDonough	1	8	3
Newnan	0	1	0
South DeKalb	1	7	1

Figure 22.

National 8-hour ozone concentrations

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

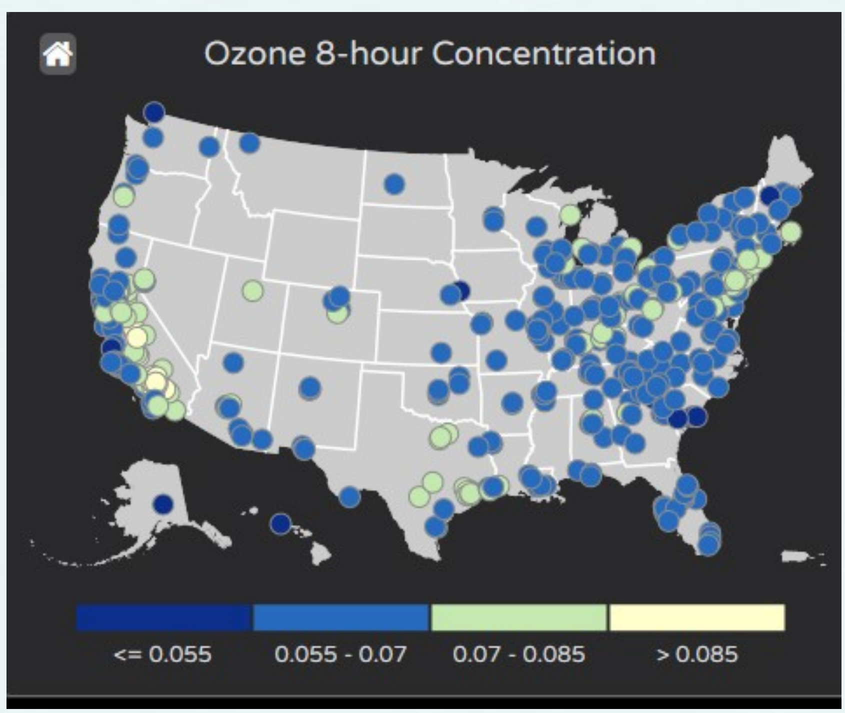


Figure 23.

Lead (Pb)

What is it?

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

Where does it come from?

- In the past, the Clean Air Act required extensive lead monitoring to detect the high levels of airborne lead that resulted from the use of leaded gasoline. With the phase-out of leaded gasoline, lead concentrations decreased drastically by the late 1980s. Figure 24 shows the drop in annual averages from 1990 through 2017.
- A major source of lead is acid battery plants. Lead can also come from the dust of vehicle traffic, construction activities, and agricultural activities and deposit on leaves and plants.

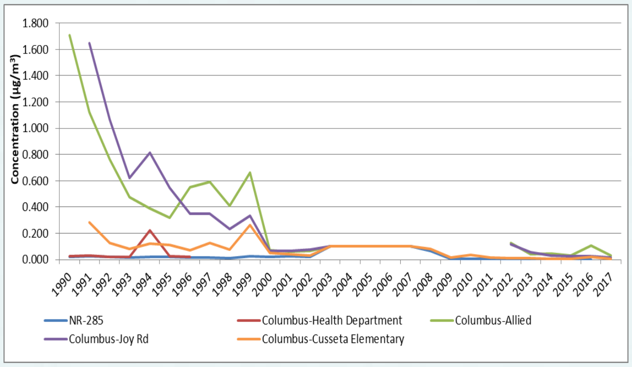


Figure 24.

Health Impacts

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

Georgia Monitoring Information for Lead

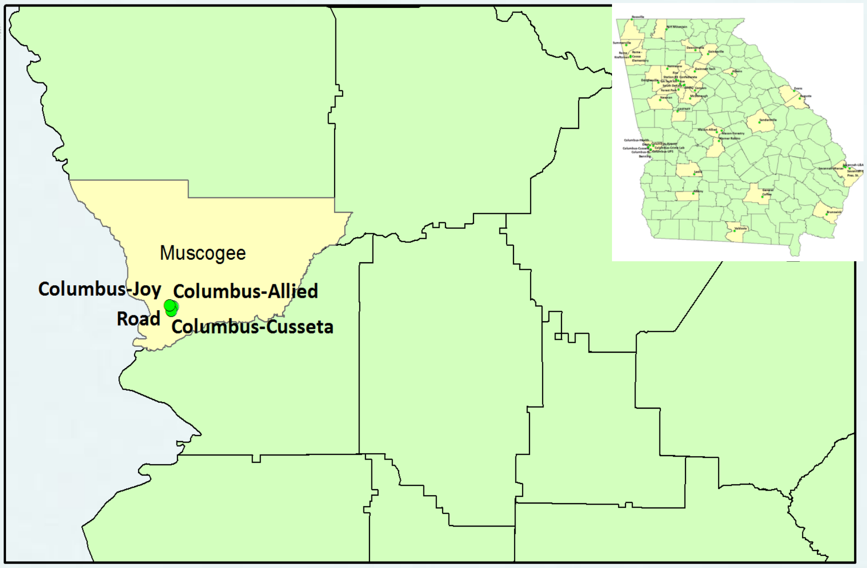


Figure 25. Georgia's lead monitoring sites

Measurement Technique

24-hour total suspended particulate (100 microns or less) on 8"x10" pre-weighed fiberglass filter[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 2017.
- 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.

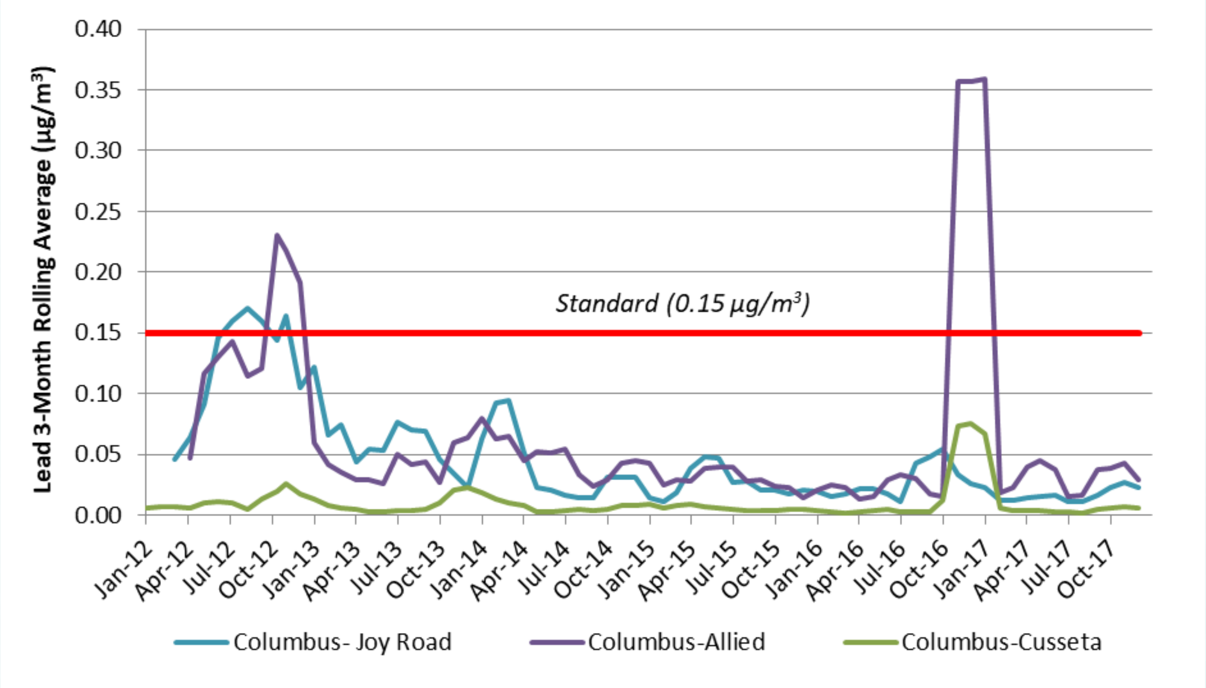


Figure 26. Georgia's three-month rolling averages, 2012-2017

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.

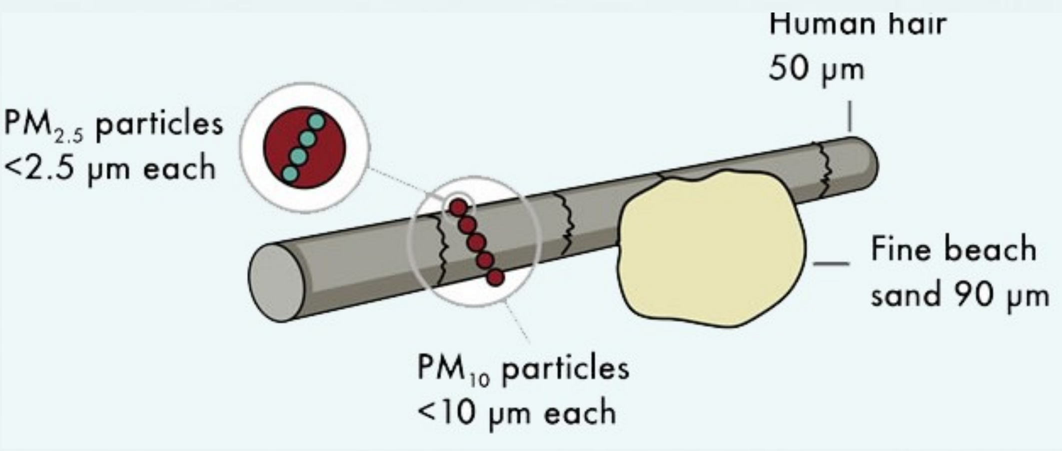


Figure 27. Comparison of particulate matter size to human hair

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.

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}

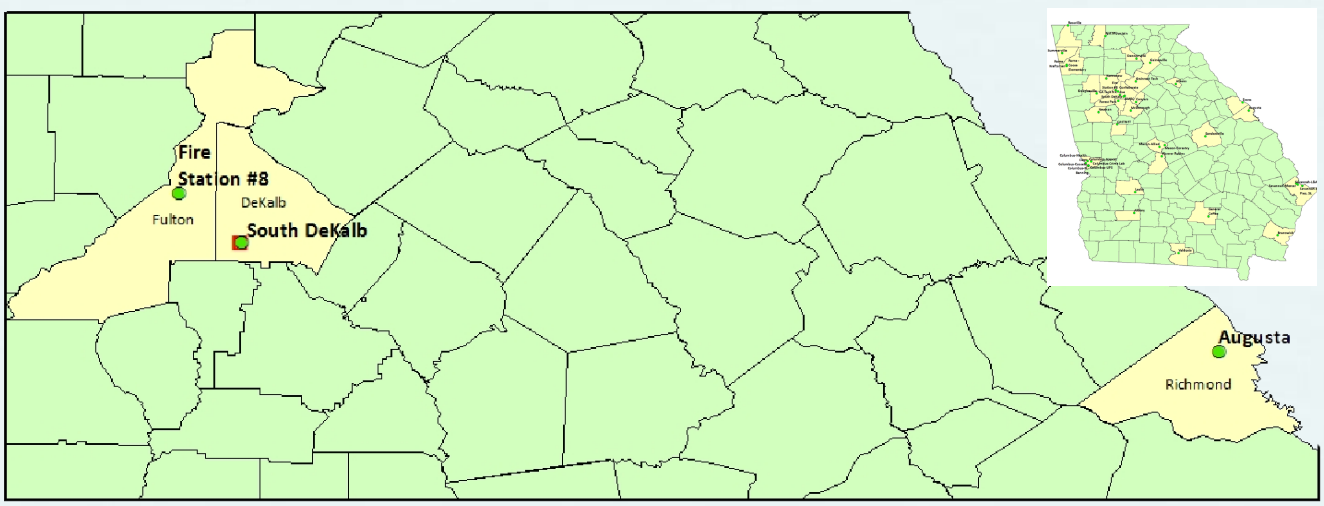


Figure 28. Georgia's PM_{10} and PM_{coarse} (red square) monitoring sites

Measurement Techniques

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

⇒ Integrated low-volume monitor that collects a 24-hour sample through an impaction inlet device that only allows particles with 10 microns or less in size to reach the filter media.[11]

⇒ Continuous beta ray attenuation monitor, Teledyne T640X monitor, tapered element oscillating microbalance (TEOM) method with an inlets 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

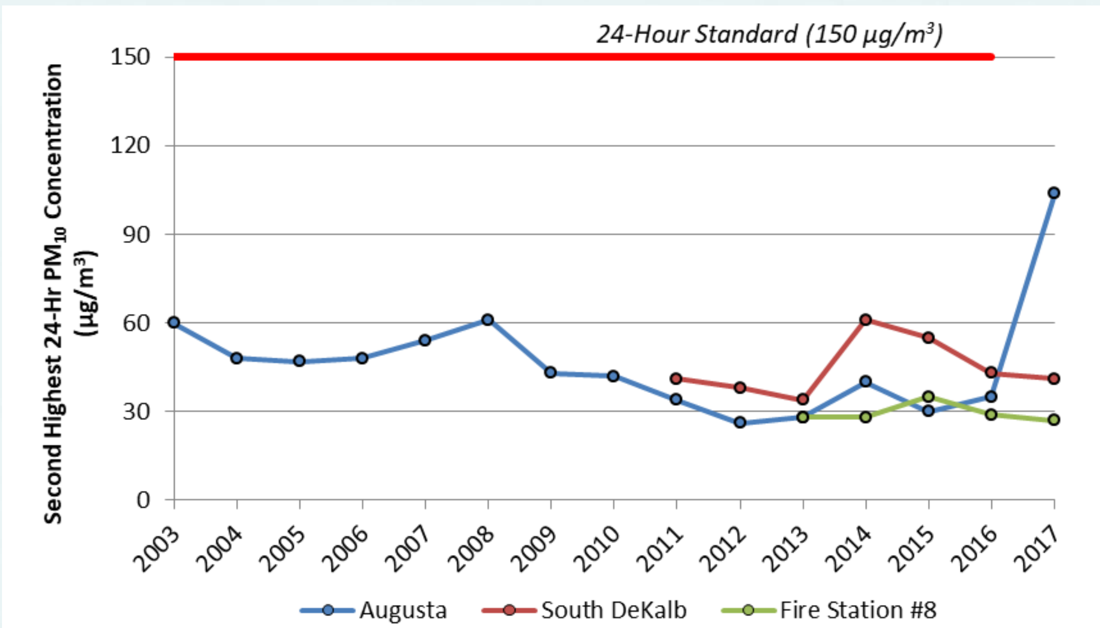
National Ambient Air Quality Standards for Particulate Matter PM_{10}

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

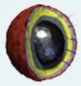
Attainment Designation

- 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

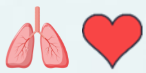
$PM_{2.5}$ 

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.

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 three types of instruments.
  - ⇒ The beta attenuation method (BAM) is designed for the inlet to cut out particles larger than 2.5 microns in size. EPD has two sites where BAM samplers are running as Federal Equivalent Method (FEM) samplers that can be used for attainment determinations as well: South DeKalb and Albany.[16]
  - ⇒ 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.[17]
  - ⇒ 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.[18] These samplers are also FEMs and collect data that can be used for attainment determinations.
- 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] https://www.thermofisher.com/order/catalog/

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

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.

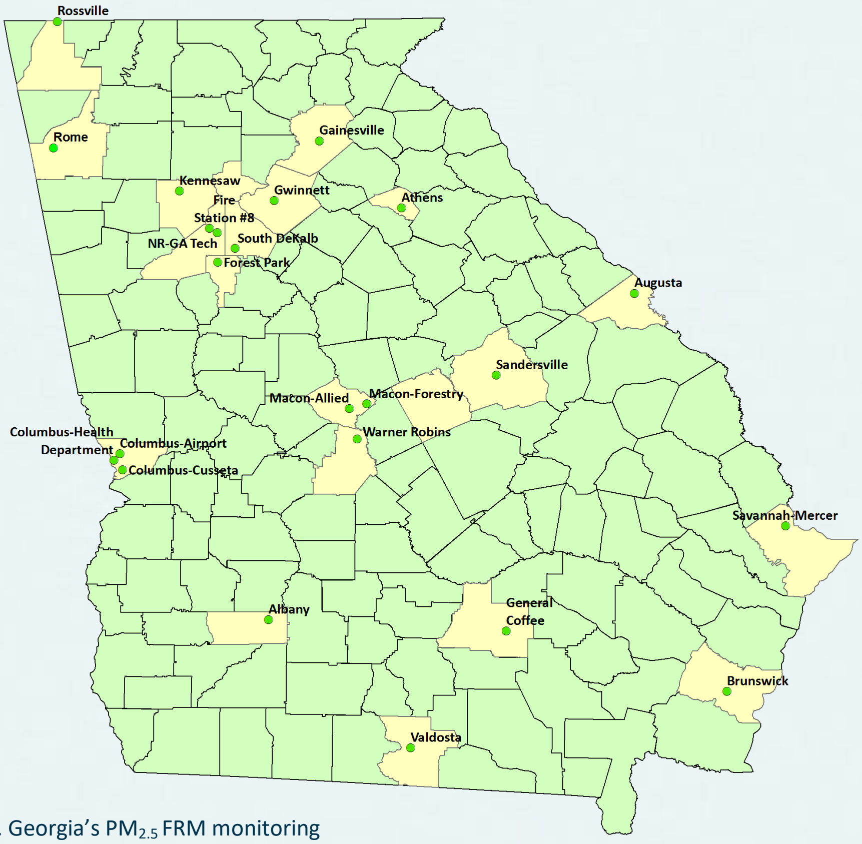


Figure 30. Georgia's $PM_{2.5}$ FRM monitoring sites

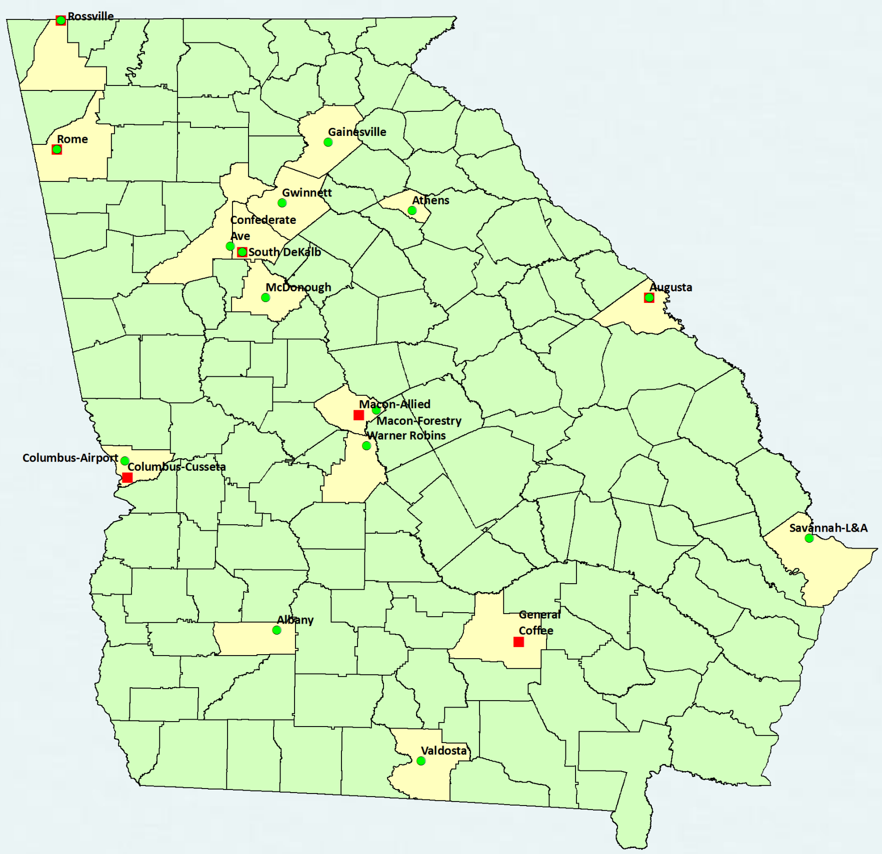


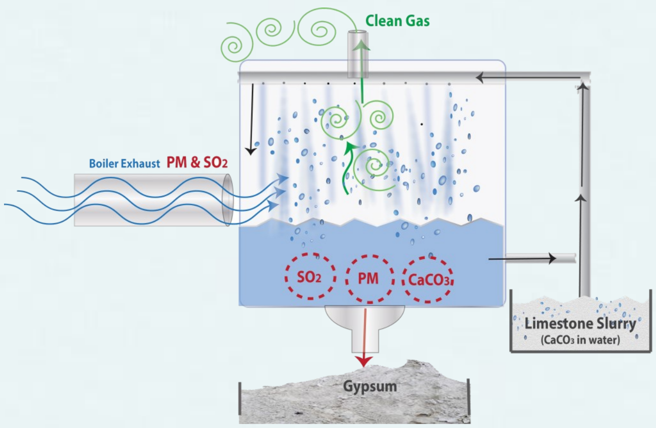
Figure 31. Georgia's $PM_{2.5}$ continuous (green circles) and $PM_{2.5}$ speciation (red squares) monitoring sites

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

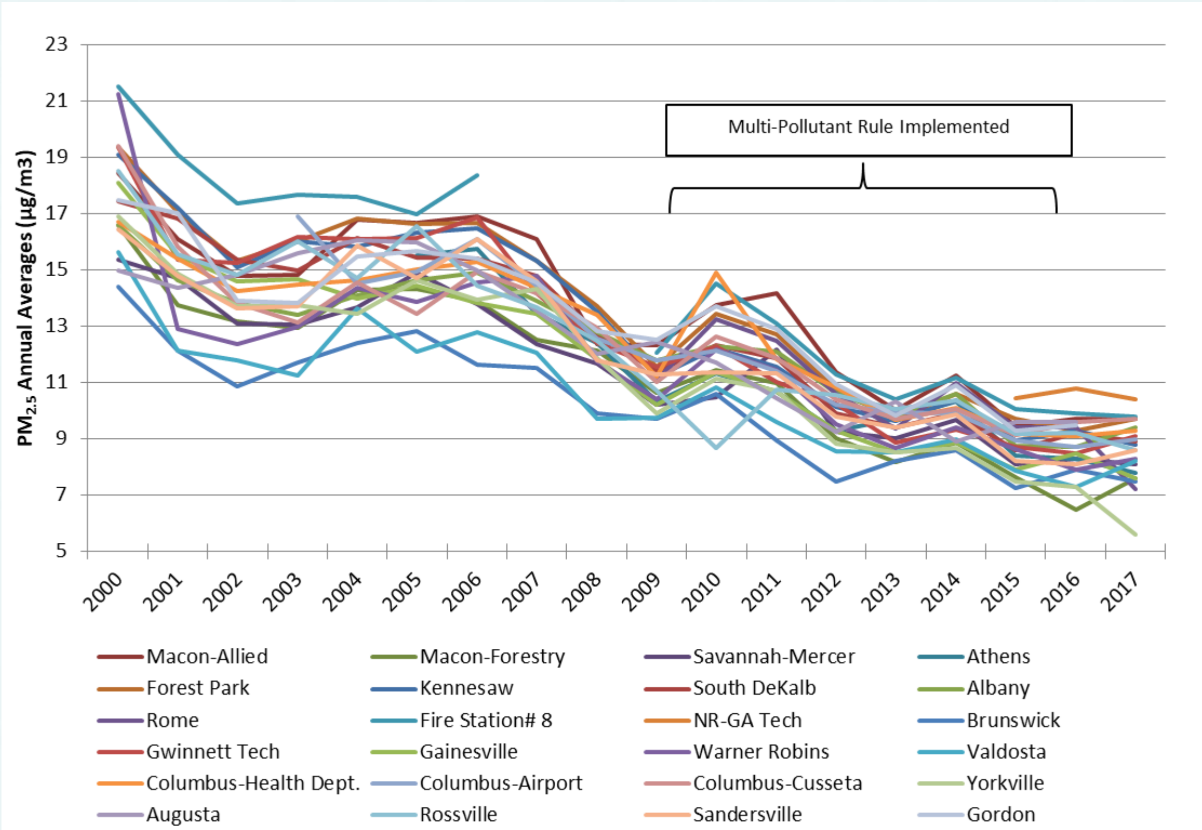


Figure 32: Implementation of PM Controls

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.

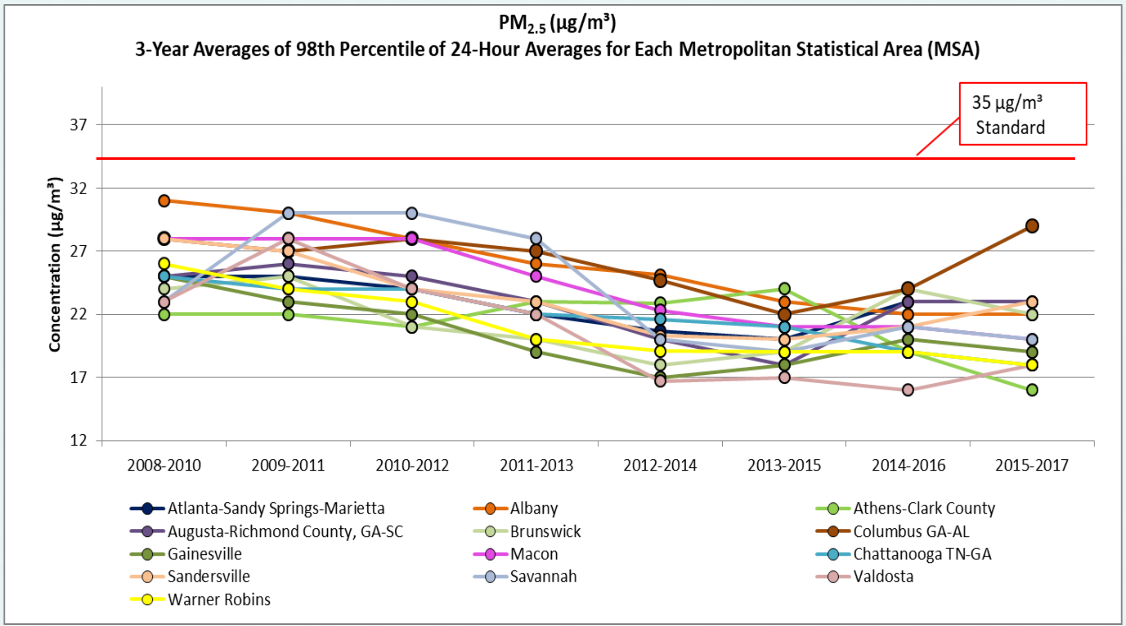


Figure 33. Comparison of the three-year averages of the 98th percentile of $PM_{2.5}$ 24-hour data

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

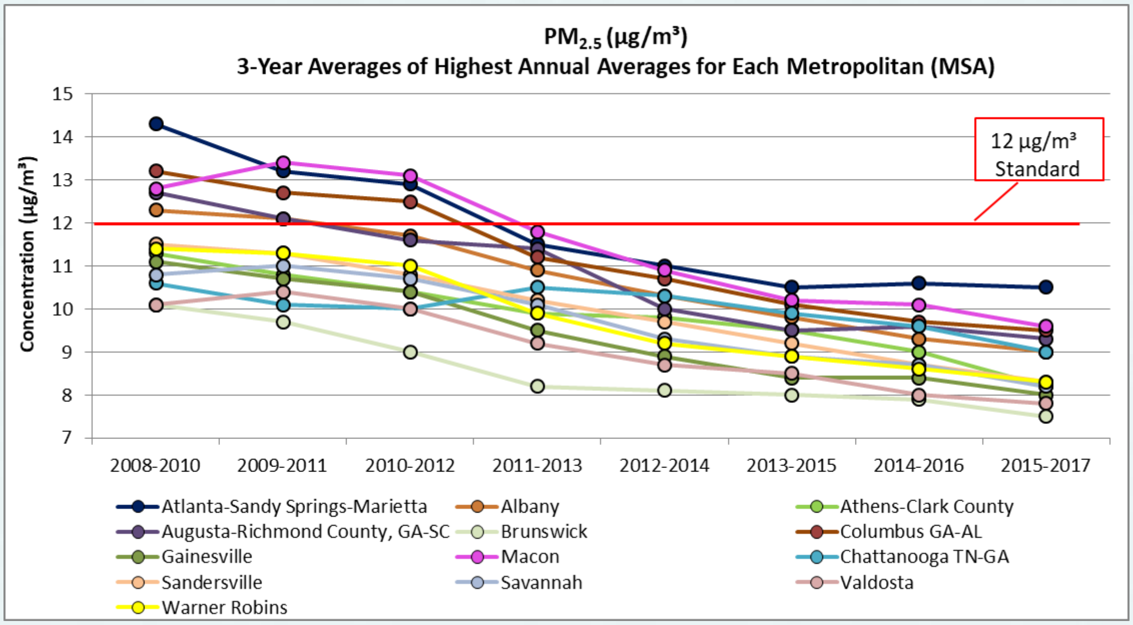


Figure 34. Comparison of the $PM_{2.5}$ three-year annual averages to the annual standard

$PM_{2.5}$ 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 38 compares the percent composition of $PM_{2.5}$ for each site based on 2017 annual averages.

- Organic carbon makes up 44-57% 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 16-23%.
- Nitrate, crustal, elemental carbon, and ammonium ion make up no more than 13% of $PM_{2.5}$ for all sites.
- The chemical elements typical of the Earth's crust are grouped together as "crustal".

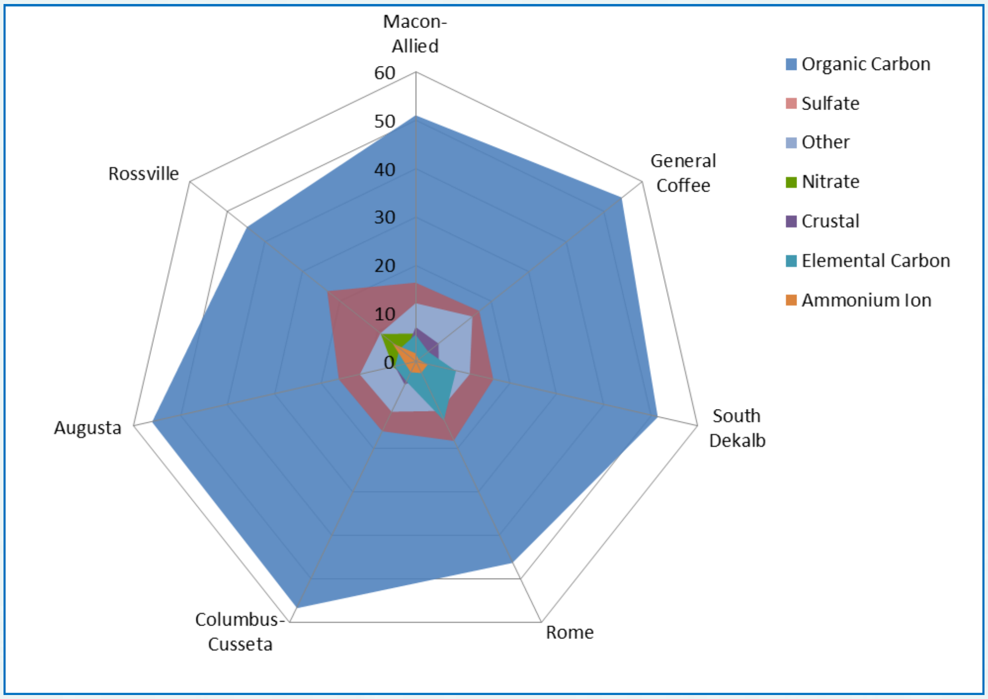


Figure 38. Percentages of 2017 Speciation Data

Measurement Techniques[19,20]

- 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

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

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

PREDOMINANT SPECIES FOUND IN $PM_{2.5}$

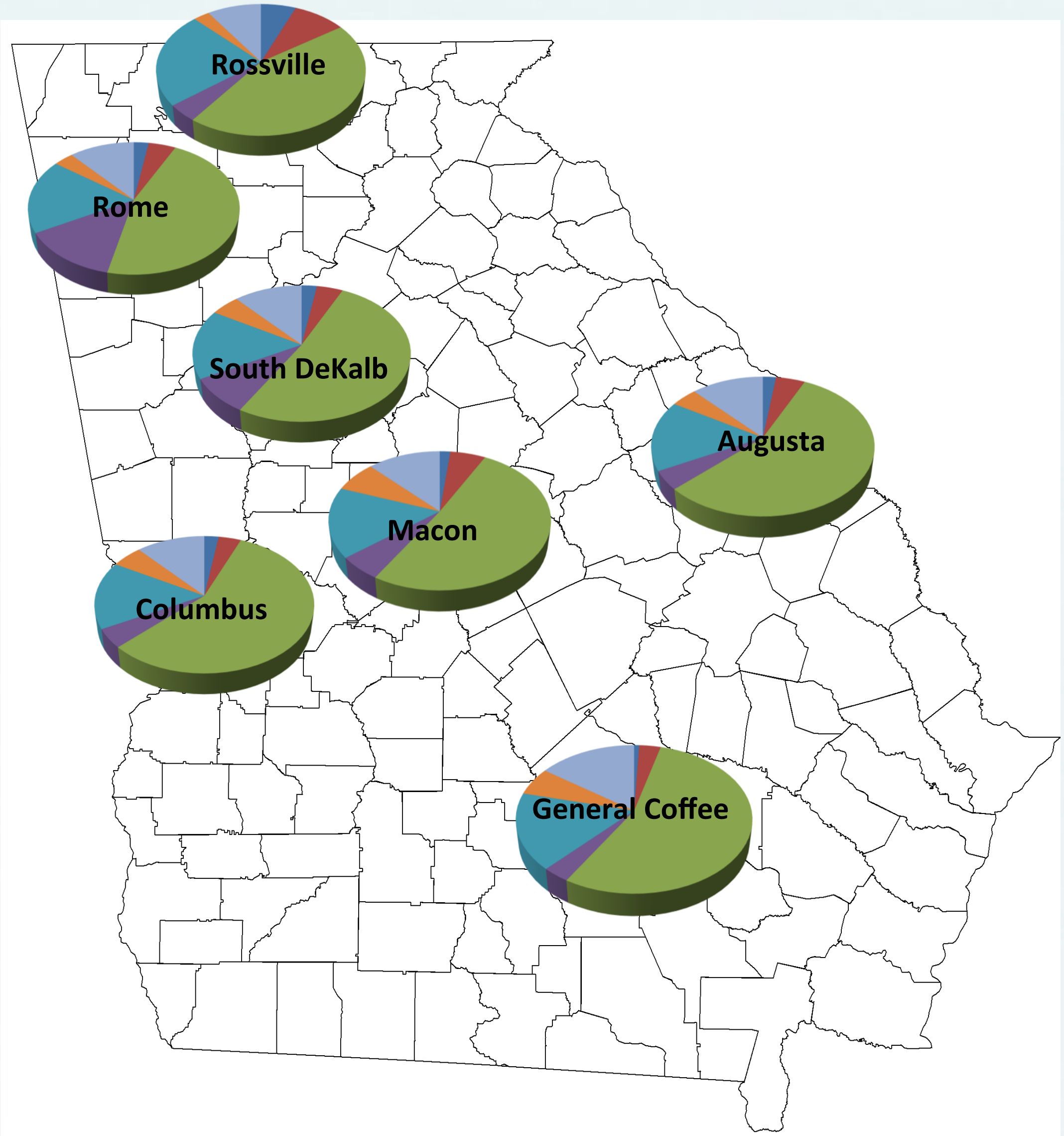


Figure 39 presents each site with all species making up the composition at each location.

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

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

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

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

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

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

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

The Air Quality Index

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

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

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

Maximum Pollutant Concentration									
$PM_{2.5}$	PM_{10}	SO_2	O_3	O_3	CO	NO_2			
(24hr) µg/m^3	(24hr) µg/m^3	(1hr)* ppm	(8hr)^ ppm	(1hr) ppm	(8hr) ppm	(1hr) ppm	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 affected.
350.5–500	505–604	0.805–1.004*	None^	0.505–0.604	40.5–50.4	1.650–2.049	401 to 500		

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

2017 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						
$PM_{2.5}$	272	83	-	1	-	-
Americus						
O_3	229	12	-	-	-	-
Athens-Clark County						
O_3, $PM_{2.5}$	314	46	-	-	-	-
Atlanta-Sandy Springs-Roswell						
O_3, NO_2, $PM_{2.5}$, CO, SO_2, PM_{10}	174	180	11	-	-	-
Augusta-Richmond County, GA-SC						
O_3, $PM_{2.5}$, PM_{10}	260	103	1	-	-	1
Brunswick						
O_3, $PM_{2.5}$	257	19	-	-	-	-
Chattanooga, TN-GA						
O_3, $PM_{2.5}$	237	123	2	-	-	-
Columbus, GA-AL						
O_3, $PM_{2.5}$	249	113	-	-	-	-
Dalton						
O_3	207	34	-	-	-	-
General Coffee						
$PM_{2.5}$	98	9	-	-	-	-
Gainesville						
$PM_{2.5}$	206	48	-		-	-
Macon						
O_3, SO_2, $PM_{2.5}$	284	81	-	-	-	-
Rome						
SO_2, $PM_{2.5}$	249	116	-	-	-	-
Savannah						
O_3, SO_2, $PM_{2.5}$	289	76	-	-	-	-
Summerville						
O_3	232	8	-	-	-	-
Valdosta						
$PM_{2.5}$	241	89	-	1	-	-
Warner Robins						
$PM_{2.5}$	263	64		-	-	-

Table 1. 2017 AQI summary data, most days had an AQI value in the 'Good' (0-50) category for all the sites.

Atlanta-Sandy Springs-Roswell MSA

Figure 41 shows in more detail the AQI values for the Atlanta-Sandy Springs-Roswell MSA. There were 11 days with an AQI value above 100 in 2017. Ozone is a major driver of an elevated AQI and can be higher in the summer months due to increased sunlight. Higher ozone and $PM_{2.5}$ concentrations are the primary sources of AQI values in the "Unhealthy for Sensitive Groups" category in the Atlanta-Sandy Springs-Roswell MSA.

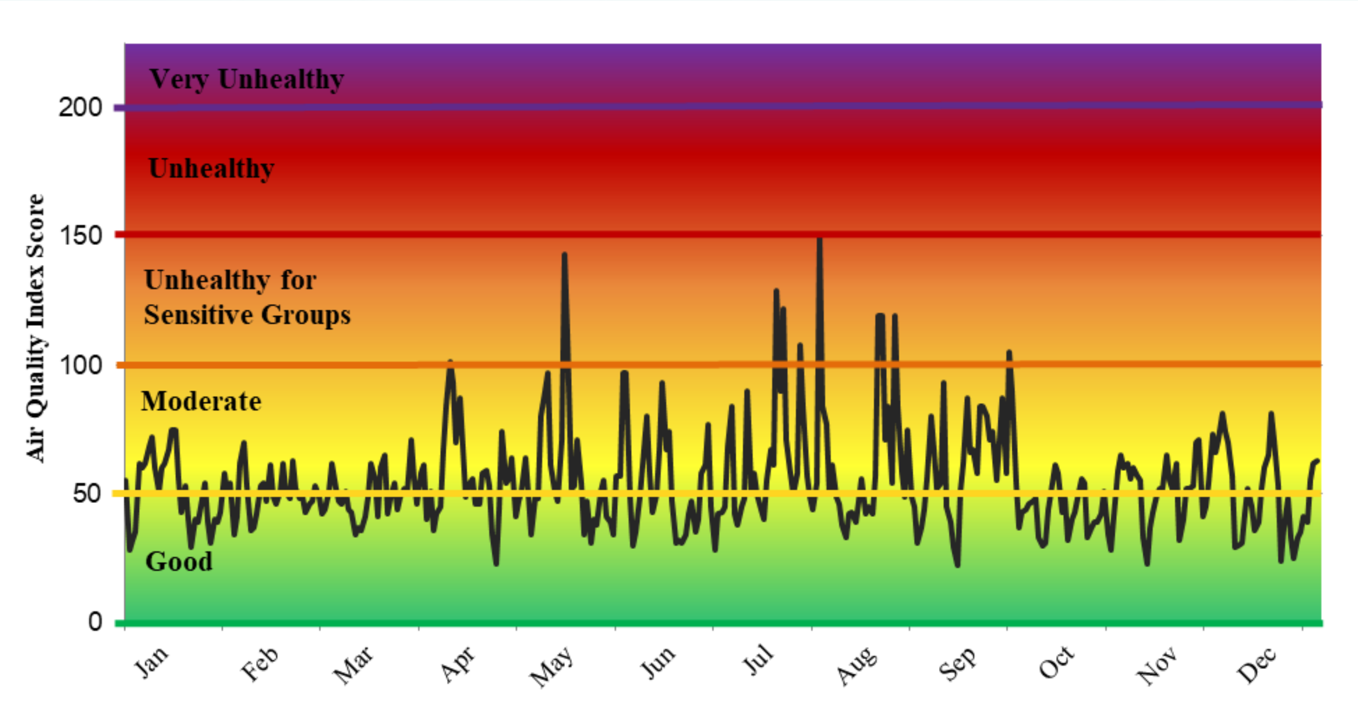


Figure 41. 2017 AQI Values for the Atlanta-Sandy Springs-Roswell MSA

PHOTOCHEMICAL ASSESSMENT MONITORING STATIONS (PAMS)

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

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

Georgia Monitoring Information

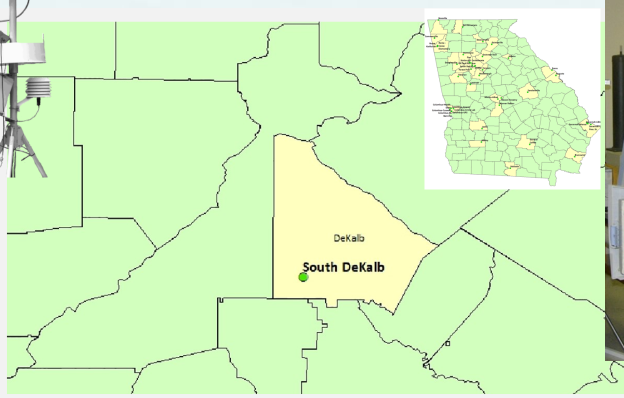


Figure 42. Georgia's PAMS monitoring site

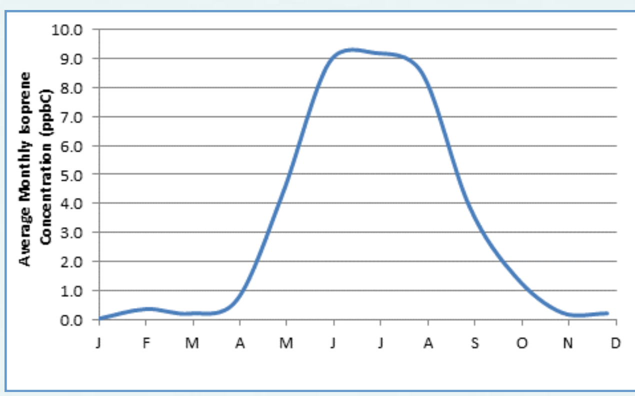
MORE INFORMATION ABOUT MEASUREMENT TECHNIQUE

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

Measurement Techniques

- Throughout the year, 24-hour integrated volatile organic compounds samples are taken with a canister every sixth day and analyzed in the EPD laboratory for 56 hydrocarbon compounds using a gas chromatograph with mass spectroscopy detection (GC/MS).
- Additionally, from June through August, hydrocarbon samples are analyzed hourly at the South DeKalb PAMS site using a gas chromatography unit with a Flame Ionization Detector (FID). [21]

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



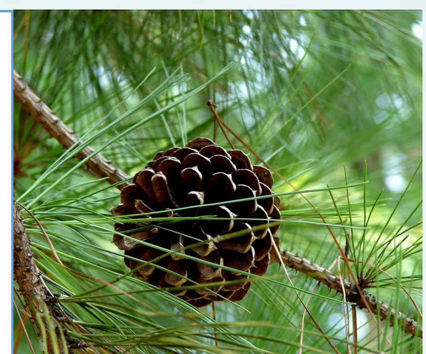


Figure 43. Average yearly profile of isoprene

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

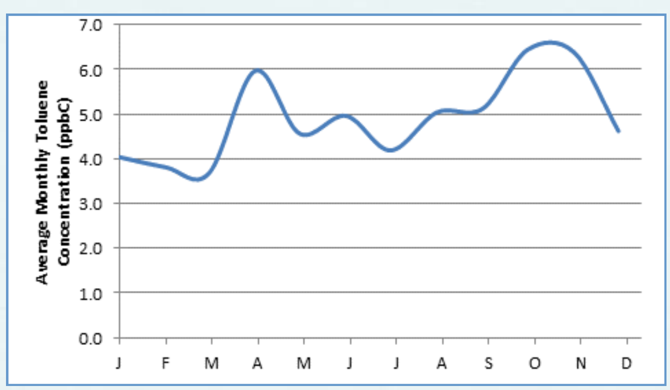


Figure 44. Toluene average annual occurrence

Carbonyl Compounds

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

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

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

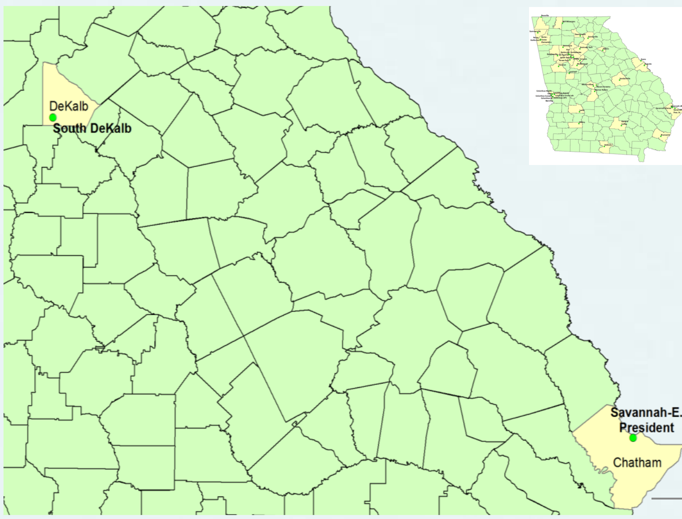


Figure 45. Georgia's carbonyls monitoring sites

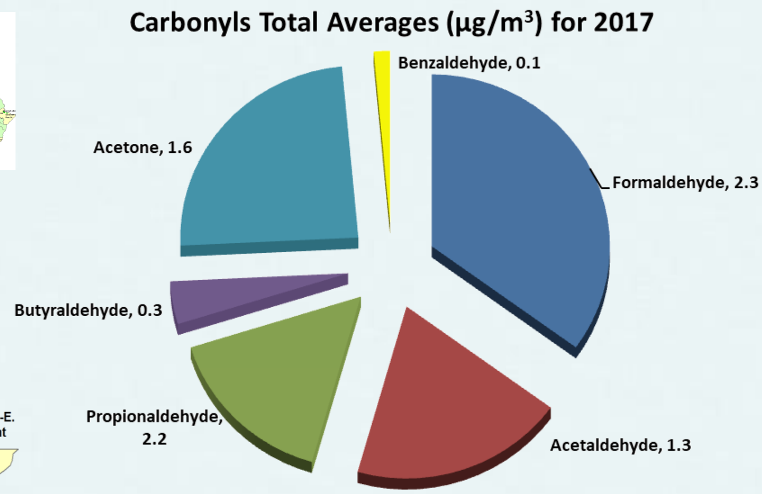


Figure 46. Total Average 24-hour carbonyl concentrations by

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. [22]
- Another collection method is the canister sampler that is used for sampling volatile organic compounds at the Air Toxics sites. Acrolein is analyzed using this method. The graph to the right shows this data.

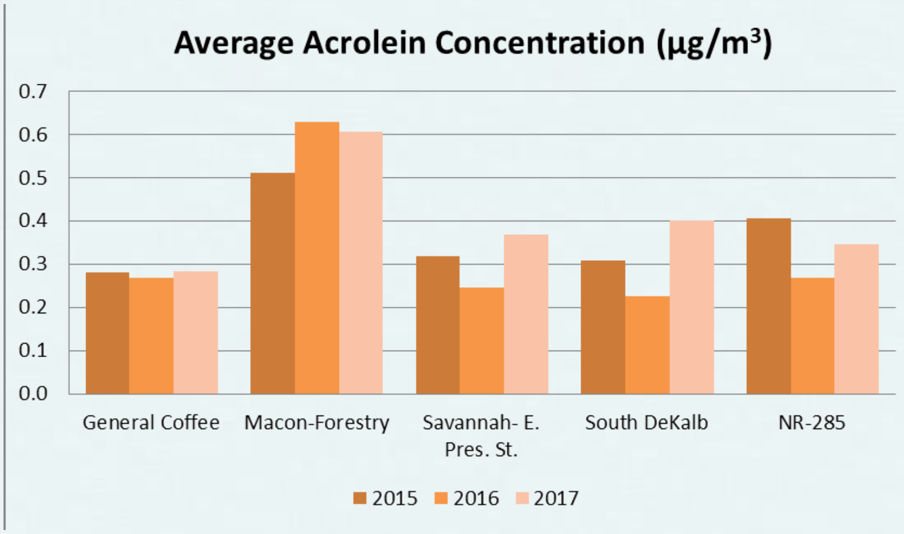


Figure 47. Acrolein concentrations, 2015- 2017

MORE INFORMATION ABOUT MEASUREMENT TECHNIQUES

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

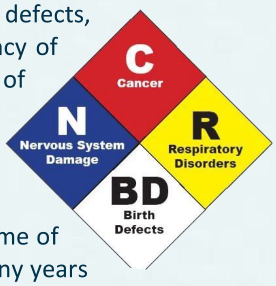
AIR TOXICS MONITORING

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

Air Toxics are those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects.

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

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



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

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

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

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

Monitoring Techniques

Three types of samplers are used at all locations: the HIVOL, PUF, and canister. [23]

- 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

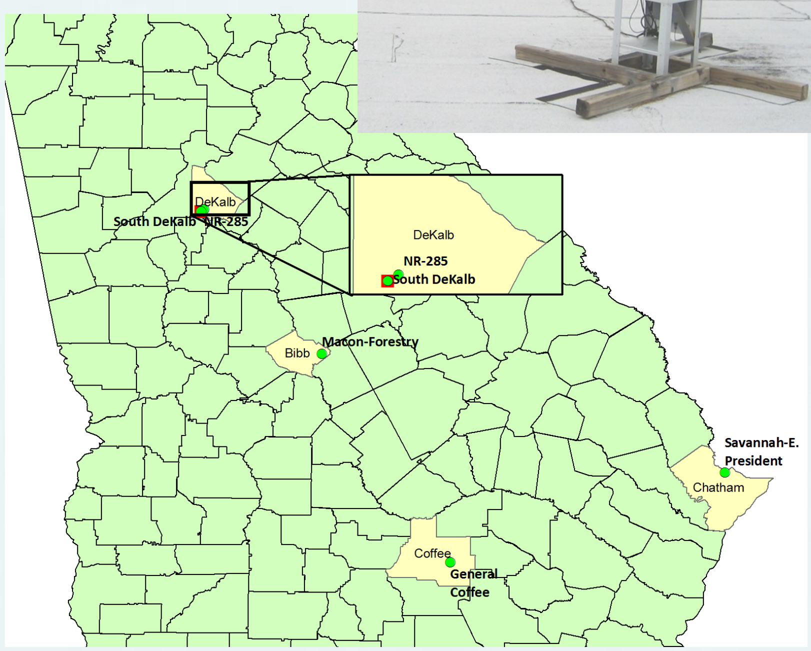


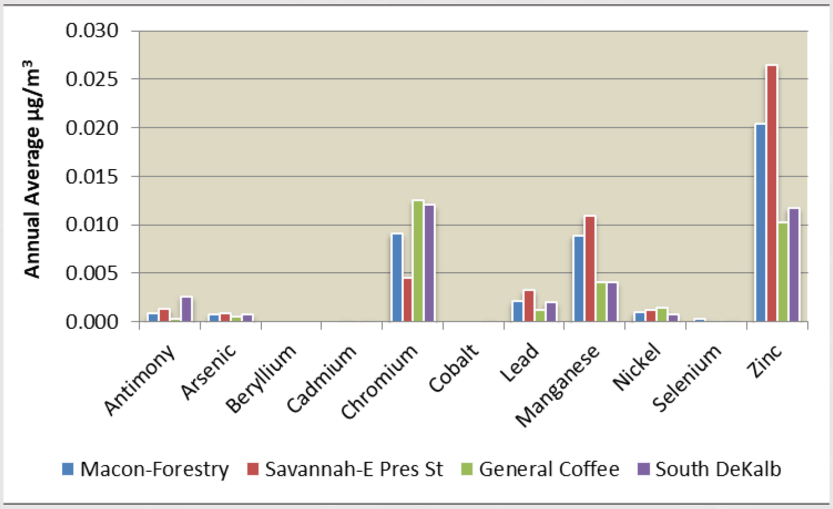
Figure 48. Air Toxics monitoring sites

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

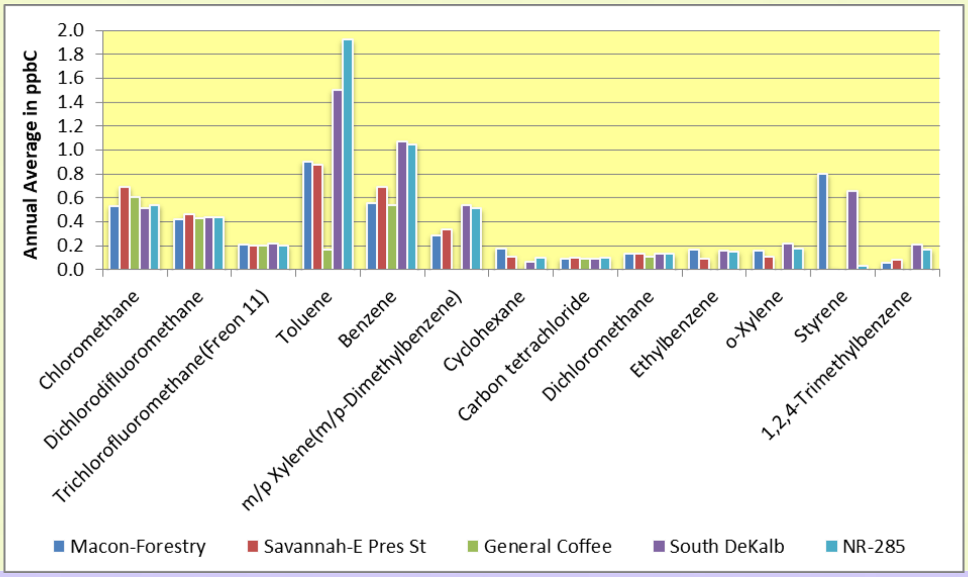
METALS

Sources include:

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



VOLATILE ORGANIC COMPOUNDS



Sources include:

- various industrial, stationary and mobile sources

SEMI-VOLATILE ORGANIC COMPOUNDS

Sources include:

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

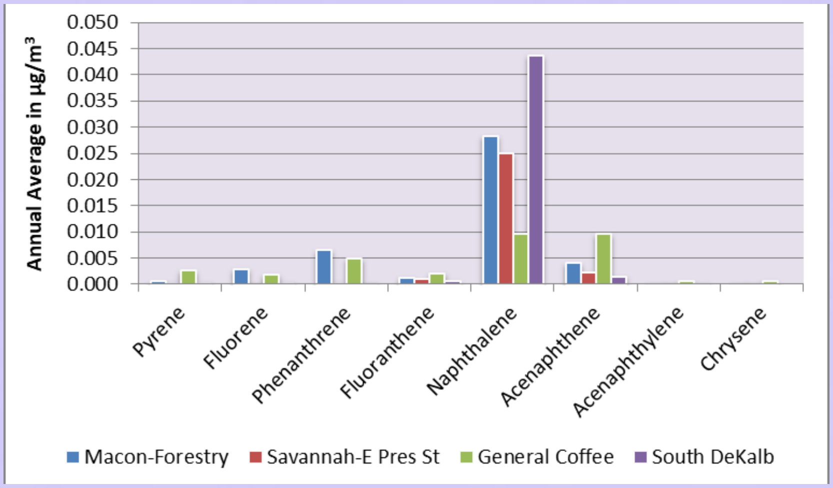


Figure 49. Air Toxics data

NATTS

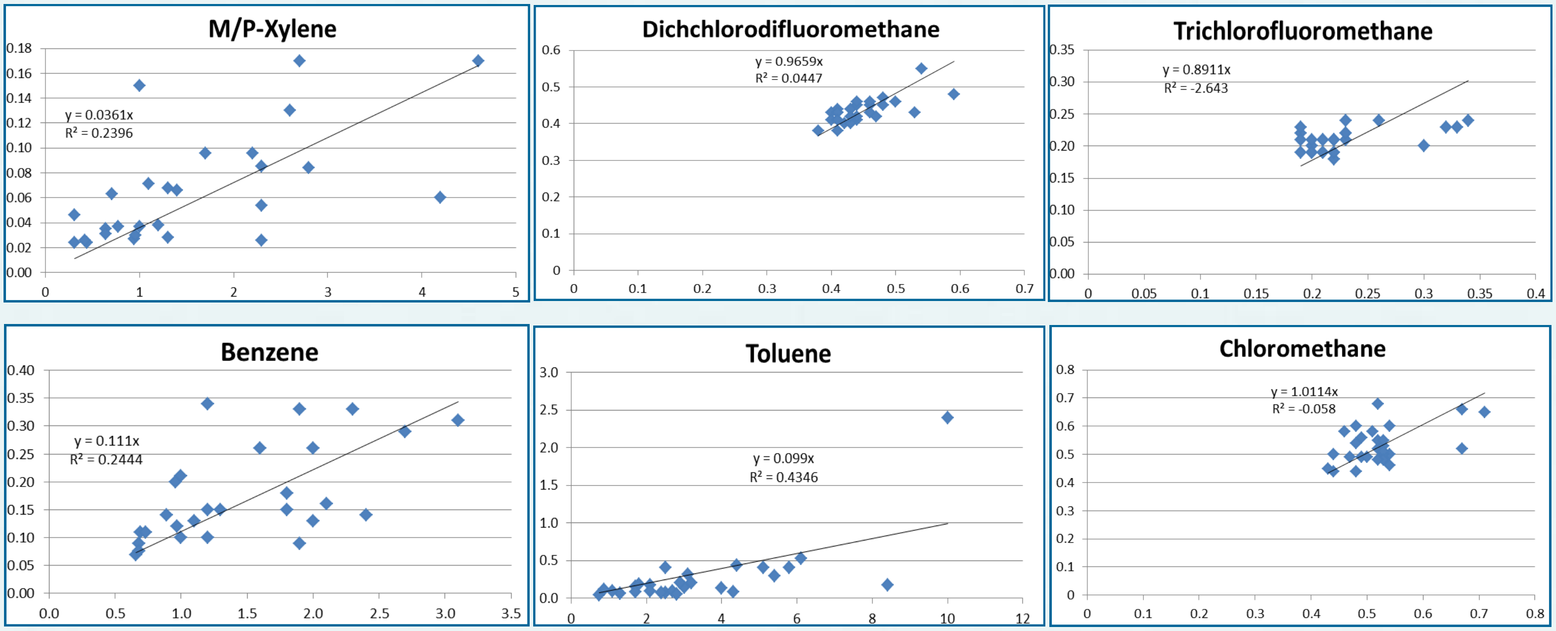
The National Air Toxics Trends Station (NATTS) network was established in 2003 at the South DeKalb site and is intended for long-term operation for the purpose of discerning national trends.

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

Near-Road VOCs

The 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	0.704
M/P Xylene	0.612
Chloromethane	0.493
Trichlorofluoromethane	0.501
Dicholrodifluoromethane	0.697
Benzene	0.590

Figure 50. Comparison of select VOCs at the South DeKalb and NR-285 sites

A few of the VOCs at the South DeKalb and NR-285 sites have relatively low to moderate correlations (values below and around 0.50). Stronger correlations would be values above 0.70. This suggests that some VOCs found in vehicle exhaust dissipate quickly in the air.

Black Carbon

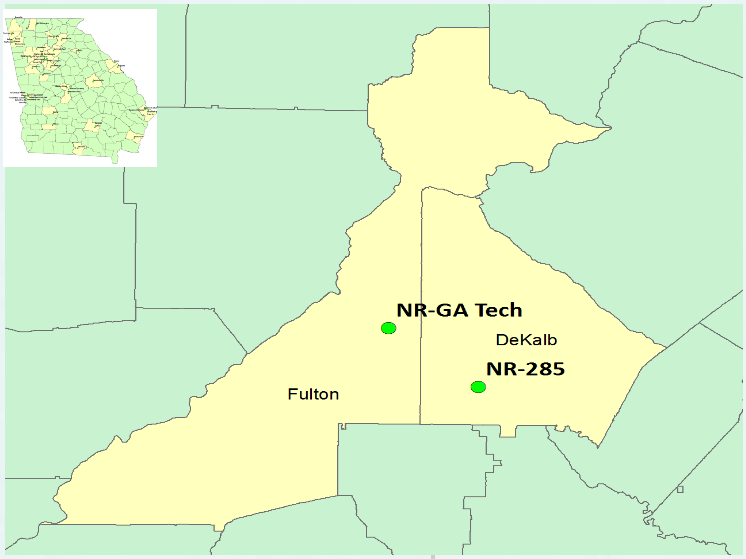
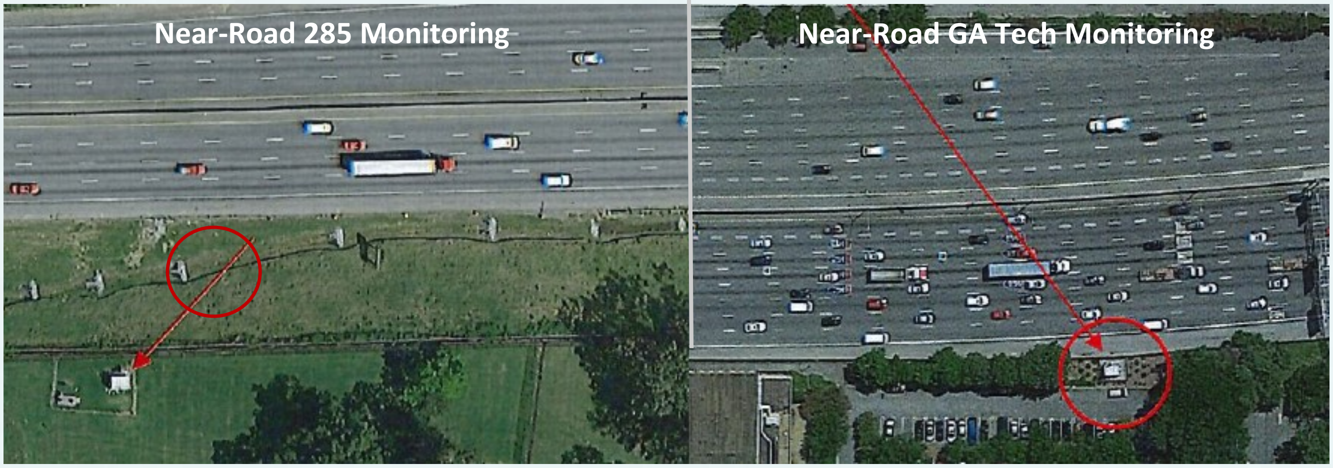


Figure 51. Black carbon monitoring sites



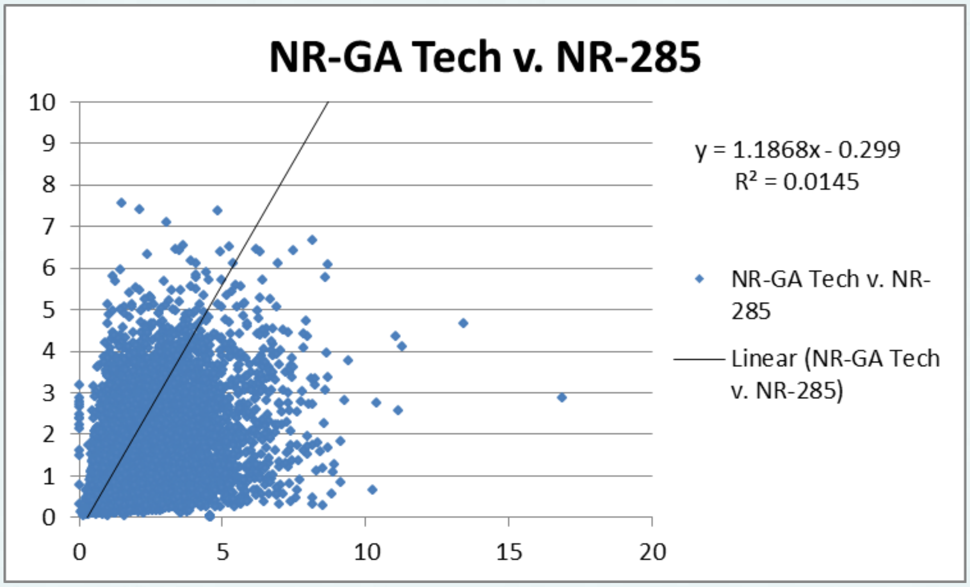


Figure 52. Comparison of black carbon at the NR-Georgia Tech and NR-285 sites

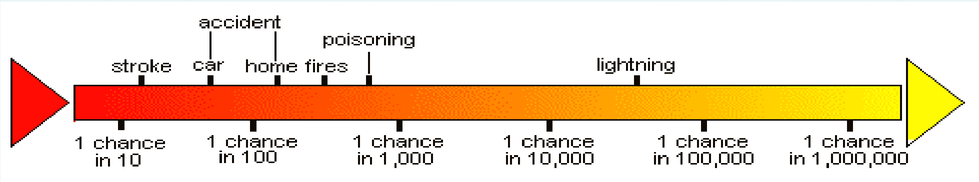
The black carbon scatterplots show a relatively high correlation (R^2=0.5546) between the South DeKalb and NR-285 sites. The scatterplots that include GA Tech have less correlation, (R^2=0.0835 and 0.1739) which could be an indication of less truck diesel traffic (black carbon) in the downtown corridor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

RISK ASSESSMENT

The following risk assessment reflects data collected at the Air Toxics Network (ATN) sites (Macon–Forestry, General Coffee, Savannah–E. President St.) and the National Air Toxics Trends Station (NATTS) (South DeKalb). Some of the chemicals monitored at the ATN sites are also monitored at Photochemical Assessment Monitoring Station (PAMS) (South DeKalb) and at a Near-road Monitoring Network site (NR-285); therefore, those chemicals were evaluated and compared to concentrations measured at nearby ATN sites for this report.

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

Putting Risks in Perspective



Methods

The initial evaluation consisted of a comparison of the monitored results to “health based” screening values. These values were calculated using procedures recommended in EPA’s latest guidance on risk assessment for air toxics, ‘A Preliminary Risk-Based Screening Approach for Air Toxics Monitoring Data Sets’ (https://archive.org/details/APreliminaryRisk-basedScreeningApproachForAirToxicsMonitoringDataSets). Briefly, EPA’s prioritized chronic dose-response (toxicity) values for both non-cancer (reference concentrations, RfC) and cancer (inhalation unit risks, IUR) effects were used to generate screening air concentrations. To screen for non-cancer effects, the reference concentration was used as a starting point. However, to account for possible exposure to multiple contaminants acting on the same target organ or body system, the screening air concentration was obtained by dividing the RfC by a factor of 10. Screening values for the cancer endpoint were determined by calculating air concentrations equivalent to a risk level of one in one million. Most screening values utilized in this assessment are listed in Appendix A of the above mentioned guidance document and updated “Table 1. Prioritized Chronic Dose-Response Values for Screening Risk Assessments (6/18/2018)” (https://www.epa.gov/sites/production/files/2014-05/documents/table1.pdf). The screening values are derived from the dose-response values: cancer-based air screening values=1E-06/IUR and non-cancer based air screening values=RfC x 0.1 x 1000. For a limited number of chemicals, other resources such as toxicity values from the Regional Screening Table (https://semspub.epa.gov/work/HQ/197233.pdf) were used to calculate conservative screening values protective of a worse-case residential exposure scenario. Assumptions were made that accounted for the potential for continuous exposure to air toxics for 24 hours per day for 70 years. The conservative screening process was utilized so that the chance of underestimating the potential for health impacts would be minimized, as chemicals were excluded from further quantitative analysis. The following figure shows the formulas used to calculate cancer risk and non-cancer hazard for chemicals that were carried beyond the screening process into the quantitative assessment.

Formula for Calculating Risk Using IUR for Carcinogens:

$$Risk = IUR * Conc$$

Formula for Calculating Hazard Quotient Using RfC for Noncarcinogens:

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

Equation Parameters:

Risk: Theoretical lifetime cancer risk (unitless probability)

HQ: Hazard quotient (unitless ratio)

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

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

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

Results and Interpretation

Seventy-one air toxic chemicals were assessed at four sites, and 42 volatile organic compounds were assessed at one site (NR-285) in Georgia. Out of these air toxic chemicals, ten were found to be above the screening values. Table 2 shows the theoretical cancer risk and non-cancer hazard that would result from an individual breathing air containing the detected chemicals at the estimated concentrations daily for 70 years, or a full lifetime. These cancer risk and hazard quotient estimates are likely conservative because they were calculated assuming continuous exposure to outdoor air at breathing rates typical of moderate exertion. Real risk cannot be calculated, but may be substantially lower. Lifetime cancer risks for the limited number of chemicals exceeding screening values exceeded 1×10^{-6} or one in one million, a value generally deemed as insignificant. However, lifetime cancer risks for these chemicals did not exceed 2×10^{-5} or two in one-hundred thousand. This risk estimate falls within EPA's acceptable cancer risk range of 1×10^{-6} to 1×10^{-4} commonly used for regulatory decision making.

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

Site	Chemical	CAS #	Annual Average ($\mu g/m^3$)	Cancer Risk	Hazard Quotient
Macon-Forestry	Arsenic	7440-38-2	7.0E-04	3.E-06	0.05
	Benzene	71-43-2	2.9E-01	2.E-06	0.01
	Ethylene dichloride	107-06-2	8.2E-02	1.E-07	0.0002
	Carbon tetrachloride	56-23-5	4.1E-01	2.E-06	0.004
	Ethylene dibromide	106-93-4	1.5E-02	9.E-06	0.002
	1,1,2,2-tetrachloroethane	79-34-5	1.8E-02	1.E-06	N/A
	Acrolein	107-02-8	6.1E-01	N/A	2
Savannah-E. Pres. St.	Arsenic	7440-38-2	8.0E-04	3.E-06	0.05
	Benzene	71-43-2	3.6E-01	3.E-06	0.01
	Ethylene dichloride	107-06-2	4.8E-02	8.E-08	0.0001
	Carbon tetrachloride	56-23-5	4.1E-01	2.E-06	0.004
	Ethylene dibromide	106-93-4	9.9E-03	6.E-06	0.001
	Acrolein	107-02-8	3.7E-01	N/A	1
General Coffee	Arsenic	7440-38-2	5.0E-04	2.E-06	0.03
	Benzene	71-43-2	2.9E-01	2.E-06	0.01
	Ethylene dichloride	107-06-2	4.1E-02	7.E-08	0.00008
	Carbon tetrachloride	56-23-5	4.0E-01	2.E-06	0.004
	Ethylene dibromide	106-93-4	1.1E-02	7.E-06	0.001
South DeKalb	Arsenic	7440-38-2	7.0E-04	3.E-06	0.05
	Benzene	71-43-2	5.7E-01	4.E-06	0.02
	Ethylene dichloride	107-06-2	6.4E-02	1.E-07	0.0001
	Carbon tetrachloride	56-23-5	3.8E-01	2.E-06	0.004
	Ethylene dibromide	106-93-4	1.0E-02	6.E-06	0.001
	1,4-dichlorobenzene	106-46-7	9.7E-02	1.E-06	0.0001
	Acrolein	107-02-8	4.0E-01	N/A	1
NR-285	Benzene	71-43-2	5.5E-01	4.E-06	0.02
	Ethylene dichloride	107-06-2	5.4E-02	9.E-08	0.0001
	Carbon Tetrachloride	56-23-5	4.0E-01	2.E-06	0.004
	Ethylene dibromide	106-93-4	1.3E-02	8.E-06	0.001
	Acrolein	107-02-8	3.5E-01	N/A	1

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

Table 2. Site-specific mean concentration, cancer risk, and hazard quotient by location for chemicals that exceeded their screening values in 2017

The following table and graph show the aggregate, or sum, of all the theoretical cancer risk and hazard quotients at each site.

Site	Aggregate Cancer Risk	Hazard Index
Macon-Forestry	2.E-05	2
Savannah-E. Pres. St.	1.E-05	1
General Coffee	1.E-05	0.05
South DeKalb	2.E-05	1
NR-285	1.E-05	1

Table 3. Aggregate cancer risk and hazard index by site for 2017

Figure 53 is a graphical representation of each site's theoretical hazard index and respective cancer risks shown in Table 3. The screening values utilized in this assessment are listed in Appendix B.

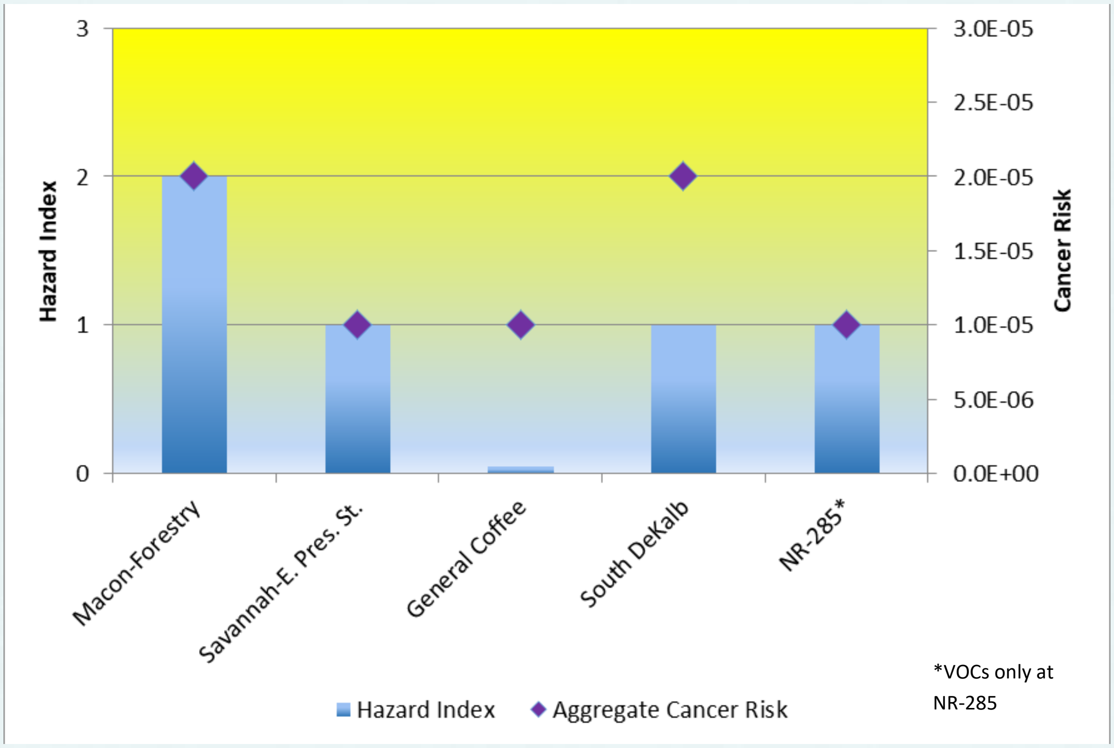


Figure 53. Aggregate cancer risk and hazard index by site for 2017

The following table shows the summary information for the PAMS site. Of the chemicals that are evaluated in conjunction with the Air Toxics data, benzene, ethylbenzene, and 1,2,4 trimethylbenzene were three chemicals found above the screening value at this site.

Site	Chemical	CAS #	Annual Average (µg/m3)	Cancer Risk	Hazard Quotient
South DeKalb	Benzene	71-43-2	5.5	4.E-05	0.2
	Ethylbenzene	100-41-4	2.3	6.E-06	0.002
	1,2,4-Trimethylbenzene	95-63-6	94.4	N/A	2

Table 4. Mean, cancer risks, and hazard quotients for VOCs from the PAMs site which exceeded their screening levels in 2017

There are two air monitoring sites in Georgia that collect carbonyls data in 2017, as discussed earlier. The risk assessment for this data is summarized in the following table.

Site	Chemical	CAS #	Annual Average ($\mu g/m^3$)	Cancer Risk	Hazard Quotient
Savannah	Formaldehyde	50-00-0	3.7E-01	5.E-06	0.04
South DeKalb	Formaldehyde	50-00-0	1.7E+00	2.E-05	0.2
	Acetaldehyde	75-07-0	2.1E+00	5.E-06	0.2
	Propionaldehyde	123-83-6	2.8E+00	N/A	0.3

Table 5. Mean, cancer risks, and hazard quotients for carbonyls which exceeded their screening levels in 2017

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

Franklin Sanchez, REHS

Director

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404.657.6534

Fax: 404.657.6516

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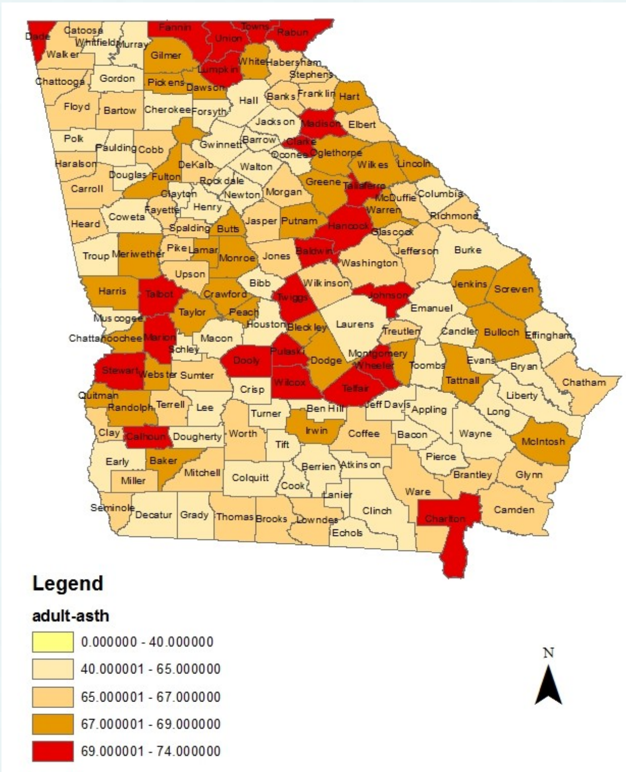
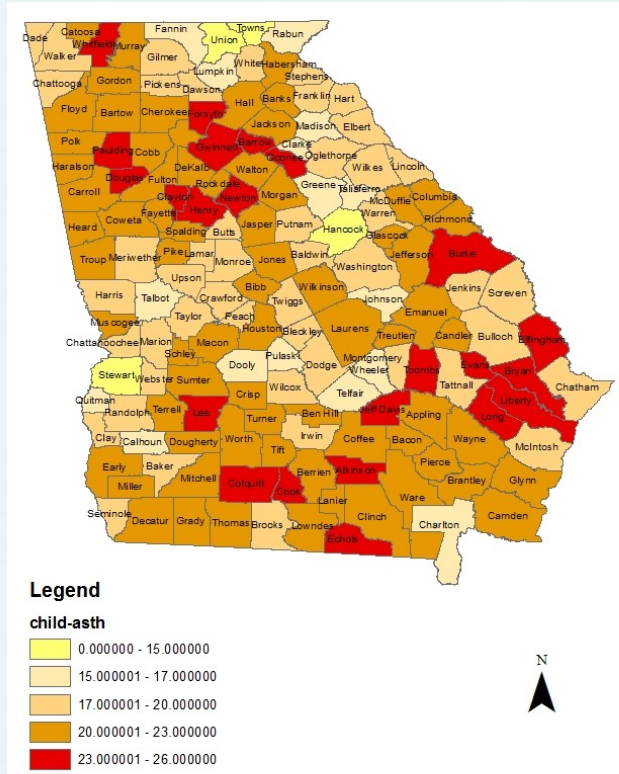
The maps below show the estimated rate of lung related diseases per county in Georgia. This is based on data obtained from the American Lung Association's 'Estimated Prevalence and Incidence of Lung Disease' (https://www.lung.org/our-initiatives/research/monitoring-trends-in-lung-disease/estimated-prevalence-and-incidence-of-lung-disease/). These rates are mapped as the number of estimated lung related disease cases per 1000 or 100 people in each county, based on 2016 data.

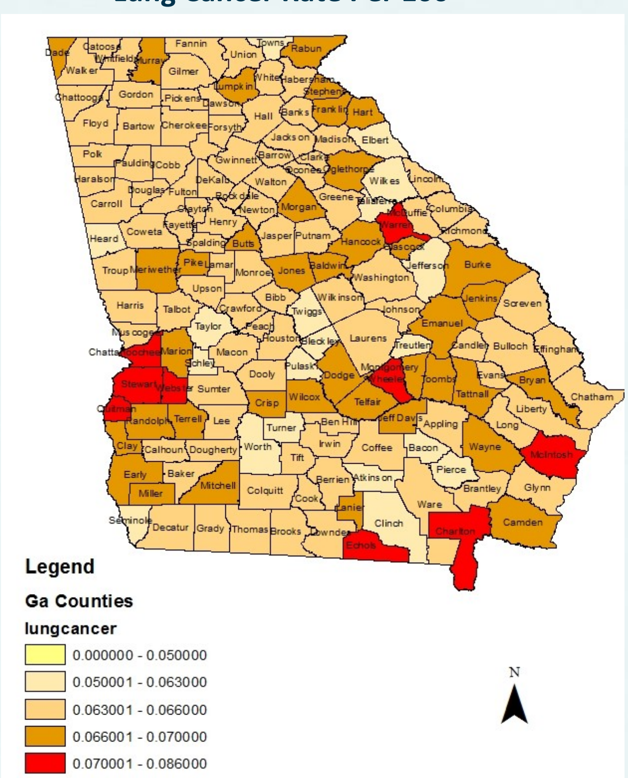
Adult Asthma Rate Per 1000



Pediatric Asthma Rate Per 1000



Lung Cancer Rate Per 100



Chronic Obstructive Pulmonary Disease Rate Per 1000

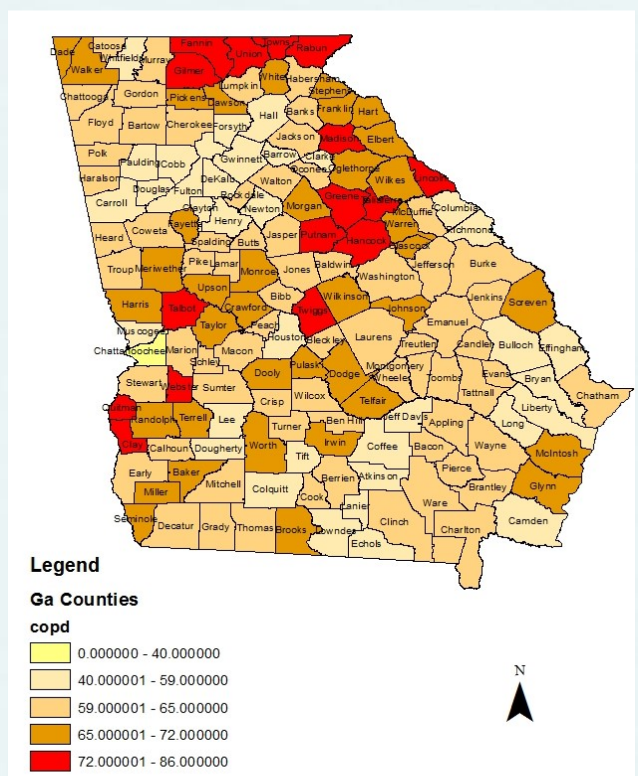


Figure 54. Estimated incidence of lung related diseases in Georgia

METEOROLOGICAL REPORT

State Climatology and Meteorological Summary of 2017

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

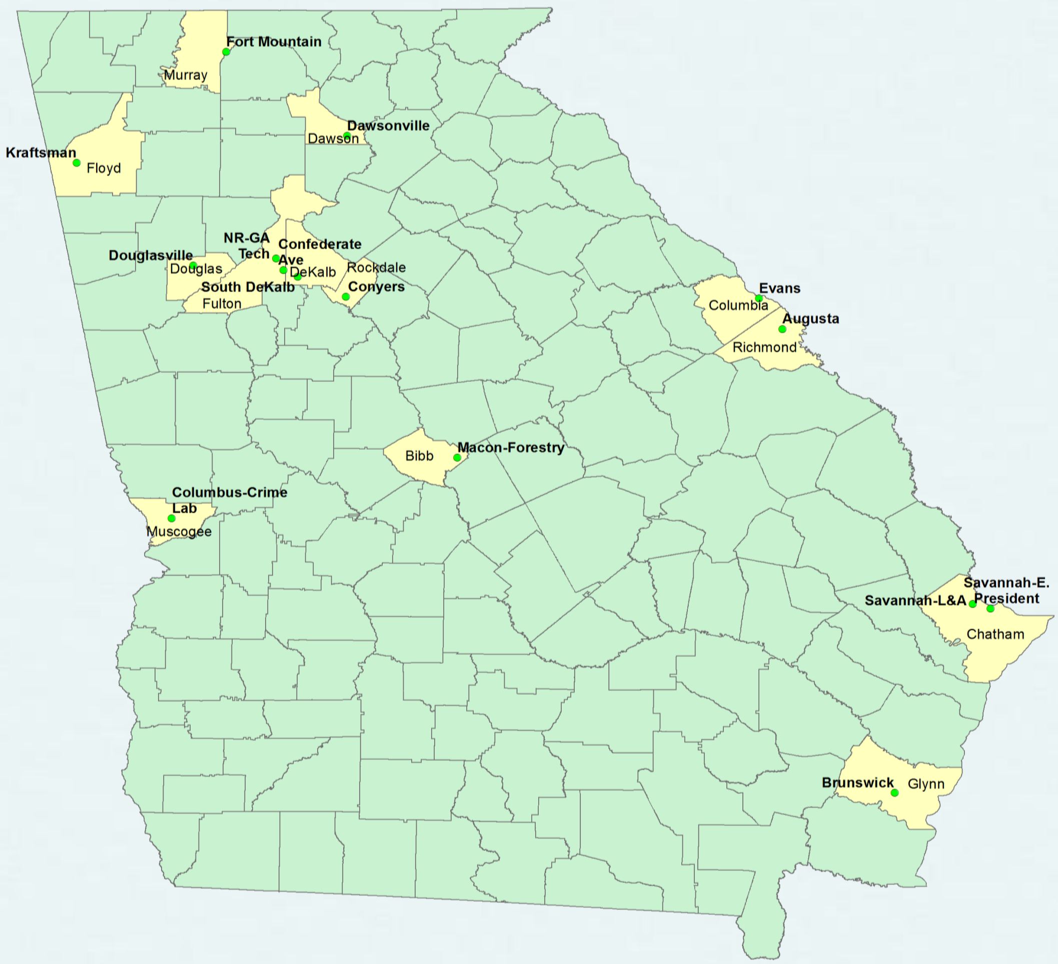


Figure 55. Meteorological Site Map

Figure 56. Sample meteorological instrumentation at EPD sites:

a) ceilometer, b) sonic anemometer, c) Temperature probe and relative humidity monitor, d) tipping bucket

2017 Climate Highlights

Hurricane Irma

- Hurricane Irma made landfall in southwest Florida on September 10, 2017.
- By the morning of Monday, September 11th, then-Tropical Storm Irma moved into Georgia with a very large wind field containing at least tropical storm force wind gusts (39+mph).
- The heaviest rainfall totals were confined to far southeast Georgia
- Widespread sustained winds of 30-45 mph with gusts in the 50-65 mph range downed numerous trees and power lines across the area

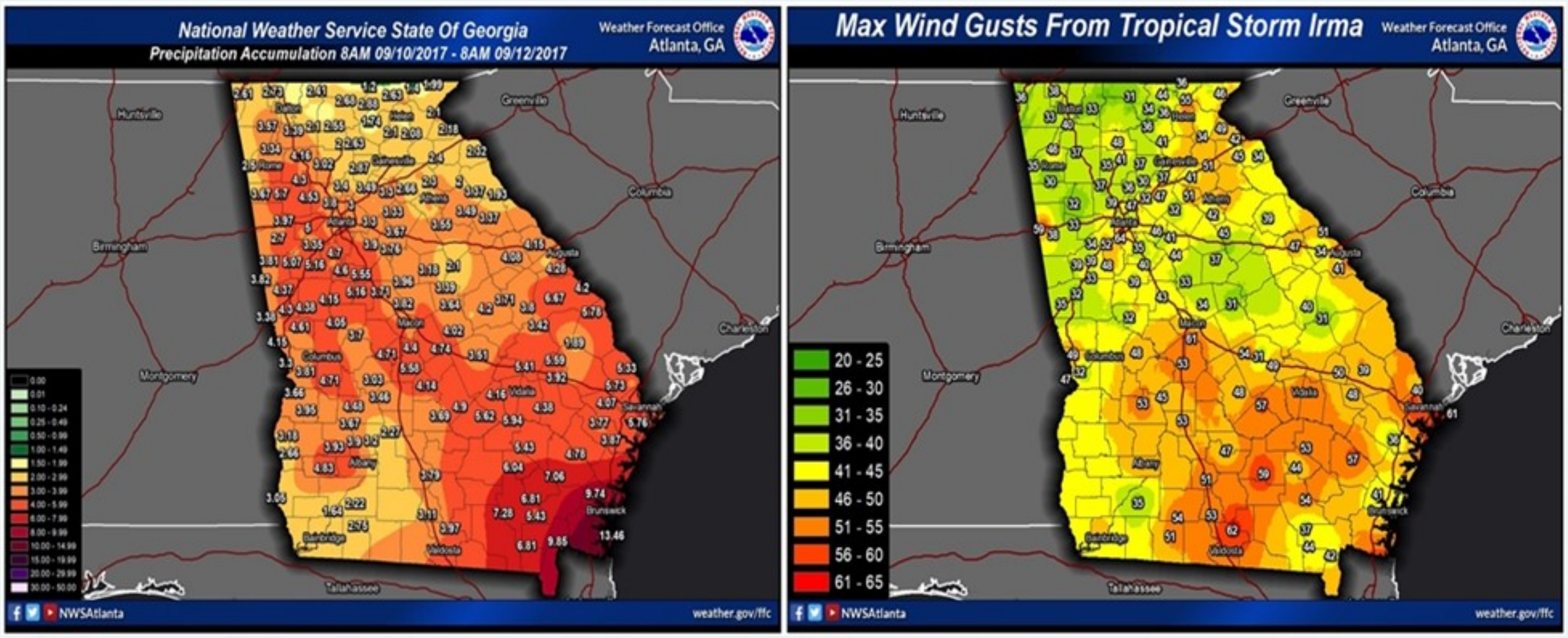


Figure 57. Rainfall in Georgia during Hurricane Irma
(*images and information courtesy of National Weather Service – Peachtree City*)

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

North Georgia Winter Storm

- A winter weather event unfolded across most of north Georgia beginning the evening of Friday, January 6, 2017 and lasted through the morning hours on Saturday, January 7, 2017.
- The result was several inches of snow across much of north Georgia, with significant freezing rain accumulations up to a quarter of an inch across much of the Atlanta metropolitan area.

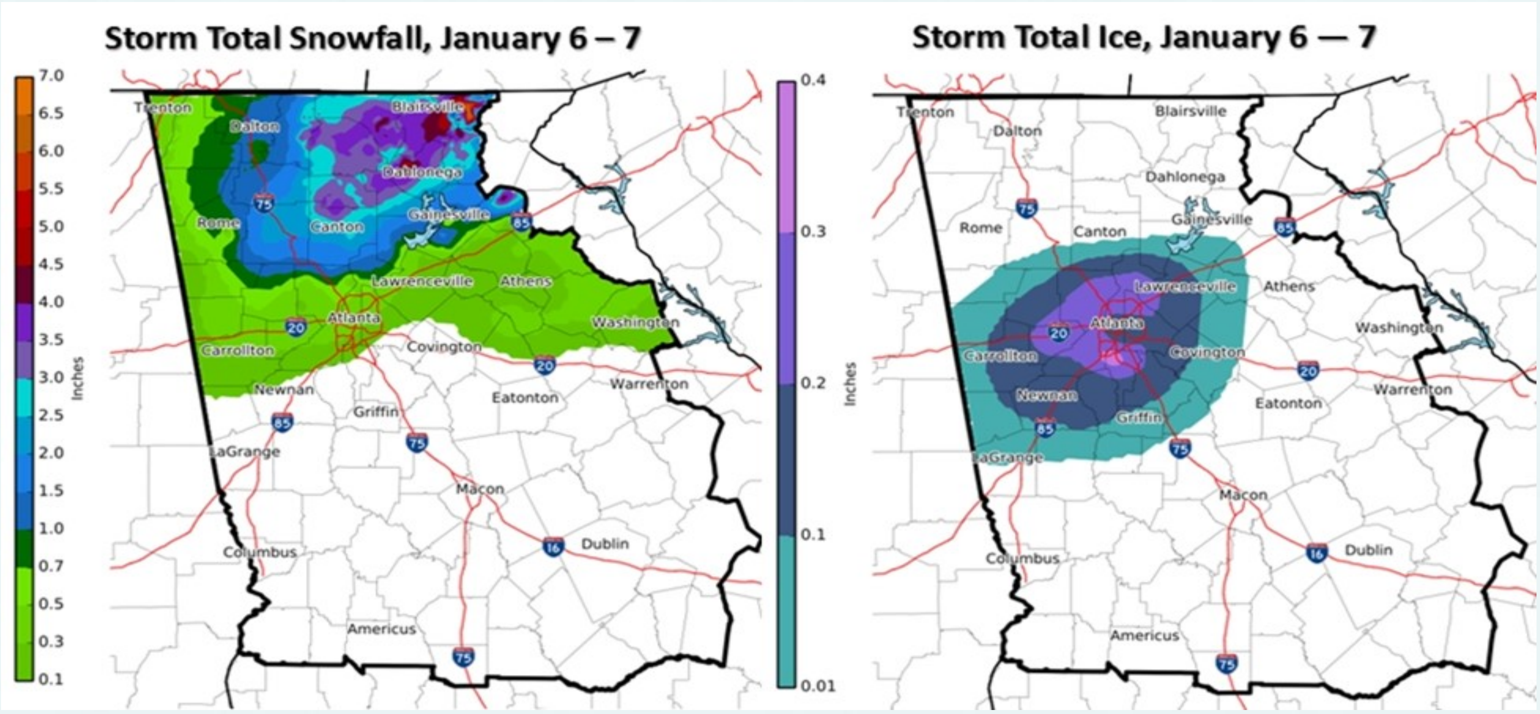


Figure 59. Snowfall in Georgia, January 6-7 *(National Weather Service at Peachtree City)*

Solar Eclipse

- A total solar eclipse of the sun was visible within a narrow pathway across the U.S. on August 21st. Parts of North Georgia were within the path of the shadow.
- There was a noticeable decrease in photochemically-produced ozone detected during the eclipse, as seen in hourly ozone and solar radiation data below.

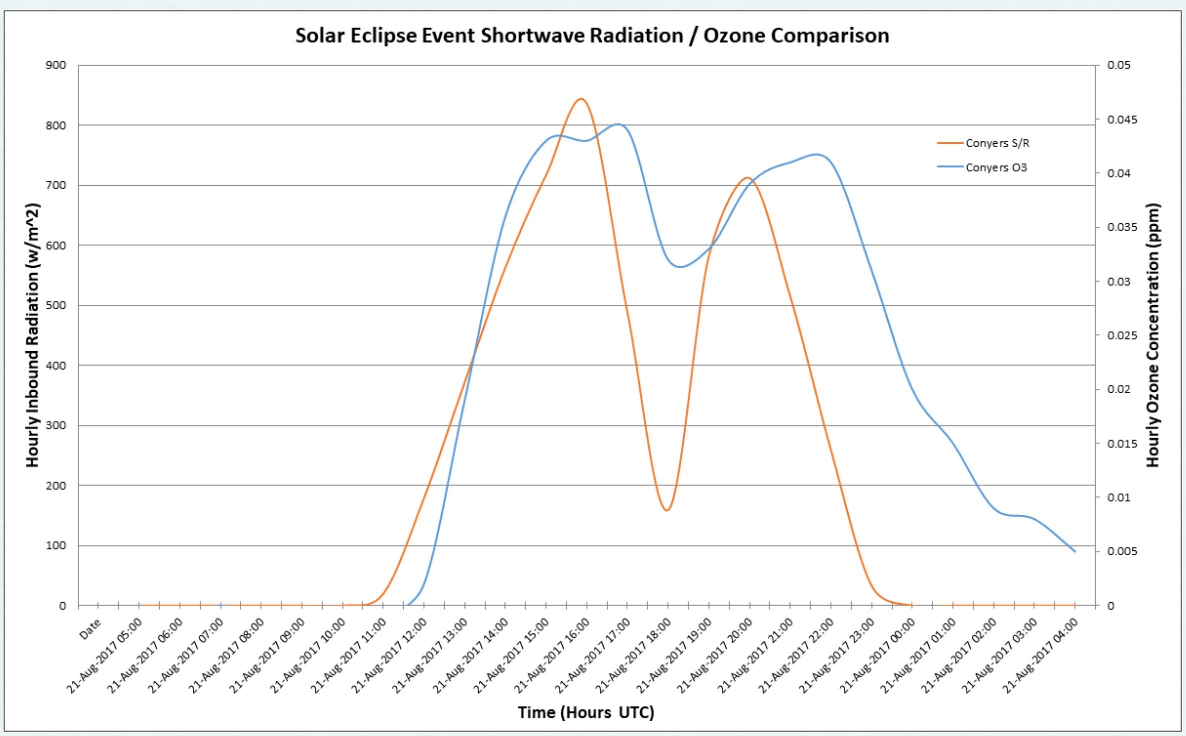


Figure 60. Solar Eclipse Event/Ozone Comparison

2017 Drought Conditions for Georgia

- From January through March, drought conditions were mostly confined to north Georgia with D3 drought conditions present in north Georgia
- Drought conditions migrated southward through mid-June with D3 conditions observed in south Georgia
- All drought conditions were eliminated by July 25th
- By mid-November, much of south Georgia and the Atlanta metro area either showed D0 or D1 drought conditions
- D1 conditions across south Georgia continued to expand through the end of the year

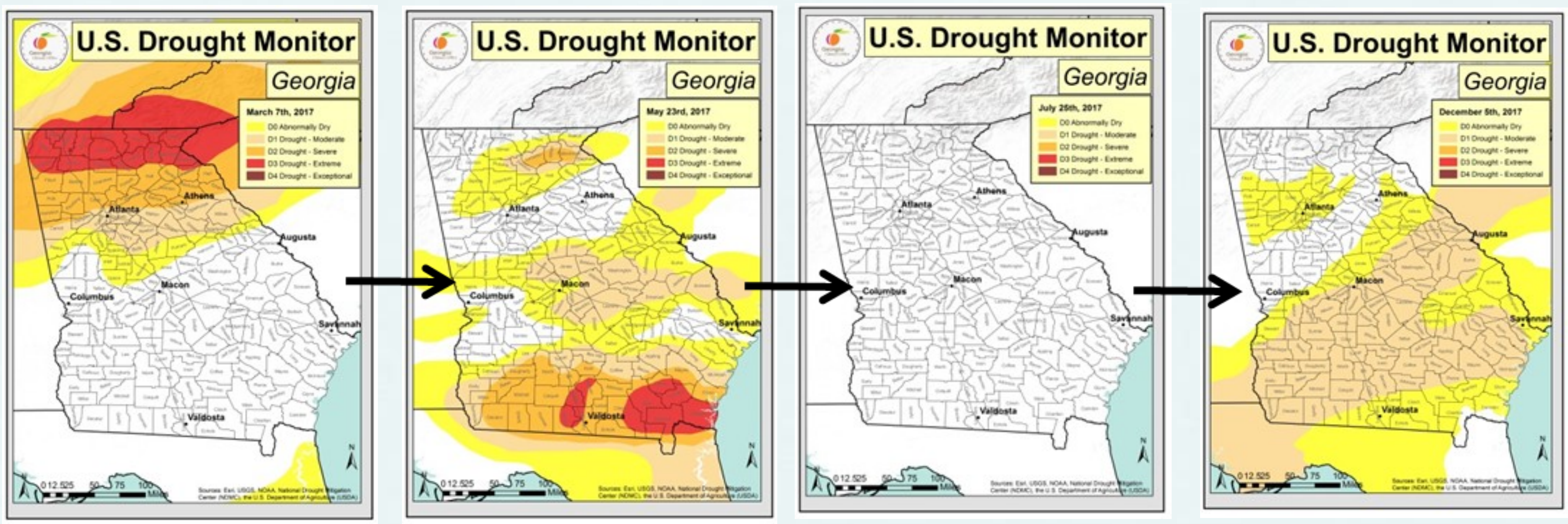


Figure 61. Drought Conditions in Georgia

Agricultural Impacts

- Most of the agricultural impacts were felt in northeast and far south Georgia where drought conditions were most extreme
- Much of the peach crop (around 80%) was devastated by a combinations of the warm winter, a late frost, and lingering stress from the La Nina 2016 drought
- Critical hay shortage during peak drought conditions – with no hay to harvest, farmers had to import scarce, smaller, and more expensive hay with poorer quality
- Numerous reports of reduced amounts of beef and milk produced by livestock, ponds and creeks that were dried up completely, and brush fires

Air Quality Forecasting Statistics

Table 6: Observed Air Quality in 2017

		Observed # of Days in AQI Category			
Metro Area and Pollutant	Total # of days in record	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy
Atlanta Ozone	214	137	67	11	0
Macon Ozone	214	193	21	0	0
Atlanta $PM_{2.5}$	365	217	148	0	0
Columbus $PM_{2.5}$	342	286	56	0	0

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

Table 7: Predicted Air Quality in 2017

	Hits	Misses	False Alarms	Bias	Gross Error	Correlation (-1 to +1)	% Accurate 2 categories	% Accurate 5 categories
Atlanta Ozone	1	9	4	2.7 ppbv	7.2 ppbv	0.76	94	79
Macon Ozone	0	0	0	4.0 ppbv	7.3 ppbv	0.68	100	90
Atlanta $PM_{2.5}$	0	0	0	0.2 $\mu g/m^3$	2.7 $\mu g/m^3$	0.65	100	78
Columbus $PM_{2.5}$	0	0	0	0.5 $\mu g/m^3$	2.5 $\mu g/m^3$	0.61	100	84

Notes:

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

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

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

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

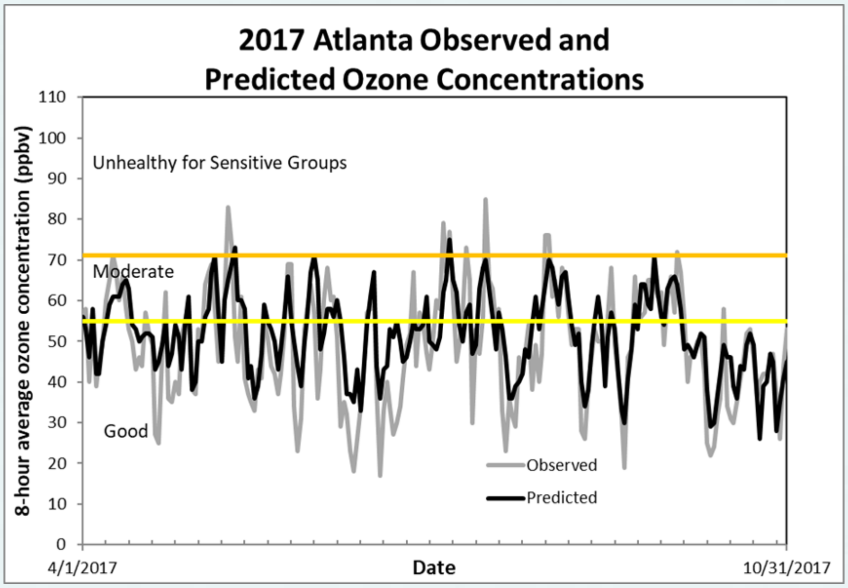
Gross Error is the average absolute error of the predictions relative to the observations.

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

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

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

Observed and Predicted Air Quality:



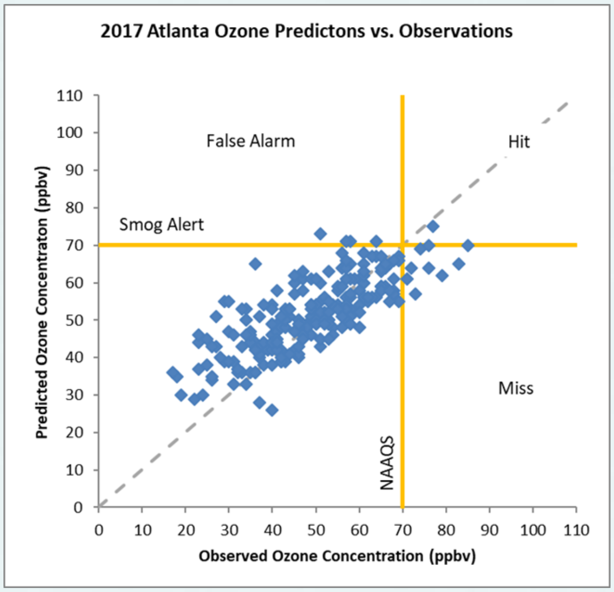
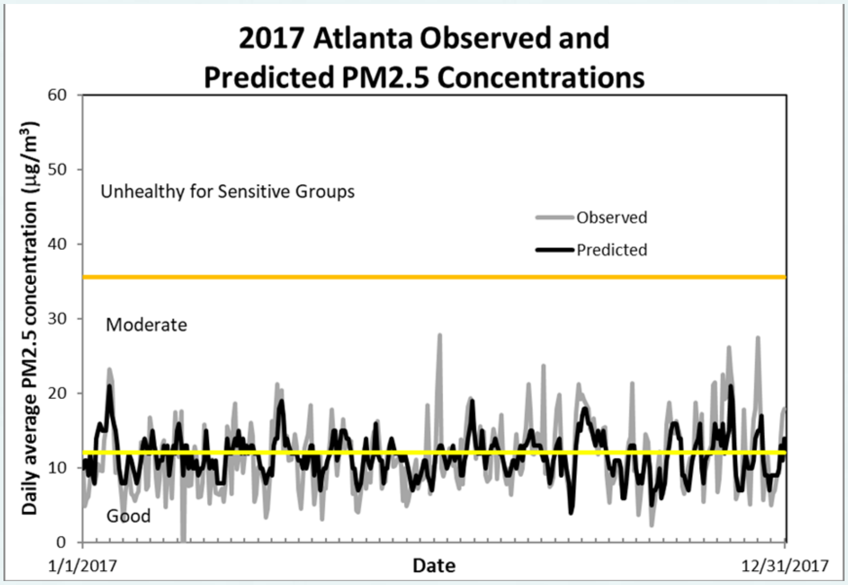


Figure 62. Atlanta observed and predicted ozone, 2017



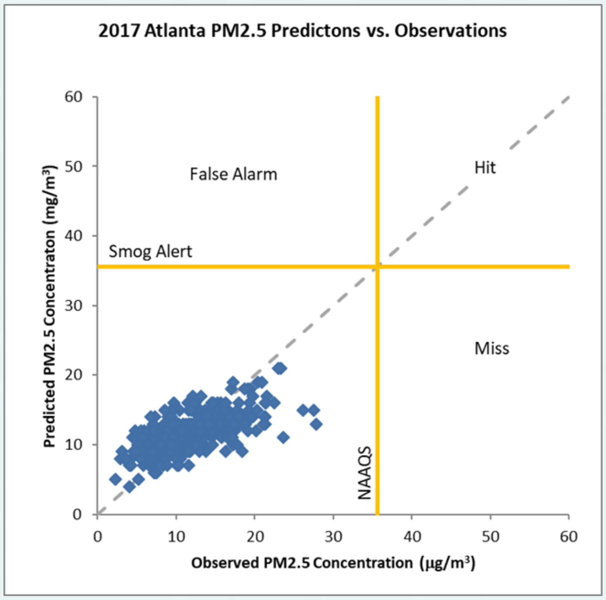


Figure 63. Atlanta observed and predicted $PM_{2.5}$, 2017

Observed and Predicted Air Quality:

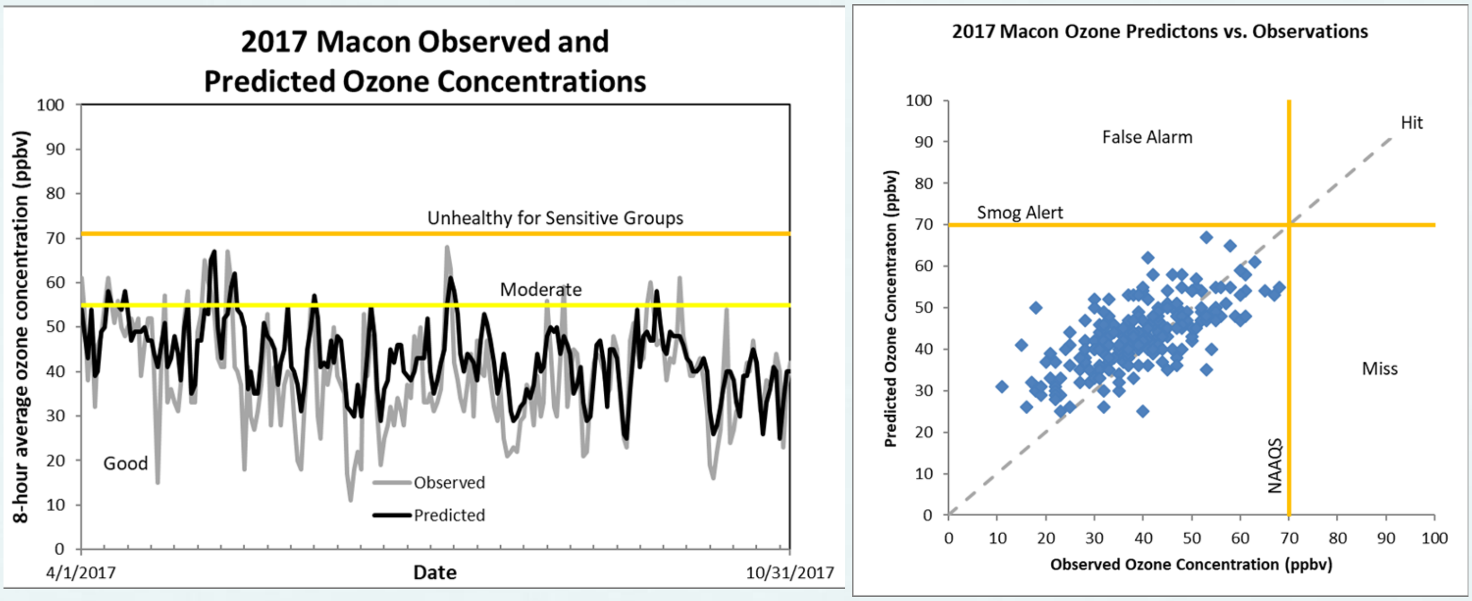


Figure 64. Macon observed and predicted ozone, 2017

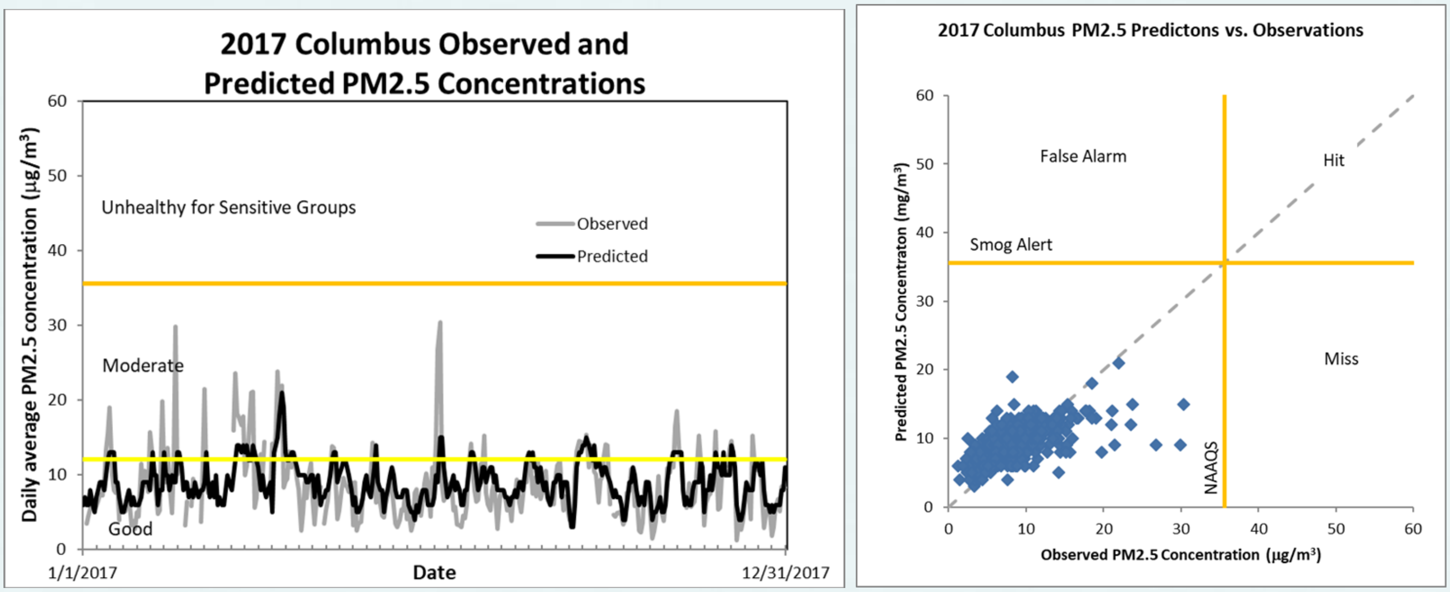


Figure 65. Columbus observed and predicted $PM_{2.5,}$ 2017

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.

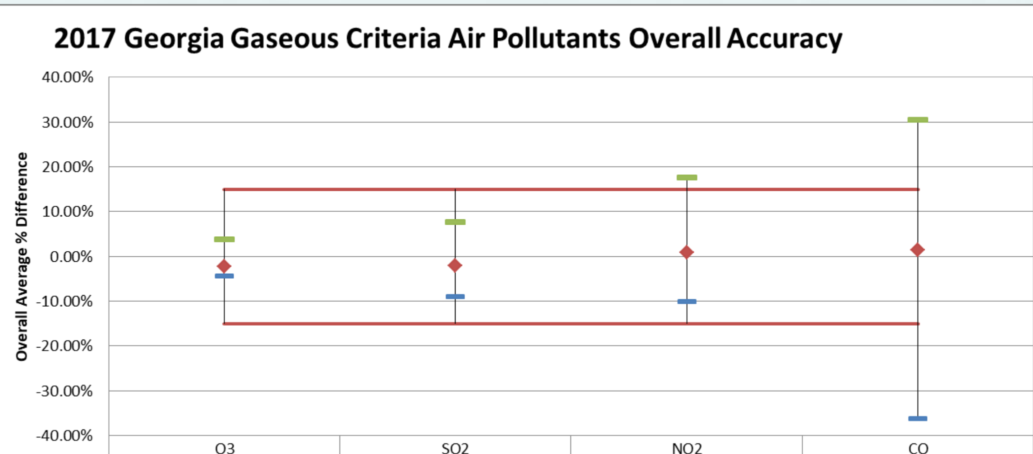
The QA/QC program includes but is not limited to the following activities:

- 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.

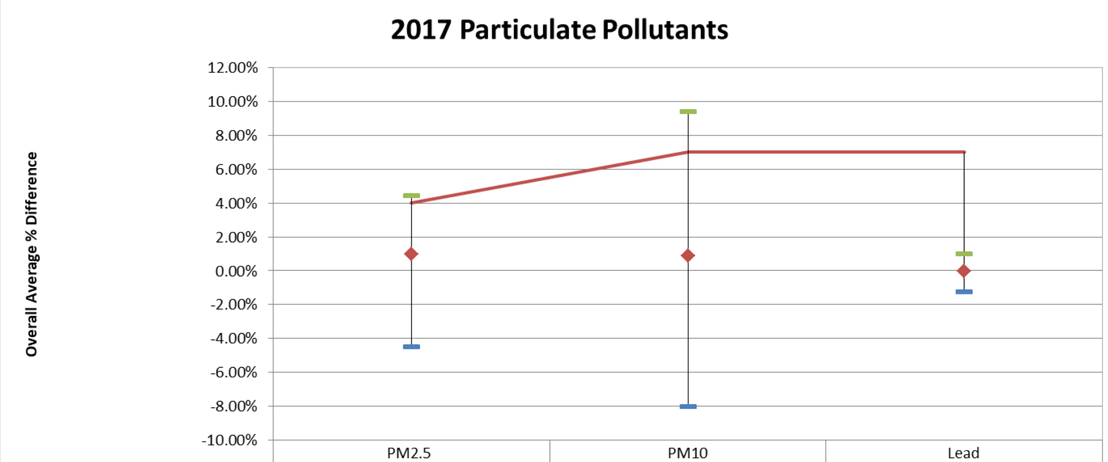
Accuracy Levels



	O3	SO2	NO2	CO
Lower Confidence Limit	-4.41%	-9.16%	-10.29%	-36.32%
Overall Average % Difference	-2.21%	-2.10%	0.90%	1.43%
Upper Confidence Limit	3.73%	7.71%	17.52%	30.47%
Targeted % Difference	15%	15%	15%	15%
Targeted % Difference	-15%	-15%	-15%	-15%

Gaseous Criteria Air Pollutants

Accuracy Levels



	PM2.5	PM10	Lead
Lower Confidence Limit	-4.51%	-8.05%	-1.25%
Overall Average % Difference	1.00%	0.89%	-0.03%
Upper Confidence Limit	4.42%	9.38%	0.98%
Targeted % Difference	4%	7%	7%

Particulate Criteria Air Pollutants

Appendix Section

Appendix A: Georgia Air Monitoring Network

SITE ID	Site Name	COUNTY	O_3	CO	$PM_{2.5}$ FRM	$PM_{2.5}$ Cont.	$PM_{2.5}$ Spec.	PM Coarse	NOx	NO_2	NOy	SO_2	Pb	PM_{10}	PM_{10} Cont.	PAMS VOC	VOC	SVOC	Carb-onyls	Met	Black Car-bon	Met als
Rome MSA																						
131150003	Rome	Floyd				S	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 Rob-ins	Houston			S	S																
Dalton MSA																						
132130003	Fort Moun-tain	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		

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

Appendix A: Georgia Air Monitoring Network (continued)

SITE ID	Site Name	COUNTY	O_3	CO	$PM_{2.5}$ FRM	$PM_{2.5}$ Cont.	$PM_{2.5}$ Spec.	PM Coarse	NO/ NOx	NO_2	NOy	SO_2	Pb	PM_{10}	PM_{10} Cont	PAMS VOC	VOC	SVOC	Carb-onyls	Met	Black Car-bon	Met als
Atlanta-Sandy Springs-Roswell MSA																						
130630091	Forest Park	Clayton			S																	
130670003	Kennesaw	Cobb	S		S																	
130770002	Newnan*	Coweta	S			S														NR		
130850001	Dawsonville	Dawson	S																	NR		
130890002	South DeK-alb	DeKalb	S/	S/ P/C	S/C	S/C	T/C	C	S/P	S/P	S/P/ C	C			C	P	N	N	P/N	P	N	N
130890003	NR-285	DeKalb							R	R			S				R				R	
130970004	Douglasville	Douglas	S																	NR		
131210039	Fire Station	Fulton			S									S								
131210055	Confederate	Fulton	S			S						S								NR		
131210056	NR-GA Tech	Fulton		R	R				R	R										R	R	
131350002	Gwinnett	Gwinnett	S		S	S																
131510002	McDonough	Henry	S			S																
132319991	EPA CAST-	Pike	A																			
132470001	Conyers	Rockdale	S/P																	P		
Chattanooga Tennessee-Georgia MSA																						
132950002	Rossville	Walker			S	S	X															
Not In An MSA																						
130550001	Summerville	Chattooga	S																			
130690002	General	Coffee			S		X										NR	NR				NR
132611001	Leslie	Sumter	S																			
133030001	Sandersville	Washing-ton			S																	

*closed in 2017

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

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

CAS #	Chemical	Screen Value (µg/m^3)	CAS #	Chemical	Screen Value (µg/m^3)
	Metals				
7440-36-0	Antimony	0.02	7440-48-4	Cobalt	0.01
7440-38-2	Arsenic	0.00023	7439-92-1	Lead	0.15
7440-41-7	Beryllium	0.00042	7439-96-5	Manganese	0.3
7440-43-9	Cadmium	0.00056	7440-02-0	Nickel	0.0021
18540-29-9	Chromium**	N/A	7782-49-2	Selenium	2
			7440-66-6	Zinc	N/A
	Semi-Volatiles				
83-32-9	Acenaphthene	0.3	27208-37-3	Cyclopenta(cd)pyrene	N/A
208-96-8	Acenaphthylene	0.3	53-70-3	Dibenzo(a,h)anthracene	0.0017
120-12-7	Anthracene	0.3	206-44-0	Fluoranthene	0.3
56-55-3	Benzo(a)anthracene	0.017	86-73-7	Fluorene	0.3
205-99-2	Benzo(b)fluoranthene	0.017	193-39-5	Indeno(1,2,3-c,d)pyrene	0.017
207-08-9	Benzo(k)fluoranthene	0.17	91-20-3	Naphthalene	0.3***
191-24-2	Benzo(g,h,i)perylene	0.3	85-01-8	Phenanthrene	0.3
50-32-8	Benzo(a)pyrene	0.0017	198-55-0	Perylene	N/A
192-97-2	Benzo(e)pyrene	0.3	129-00-0	Pyrene	0.3
218-01-9	Chrysene	0.091			
	Volatile Organic Compounds				
71-43-2	Benzene	0.13	108-38-3/106-42-3	1,3 and 1,4-Dimethylbenzene (m/p-Xylene)	10
100-52-7	Benzenecarbonal (Benzaldehyde)	N/A	75-07-0	Ethanal (Acetaldehyde)	0.45
100-44-7	Benzyl chloride	0.02	100-41-4	Ethylbenzene	0.4
74-83-9	Bromomethane (Methyl bromide)	0.5	100-42-5	Ethenylbenzene (Styrene)	100
106-99-0	1,3-Butadiene	0.03	622-97-9	Benzene,1-ethenyl-4-methyl (p-Ethyltoluene)	N/A
123-72-8	Butanal (Butyraldehyde)	N/A	76-13-1	Freon 113	N/A
108-90-7	Chlorobenzene (Phenyl chloride)	100	87-68-3	Hexachloro-1,3-Butadiene(Hexachlorobutadiene)	0.045
75-00-3	Chloroethane (Ethyl chloride)	1000	110-54-3	n-Hexane	70
75-01-4	Chloroethene (Vinyl chloride)	0.11	50-00-0	Methanal (Formaldehyde)	0.0769
74-87-3	Chloromethane (Methyl chloride)	9.0	108-88-3	Methylbenzene/Phenylmethane (Toluene)	40
110-82-7	Cyclohexane	6300*	123-38-6	Propanal (Propionaldehyde)	0.8
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	0.002	67-64-1	2-Propanone (Acetone)	32000*
95-50-1	1,2-Dichlorobenzene	210*	107-02-8	Propenal (Acrolein)	0.35
541-73-1	1,3-Dichlorobenzene	N/A	79-34-5	1,1,2,2-Tetrachloroethane	0.017
106-46-7	1,4-Dichlorobenzene	0.091	127-18-4	Tetrachloroethene (Perchloroethylene)	3.846
75-71-8	Dichlorodifluoromethane (Freon 12)	100*	56-23-5	Tetrachlormethane (Carbon tetrachloride)	0.17
75-34-3	1,1-Dichloroethane (Ethylidene chloride)	0.63	120-82-1	1,2,4-Trichlorobenzene	20
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	0.038	526-73-8	1,2,3-Trimethylbenzene	63*
156-59-2	cis-1,2-Dichloroethene	N/A	95-63-6	1,2,4-Trimethylbenzene	63*
75-35-4	1,1-Dichloroethene (1,1-Dichloroethylene)	210*	108-67-8	1,3,5-Trimethylbenzene	N/A
75-09-2	Dichloromethane (Methylene chloride)	100	71-55-6	1,1,1-Trichloroethane (Methyl chloroform)	5000
78-87-5	1,2-Dichloropropane (Propylene dichloride)	0.76*	79-00-5	1,1,2-Trichloroethane	0.063
10061-01-5	cis-1,3-Dichloropropene	N/A	79-01-6	Trichloroethene (Trichloroethylene)	0.244
10061-02-6	trans-1,3-Dichloropropene	N/A	75-69-4	Trichlorofluoromethane (Freon 11)	N/A*
76-14-2	1,1-Dichloro-1,2,2,2-tetrafluoroethane(Freon114)	N/A	67-66-3	Trichloromethane (Chloroform)	9.8
95-47-6	1,2-Dimethylbenzene (o-Xylene)	10			

Sources: 'A Preliminary Risk-Based Screening Approach for Air Toxics Monitoring Data Sets' (U.S. EPA, 2010)(https://archive.org/details/APreliminaryRisk-basedScreeningApproachForAirToxicsMonitoringDataSets), "Table 1. Prioritized Chronic Dose-Response Values for Screening Risk Assessments (6/18/2018)(https://www.epa.gov/sites/production/files/2014-05/documents/table1.pdf)."

*Regional Screening Level (RSL) Summary Table (TR=1E-06. HQ=1) May 2018 (https://semspub.epa.gov/work/HQ/197233.pdf)

**After discussing with GA EPD Laboratory, the chromium sample was clarified to be chromium+3, which does not have a screening value. Therefore, chromium was not assessed.

***Naphthalene: 1 in 10,000 uncertainty in IUR; therefore IUR not used in developing screening value.

Appendix C: Meteorological Instruments used in 2017

PARAMETER	COMPANY	INSTRUMENT	MODEL	LOCATION														
				Augusta	Brunswick	Col Cr Lab	Conf Ave.	Conyers	Dawsonville	S. DeKalb	Sav. Pres	Macon SE	Douglasville	Newnan	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
	R.M. Young	Ultrasonic Anemometer	85000				X					X			X	X		
Ambient Temperature/ Relative Humidity	R.M. Young	TEMP/RH Probe	41375VC	X		X									X			
	R.M. Young	TEMP/RH SENSOR, DEG C	41382VC					X		X	X					X		
Barometric Pressure	R.M. Young	Barometric Pressure Sensor	61201	X				X										
	R.M. Young	Barometric Pressure Sensor	61302V			X				X	X							
Precipitation	Novalynx	Tipping Bucket Rain Gauge	260-2501	X		X		X		X								
Solar Radiation	Eppley Lab	Standard Precision Pyronometer	PSP/ SPP					X										
Total Ultraviolet Radiation	Eppley Lab	Total Ultraviolet Radiometer	TUVR					X										
Data Logger	ESC	Data System Controller	8832	X	X		X	X	X	X	X	X	X	X	X	X	X	X
	ESC	Data System Controller	8816			X												
Towers	Aluma Tower Inc.	Crank-Up Tower	T-135	X	X	X	X	X		X	X	X	X	X			X	X
	Aluma Tower Inc.	Fold-Over Tower	FOT-10						X						X	X		

Appendix D: Pollutant Concentrations

National Ambient Air Quality Standards for Carbon Monoxide

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

Secondary NAAQS: None

Criteria Pollutant Summary Report - 2017

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	7349	2.853	2.292	0	1.4	1.3	0
131210056	Atlanta	Fulton	NR-GA Tech	8460	2.4	2.3	0	2.1	1.8	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 - 2017

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	74	44.9	51.9	51.6	8.72
130890003	Atlanta	DeKalb	NR-285	200	52.5	61.2	58.1	14.91
131210056	Atlanta	Fulton	NR-GA Tech	74	47.2	58.7	52.3	17.93

Pollutant Summary Report - 2017

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	8011	361.6	328	20.36
130890003	Atlanta	DeKalb	NR-285	8504	398.5	385.5	36.79
131210056	Atlanta	Fulton	NR-GA Tech	8361	292.4	251.9	41.96

Pollutant Summary Report - 2017

Pollutant: NOy

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

Site ID	City	County	Site Name	Hours Meas-ured	Max 1-Hour		Annual Arith-metic Mean
					1st	2nd	
130890002	Decatur	DeKalb	South DeKalb	8063	216.0	214.0	21.24

National Ambient Air Quality Standards for Ozone

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

Criteria Pollutant Summary Report - 2017

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	245	.068	.067	.065	.063	0
130510021	Savannah	Chatham	Savannah-E. Pres. St.	220	.063	.058	.058	.057	0
130550001	Summerville	Chattooga	Summerville	240	.059	.059	.057	.057	0
130590002	Athens	Clarke	Athens	244	.069	.066	.063	.063	0
130670003	Kennesaw	Cobb	Kennesaw	245	.069	.067	.065	.065	0
130730001	Evans	Columbia	Evans	245	.072	.061	.059	.058	1
130770002	Newnan	Coweta	Newnan	242	.062	.062	.058	.057	0
130850001	Dawsonville	Dawson	Dawsonville	242	.074	.071	.068	.065	2
130890002	Decatur	DeKalb	South DeKalb	352	.083	.069	.069	.068	1
130970004	Douglasville	Douglas	Douglasville	225	.085	.068	.067	.066	1
131210055	Atlanta	Fulton	Confederate Ave.	235	.081	.077	.076	.074	6
131270006	Brunswick	Glynn	Brunswick	241	.063	.058	.057	.056	0
131350002	Lawrenceville	Gwinnett	Gwinnett Tech	234	.069	.067	.067	.065	0
131510002	McDonough	Henry	McDonough	237	.079	.076	.073	.065	3
132130003	Chatsworth	Murray	Fort Mountain	209	.070	.068	.067	.066	0
132150008	Columbus	Muscogee	Columbus-Airport	244	.065	.064	.063	.058	0
132319991	Williamson	Pike	CASTNET	236	.076	.066	.064	.062	1
132450091	Augusta	Richmond	Augusta	240	.061	.059	.058	.058	0
132470001	Conyers	Rockdale	Conyers	239	.078	.069	.067	.065	1
132611001	Leslie	Sumter	Leslie	240	.060	.059	.059	.058	0

Criteria Pollutant Summary Report - 2017

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	.078	.076
130510021	Savannah	Chatham	Savannah-E. Pres. St.	223	.070	.069
130550001	Summerville	Chattooga	Summerville	240	.072	.064
130590002	Athens	Clarke	Athens	244	.084	.073
130670003	Kennesaw	Cobb	Kennesaw	245	.077	.076
130730001	Evans	Columbia	Evans	245	.077	.073
130770002	Newnan	Coweta	Newnan	243	.073	.072
130850001	Dawsonville	Dawson	Dawsonville	244	.099	.079
130890002	Decatur	DeKalb	South DeKalb	354	.099	.086
130970004	Douglasville	Douglas	Douglasville	239	.097	.078
131210055	Atlanta	Fulton	Confederate Ave.	238	.090	.086
131270006	Brunswick	Glynn	Brunswick	241	.072	.067
131350002	Lawrenceville	Gwinnett	Gwinnett Tech	234	.087	.079
131510002	McDonough	Henry	McDonough	239	.092	.090
132130003	Chatsworth	Murray	Fort Mountain	223	.084	.075
132150008	Columbus	Muscogee	Columbus- Airport	245	.073	.071
132319991	Williamson	Pike	CASTNET	238	.088	.080
132450091	Augusta	Richmond	Augusta	243	.073	.072
132470001	Conyers	Rockdale	Conyers	243	.094	.082
132611001	Leslie	Sumter	Leslie	241	.067	.066

National Ambient Air Quality Standards for Sulfur Dioxide

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

Criteria Pollutant Summary Report - 2017

Pollutant: Sulfur Dioxide

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

Site ID	City	County	Site Name	Hours Meas-ured	Max 24 - Hour		Max 3 - Hour		Max 1-Hour		99th Pctl 1- Hr	Maxi-mum 5-Minute Average	Annual Arith-metic Mean
					1st	2nd	1st	2nd	1st	2nd			
130210012	Macon	Bibb	Macon-Forestry	8467	1.5	1.3	2.2	1.8	8.4	2.3	2.2	5.0	0.60
130510021	Savan-nah	Chat-ham	Savannah-E. Pres. St	8318	10.4	9.6	23.1	22.5	40.8	38.8	35.8	73.4	1.04
130511002	Savan-nah	Chat-ham	Savannah-L&A	8581	12.7	11.6	44.9	41	62.1	59.9	53.2	133.8	1.47
130890002	Decatur	DeKalb	South DeKalb	8174	1.0	0.9	1.5	1.3	2.0	1.9	1.6	3.4	0.16
131150006	Rome	Floyd	Kraftsman	8508	6.8	5.5	21	14	33.1	23.6	21.6	85.6	0.91
131210055	Atlanta	Fulton	Confeder-ate Ave.	8500	2.9	2.5	6.1	5.6	8.5	8.3	7.4	35.5	1.18
132450091	Augusta	Rich-mond	Augusta	8553	8.3	8.1	26.5	25.3	68.3	49.8	34.8	114.3	0.98

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

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

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

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

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

Criteria Pollutant Summary Report - 2017

Pollutant: Particulate Matter $PM_{2.5}$

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

98^{th}% and Annual Arithmetic Mean

Integrated Sampling (midnight to midnight) Using Federal Reference Method

Site ID	City	County	Site Name	Days Meas-ured	98^{th} Percen-tile	Values Exceeding Applicable Daily Standard	Annual Arith-metic Mean
130210007	Macon	Bibb	Macon-Allied	117	18.4	0	9.61
130210012	Macon	Bibb	Macon-Forestry	118	15.1	0	7.11
130510091	Savannah	Chatham	Savannah-Mercer	111	16.4	0	8.14
130590002	Athens	Clarke	Athens	119	15.7	0	7.79
130630091	Forest Park	Clayton	Forest Park	115	19.1	0	9.67
130670003	Kennesaw	Cobb	Kennesaw	119	17.8	0	8.78
130690002	General Coffee	Douglas	General Coffee	96	17.2	0	7.40
130890002	Decatur	DeKalb	South DeKalb	122	20.9	0	8.98
130950007	Albany	Dougherty	Albany	122	25.4	1	9.43
131150003	Rome	Floyd	Rome	3	9.7	0	7.23
131210039	Atlanta	Fulton	Fire Station #8	118	18.3	0	9.77
131210056	Atlanta	Fulton	NR-GA Tech	114	21.6	0	10.38
131270006	Brunswick	Glynn	Brunswick	107	17.1	0	7.46

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

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

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

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

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

Criteria Pollutant Summary Report - 2017

Pollutant: Particulate Matter $PM_{2.5}$

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

98^{th}% and Annual Arithmetic Mean

Integrated Sampling (midnight to midnight) Using Federal Reference Method

Site ID	City	County	Site Name	Days Meas-ured	98^{th} Percentile	Values Exceeding Applicable Daily Stand-ard	Annual Arithmetic Mean
131350002	Lawrenceville	Gwinnett	Gwinnett Tech	109	15.9	0	8.50
131390003	Gainesville	Hall	Gainesville	121	15.2	0	7.47
131530001	Warner Robins	Houston	Warner Robins	115	15.8	0	8.26
131850003	Valdosta	Lowndes	Valdosta	118	20.7	1	8.18
132150001	Columbus	Muscogee	Columbus-Health Dept.	117	20.0	0	9.30
132150008	Columbus	Muscogee	Columbus Airport	121	20.5	0	9.00
132150011	Columbus	Muscogee	Columbus-Cusseta	122	34.0	0	9.70
132230003	Yorkville	Paulding	Yorkville	11	12.6	0	5.55
132450091	Augusta	Richmond	Augusta	120	20.6	0	9.07
132950002	Rossville	Walker	Rossville	109	18.9	0	8.51
133030001	Sandersville	Washing-ton	Sandersville	122	24.0	0	8.59

Pollutant Summary Report - 2017

Pollutant: Particulate Matter $PM_{2.5}$

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

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

Site ID	City	County	Site Name	Hours Meas-ured	1st Max	2nd Max	Annual Arith-metic Mean
130210012*	Macon	Bibb	Macon-Forestry	2192	54.1	53.2	9.41
130511002*	Savannah	Chatham	Savannah-L&A	1215	71.6	50.9	10.93
130890002	Decatur	DeKalb	South DeKalb	8185	46.6	45.3	8.41
130950007	Albany	Dougherty	Albany	6978	132.0	107.0	9.56
131350002*	Lawrenceville	Gwinnett	Gwinnett Tech	1469	45.3	44.1	12.62
131390003*	Gainesville	Hall	Gainesville	2114	31.4	29.2	8.76
132450091*	Augusta	Richmond	Augusta	2112	62.0	59.2	11.21
132950002*	Rossville	Walker	Rossville	2094	47.7	43.9	10.69

*partial year of data, as method changed

Pollutant Summary Report - 2017

Pollutant: Particulate Matter $PM_{2.5}$

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

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
130210012*	Macon	Bibb	Macon-Forestry	5879	45.2	41.6	7.18
130511002*	Savannah	Chatham	Savannah-L&A	7092	129.8	77.4	7.92
130590002	Athens	Clarke	Athens	8597	177.0	172.2	7.79
131210055	Atlanta	Fulton	Confederate Avenue	8487	298.1	88.7	11.25
131350002*	Lawrenceville	Gwinnett	Gwinnett Tech	6862	103.3	84.1	7.38
131390003*	Gainesville	Hall	Gainesville	3018	124.0	84.0	9.75
131510002	McDonough	Henry	McDonough	7498	122.6	52.1	7.97
131530001	Warner Robins	Houston	Warner Robins	7143	82.0	72.0	9.19
131850003	Valdosta	Lowndes	Valdosta	7643	166.0	134.0	10.51
132150008	Columbus	Muscogee	Columbus-Airport	8490	87.5	80.0	8.38
132450091*	Augusta	Richmond	Augusta	5998	143.0	110.1	7.62
132950002*	Rossville	Walker	Rossville	5085	320.0	239.0	9.48

*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 - 2017

Pollutant: Particulate Matter PM_{10}

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

24-Hour Integrated Measurements

Site ID	City	County	Site Name	Days Meas-ured	1st Max	Number Values ≥150	Annual Arithmetic Mean
131210039	Atlanta	Fulton	Fire Station #8	56	33	0	15.6
132450091	Augusta	Richmond	Augusta	58	475*	1	23.3

*house fire nearby site, causing unusually high value

Hourly Continuous Measurements

Site ID	City	County	Site Name	Hours Measured	1st Max	Annual Arith-metic Mean
130890002	Decatur	DeKalb	South DeKalb	8002	47	16.9

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 - 2017

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.	71	71	68
Nov 2016-Jan 2017	0.3592	0.0228	0.0669
Dec 2016-Feb 2017	0.0178	0.0121	0.0052
Jan 2017-Mar 2017	0.0221	0.0119	0.0036
Feb 2017-Apr 2017	0.0399	0.0145	0.0034
Mar 2017-May 2017	0.0443	0.0151	0.0036
Apr 2017-Jun 2017	0.0376	0.0160	0.0028
May 2017-Jul 2017	0.0155	0.0107	0.0023
Jun 2017-Aug 2017	0.0158	0.0109	0.0020
Jul 2017-Sep 2017	0.0371	0.0163	0.0043
Aug 2017-Oct 2017	0.0389	0.0229	0.0055
Sep 2017-Nov 2017	0.0426	0.0258	0.0072
Oct 2017-Dec 2017	0.0287	0.0221	0.0062
# of Values $\geq$ 0.15	1	0	0

PAMS Continuous Hydrocarbon Data (June-August 2017)					
(concentrations in parts per billion Carbon (ppbC))					
Name	Site	#Samples	Avg.	1st Max	2nd Max
PAMSHC	S. DeKalb	1194	45.14	182.50	176.80
TNMOC	S. DeKalb	1198	52.41	210.30	209.50
Ethane	S. DeKalb	1198	4.675	17.71	16.45
Ethylene	S. DeKalb	1198	1.768	10.03	9.01
Propane	S. DeKalb	1198	3.908	54.20	21.29
Propylene	S. DeKalb	1198	0.923	3.85	3.10
Acetylene	S. DeKalb	1198	0.490	7.30	5.20
n-Butane	S. DeKalb	1198	1.707	8.41	8.37
Isobutane	S. DeKalb	1198	0.854	5.11	4.95
trans-2-Butene	S. DeKalb	1198	0.092	17.21	8.79
cis-2-Butene	S. DeKalb	1198	0.054	0.34	0.32
n-Pentane	S. DeKalb	1198	2.277	17.59	15.32
Isopentane	S. DeKalb	1198	3.480	18.43	18.04
1-Pentene	S. DeKalb	1198	0.098	0.40	0.40
trans-2-Pentene	S. DeKalb	1198	0.091	1.94	0.67
cis-2-Pentene	S. DeKalb	1198	0.041	0.30	0.29
3-Methylpentane	S. DeKalb	1198	0.463	2.94	2.94
n-Hexane	S. DeKalb	1198	0.859	4.79	4.67
n-Heptane	S. DeKalb	1198	0.374	1.85	1.77
n-Octane	S. DeKalb	1198	0.098	0.60	0.58

PAMS Continuous Hydrocarbon Data (June-August 2017)(continued)					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
n-Nonane	S. DeKalb	1198	0.090	0.58	0.39
n-Decane	S. DeKalb	1198	0.115	1.19	1.08
Cyclopentane	S. DeKalb	1198	0.326	7.08	6.92
Isoprene	S. DeKalb	1198	5.344	31.19	29.18
2,2-Dimethylbutane	S. DeKalb	1198	0.069	1.01	0.42
2,4-Dimethylpentane	S. DeKalb	1198	0.177	1.35	1.14
Cyclohexane	S. DeKalb	1198	0.154	3.10	0.97
3-Methylhexane	S. DeKalb	1198	0.531	2.98	2.91
2,2,4-Trimethylpentane	S. DeKalb	1198	0.876	5.45	5.03
2,3,4-Trimethylpentane	S. DeKalb	1198	0.242	1.55	1.53
3-Methylheptane	S. DeKalb	1198	0.138	0.85	0.83
Methylcyclohexane	S. DeKalb	1198	0.283	1.63	1.61
Methylcyclopentane	S. DeKalb	1198	0.412	7.39	2.44
2-Methylhexane	S. DeKalb	1198	0.376	2.68	2.03
1-Butene	S. DeKalb	1198	0.327	1.03	0.83
2,3-Dimethylbutane	S. DeKalb	1198	0.133	1.00	0.85
2-Methylpentane	S. DeKalb	1198	0.573	3.37	3.30
2,3-Dimethylpentane	S. DeKalb	1198	0.277	1.51	1.47
n-Undecane	S. DeKalb	1198	0.153	5.69	2.04
2-Methylheptane	S. DeKalb	1940	0.122	0.97	0.90

PAMS Continuous Hydrocarbon Data (June-August 2017) (continued)					
(concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
m & p Xylenes	**S. DeKalb**	**1198**	**1.046**	**6.99**	**6.98**
Benzene	**S. DeKalb**	**1198**	**0.773**	**4.61**	**3.60**
Toluene	**S. DeKalb**	**1198**	**2.589**	**17.40**	**15.95**
Ethylbenzene	**S. DeKalb**	**1198**	**0.349**	**2.35**	**2.12**
o-Xylene	**S. DeKalb**	**1198**	**0.407**	**2.76**	**2.51**
1,3,5-Trimethylbenzene	**S. DeKalb**	**1198**	**0.183**	**2.76**	**1.00**
1,2,4-Trimethylbenzene	**S. DeKalb**	**1198**	**0.405**	**2.42**	**2.41**
n-Propylbenzene	**S. DeKalb**	**1198**	**0.078**	**1.13**	**0.80**
Isopropylbenzene	**S. DeKalb**	**1198**	**0.038**	**0.31**	**0.31**
o-Ethyltoluene	**S. DeKalb**	**1198**	**0.135**	**0.68**	**0.66**
m-Ethyltoluene	**S. DeKalb**	**1198**	**2.141**	**25.23**	**16.29**
m-Diethylbenzene	**S. DeKalb**	**1198**	**0.151**	**1.69**	**1.51**
p-Diethylbenzene	**S. DeKalb**	**1198**	**0.126**	**0.84**	**0.76**
Styrene	**S. DeKalb**	**1198**	**0.248**	**1.59**	**1.50**
1,2,3-Trimethylbenzene	**S. DeKalb**	**1198**	**3.276**	**13.82**	**13.59**
p-Ethyltoluene	**S. DeKalb**	**1198**	**0.220**	**5.50**	**4.22**

PAMS 2017 24-hour Canister Hydrocarbons					
(concentrations in parts per billion Carbon (ppbC))					
Name	Site	#Samples	Avg.	1st Max	2nd Max
PAMSHC	S. DeKalb	56	90.02	260.0	240.0
TNMOC	S. DeKalb	54	320.37	4300.0	1900.0
Ethane	S. DeKalb	56	7.18	21.0	19.0
Ethylene	S. DeKalb	56	0.0	0.0	0.0
Propane	S. DeKalb	56	6.21	17.0	15.0
Propylene	S. DeKalb	56	0.87	2.3	2.2
Acetylene	S. DeKalb	56	1.80	4.9	4.3
n-Butane	S. DeKalb	56	5.98	25.0	16.0
Isobutane	S. DeKalb	56	1.58	5.8	5.3
trans-2-Butene	S. DeKalb	56	0.06	0.6	0.4
cis-2-Butene	S. DeKalb	56	0.02	0.4	0.3
n-Pentane	S. DeKalb	56	7.63	120.0	70.0
Isopentane	S. DeKalb	56	4.90	15.0	14.0
1-Pentene	S. DeKalb	56	0.25	1.1	1.1

PAMS 2017 24-hour Canister Hydrocarbons (continued)					
(concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
trans-2-Pentene	**S. DeKalb**	**56**	**0.17**	**1.7**	**0.8**
cis-2-Pentene	**S. DeKalb**	**56**	**0.13**	**2.7**	**1.6**
3-Methylpentane	**S. DeKalb**	**56**	**1.12**	**4.2**	**3.4**
n-Hexane	**S. DeKalb**	**56**	**1.24**	**7.9**	**3.3**
n-Heptane	**S. DeKalb**	**56**	**0.53**	**1.5**	**1.3**
n-Octane	**S. DeKalb**	**56**	**0.16**	**0.6**	**0.5**
n-Nonane	**S. DeKalb**	**56**	**0.15**	**0.6**	**0.6**
n-Decane	**S. DeKalb**	**56**	**0.26**	**5.3**	**0.8**
Cyclopentane	**S. DeKalb**	**56**	**0.20**	**1.3**	**1.0**
Isoprene	**S. DeKalb**	**56**	**3.44**	**13.0**	**12.0**
2,2-Dimethylbutane	**S. DeKalb**	**56**	**0.35**	**2.2**	**2.1**
2,4-Dimethylpentane	**S. DeKalb**	**56**	**0.22**	**0.9**	**0.9**
Cyclohexane	**S. DeKalb**	**56**	**0.34**	**4.7**	**1.1**
3-Methylhexane	**S. DeKalb**	**56**	**0.71**	**1.9**	**1.8**

PAMS 2017 24-hour Canister Hydrocarbons (continued)					
(concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
2,2,4-Trimethylpentane	**S. DeKalb**	**56**	**1.50**	**6.2**	**5.8**
2,3,4-Trimethylpentane	**S. DeKalb**	**56**	**0.28**	**1.0**	**1.0**
3-Methylheptane	**S. DeKalb**	**56**	**0.09**	**0.6**	**0.4**
Methylcyclohexane	**S. DeKalb**	**56**	**0.38**	**1.0**	**0.9**
Methylcyclopentane	**S. DeKalb**	**56**	**0.59**	**3.1**	**1.4**
2-Methylhexane	**S. DeKalb**	**56**	**0.48**	**1.5**	**1.5**
1-Butene	**S. DeKalb**	**56**	**0.30**	**1.1**	**0.8**
2,3-Dimenthylbutane	**S. DeKalb**	**55**	**0.38**	**1.2**	**1.2**
2-Methylpentane	**S. DeKalb**	**56**	**1.51**	**4.0**	**3.9**
2,3-Dimethylpentane	**S. DeKalb**	**56**	**0.41**	**1.0**	**1.0**
n-Undecane	**S. DeKalb**	**56**	**0.61**	**16.0**	**3.0**
2-Methylheptane	**S. DeKalb**	**56**	**0.09**	**0.6**	**0.5**
m & p Xylenes	**S. DeKalb**	**56**	**1.55**	**4.7**	**4.6**
Benzene	**S. DeKalb**	**56**	**1.73**	**12.0**	**3.7**

PAMS 2017 24-hour Canister Hydrocarbons (continued)					
(concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
Toluene	**S. DeKalb**	**56**	**3.43**	**10.0**	**9.5**
Ethylbenzene	**S. DeKalb**	**56**	**0.54**	**1.5**	**1.4**
o-Xylene	**S. DeKalb**	**56**	**0.68**	**2.0**	**1.9**
1,3,5-Trimethylbenzene	**S. DeKalb**	**56**	**0.23**	**0.9**	**0.8**
1,2,4-Trimethylbenzene	**S. DeKalb**	**56**	**19.20**	**71.0**	**64.0**
n-Propylbenzene	**S. DeKalb**	**56**	**0.03**	**0.4**	**0.4**
Isopropylbenzene	**S. DeKalb**	**56**	**0.00**	**0.2**	**0.0**
o-Ethyltoluene	**S. DeKalb**	**56**	**0.32**	**1.3**	**1.0**
m-Ethyltoluene	**S. DeKalb**	**56**	**0.47**	**1.5**	**1.5**
p-Ethyltoluene	**S. DeKalb**	**56**	**0.56**	**1.6**	**1.4**
m-Diethylbenzene	**S. DeKalb**	**56**	**0.56**	**2.2**	**2.0**
p-Diethylbenzene	**S. DeKalb**	**56**	**0.09**	**0.7**	**0.5**
Styrene	**S. DeKalb**	**56**	**2.45**	**12.0**	**10.0**
1,2,3-Trimethylbenzene	**S. DeKalb**	**56**	**0.23**	**2.0**	**0.7**

2017 Metals					
(concentrations in micrograms per cubic meter (µg/m^3))					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
Antimony	Macon-Forestry	29	0.0008	0.002	0.002
	Savannah-E. Pres. St.	27	0.0013	0.006	0.003
	General Coffee	23	0.0003	0.001	0.001
	South DeKalb*	61	0.0026	0.013	0.011
Arsenic	Macon-Forestry	29	0.0007	0.003	0.002
	Savannah-E. Pres. St.	26	0.0008	0.005	0.002
	General Coffee	23	0.0005	0.001	0.001
	South DeKalb*	61	0.0007	0.002	0.002
Beryllium	Macon-Forestry	29	0.0000	0.000	0.000
	Savannah-E. Pres. St.	27	0.0000	0.000	0.000
	General Coffee	22	0.0000	0.000	0.000
	South DeKalb*	61	0.0000	0.000	0.000
Cadmium	Macon-Forestry	29	0.0000	0.000	0.000
	Savannah-E. Pres. St.	27	0.0001	0.001	0.001
	General Coffee	23	0.0000	0.000	0.000
	South DeKalb*	61	0.0001	0.000	0.000
Chromium	Macon-Forestry	23	0.0091	0.056	0.045
	Savannah-E. Pres. St.	18	0.0045	0.034	0.004
	General Coffee	22	0.0125	0.047	0.041
	South DeKalb*	45	0.0120	0.050	0.046
Cobalt	Macon-Forestry	29	0.0000	0.000	0.000
	Savannah-E. Pres. St.	27	0.0000	0.000	0.000
	General Coffee	23	0.0000	0.001	0.000
	South DeKalb*	61	0.0001	0.000	0.000

2017 Metals (continued)					
(concentrations in µg/m^3)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
Lead	Macon-Forestry	29	0.0021	0.006	0.006
	Savannah-E. Pres. St.	26	0.0032	0.014	0.010
	General Coffee	23	0.0012	0.006	0.002
	South DeKalb*	61	0.0020	0.012	0.007
Manganese	Macon-Forestry	29	0.0089	0.042	0.016
	Savannah-E. Pres. St.	27	0.0109	0.051	0.021
	General Coffee	23	0.0040	0.010	0.009
	South DeKalb*	61	0.0041	0.017	0.013
Nickel	Macon-Forestry	29	0.0010	0.004	0.002
	Savannah-E. Pres. St.	27	0.0012	0.004	0.002
	General Coffee	23	0.0014	0.003	0.003
	South DeKalb*	61	0.0007	0.001	0.001
Selenium	Macon-Forestry	29	0.0003	0.001	0.001
	Savannah-E. Pres. St.	26	0.0001	0.002	0.000
	General Coffee	23	0.0000	0.001	0.000
	South DeKalb*	61	0.0001	0.001	0.001
Zinc	Macon-Forestry	9	0.0204	0.046	0.040
	Savannah-E. Pres. St.	5	0.0264	0.062	0.027
	General Coffee	5	0.0102	0.015	0.012
	South DeKalb*	21	0.0117	0.043	0.023

*Sample collected every 6 days.

2017 Semi-Volatile Compounds					
(concentrations in µg/m^3)					
Name	**Site**	**#Samples**	**Avg.****	**1st Max**	**2nd Max**
Acenaphthene	Macon-Forestry	24	0.0040	0.010	0.009
	Savannah-E. Pres. St.	21	0.0022	0.005	0.004
	General Coffee	19	0.0096	0.004	0.003
	South DeKalb*	59	0.0015	0.010	0.006
Acenaphthylene	Macon-Forestry	24	0.0001	0.001	0.000
	Savannah-E. Pres. St.	19	0.0003	0.003	0.001
	General Coffee	19	0.0005	0.002	0.001
	South DeKalb*	56	0.0002	0.002	0.002
Anthracene	Macon-Forestry	24	0.0001	0.001	0.000
	Savannah-E. Pres. St.	21	0.0000	0.000	0.000
	General Coffee	19	0.0000	0.000	0.000
	South DeKalb*	59	0.0001	0.000	0.000
Benzo(a)anthracene	Macon-Forestry	24	0.0000	0.000	0.000
	Savannah-E. Pres. St.	21	0.0000	0.000	0.000
	General Coffee	19	0.0002	0.001	0.001
	South DeKalb*	59	0.0000	0.001	0.000
Benzo(a)pyrene	Macon-Forestry	24	0.0000	0.000	0.000
	Savannah-E. Pres. St.	21	0.0000	0.000	0.000
	General Coffee	19	0.0000	0.000	0.000
	South DeKalb*	59	0.0000	0.000	0.000
Benzo(b)fluoranthene	Macon-Forestry	24	0.0001	0.000	0.000
	Savannah-E. Pres. St.	21	0.0002	0.002	0.000
	General Coffee	19	0.0000	0.000	0.000
	South DeKalb*	59	0.0001	0.001	0.001
Benzo(e)pyrene	Macon-Forestry	24	0.0000	0.000	0.000
	Savannah-E. Pres. St.	21	0.0001	0.001	0.000
	General Coffee	19	0.0000	0.000	0.000
	South DeKalb*	59	0.0001	0.000	0.000

2017 Semi-Volatile Compounds (continued) (concentrations in µg/m³)					
Name	Site	#Samples	Avg.**	1st Max	2nd Max
Benzo(g,h,i)perylene	Macon-Forestry	24	0.0000	0.000	0.000
	Savannah-E. Pres. St.	21	0.0001	0.001	0.000
	General Coffee	19	0.0000	0.000	0.000
	South DeKalb*	59	0.0001	0.001	0.000
Benzo(k)fluoranthene	Macon-Forestry	24	0.0000	0.000	0.000
	Savannah-E. Pres. St.	21	0.0000	0.000	0.000
	General Coffee	19	0.0000	0.000	0.000
	South DeKalb*	59	0.0000	0.000	0.000
Chrysene	Macon-Forestry	24	0.0001	0.000	0.000
	Savannah-E. Pres. St.	21	0.0001	0.001	0.000
	General Coffee	19	0.0006	0.002	0.001
	South DeKalb*	59	0.0000	0.000	0.000
Dibenzo(a,h)anthracene	Macon-Forestry	24	0.0000	0.000	0.000
	Savannah-E. Pres. St.	21	0.0000	0.001	0.000
	General Coffee	19	0.0000	0.000	0.000
	South DeKalb*	59	0.0000	0.000	0.000
Fluoranthene	Macon-Forestry	24	0.0013	0.005	0.004
	Savannah-E. Pres. St.	21	0.0009	0.002	0.002
	General Coffee	19	0.0021	0.007	0.005
	South DeKalb*	59	0.0006	0.002	0.002
Fluorene	Macon-Forestry	24	0.0029	0.006	0.006
	Savannah-E. Pres. St.	21	0.0002	0.004	0.004
	General Coffee	19	0.0019	0.006	0.003
	South DeKalb*	59	0.0004	0.003	0.003
Indeno(1,2,3-cd)pyrene	Macon-Forestry	24	0.0000	0.000	0.000
	Savannah-E. Pres. St.	21	0.0001	0.001	0.000
	General Coffee	19	0.0000	0.000	0.000
	South DeKalb*	59	0.0001	0.000	0.000

2017 Semi-Volatile Compounds (continued) (concentrations in µg/m³)					
Name	**Site**	**#Samples**	**Avg.****	**1st Max**	**2nd Max**
Naphthalene	Macon-Forestry	24	0.0283	0.054	0.045
	Savannah-E. Pres. St.	21	0.0250	0.056	0.046
	General Coffee	19	0.0096	0.023	0.020
	South DeKalb*	58	0.0437	0.130	0.120
Phenanthrene	Macon-Forestry	24	0.0065	0.018	0.018
	Savannah-E. Pres. St.	21	0.0004	0.008	0.008
	General Coffee	19	0.0049	0.015	0.010
	South DeKalb*	59	0.0003	0.010	0.008
Pyrene	Macon-Forestry	24	0.0005	0.002	0.001
	Savannah-E. Pres. St.	21	0.0004	0.001	0.001
	General Coffee	19	0.0026	0.009	0.007
	South DeKalb*	59	0.0004	0.001	0.001
Perylene	South DeKalb*	59	0.0000	0.000	0.000

*Sample collected every 6 days.

2017 Volatile Organic Compounds (concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
Freon 113	Macon-Forestry	29	0.12	0.2	0.2
	Savannah-E. Pres. St.	28	0.12	0.2	0.2
	General Coffee	30	0.12	0.2	0.2
	South DeKalb*	58	0.12	0.2	0.2
	NR-285	28	0.12	0.2	0.2
Freon 114	Macon-Forestry	29	0.02	0.1	0.1
	Savannah-E. Pres. St.	28	0.01	0.1	0.1
	General Coffee	30	0.01	0.1	0.1
	South DeKalb*	58	0.01	0.1	0.1
	NR-285	28	0.02	0.1	0.1
1,3-Butadiene	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.00	0.0	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0
Cyclohexane	Macon-Forestry	29	0.18	1.0	0.8
	Savannah-E. Pres. St.	28	0.11	1.4	0.2
	General Coffee	30	0.01	0.1	0.1
	South DeKalb*	58	0.07	0.3	0.2
	NR-285	28	0.10	0.3	0.3
Chloromethane	Macon-Forestry	29	0.53	0.7	0.6
	Savannah-E. Pres. St.	28	0.69	1.1	0.9
	General Coffee	30	0.61	1.7	0.8
	South DeKalb*	58	0.51	0.7	0.7
	NR-285	28	0.54	0.7	0.7
Dichloromethane	Macon-Forestry	29	0.13	0.5	0.2
	Savannah-E. Pres. St.	28	0.13	0.4	0.2
	General Coffee	30	0.11	0.2	0.2
	South DeKalb*	58	0.13	0.6	0.2
	NR-285	28	0.13	0.3	0.2

2017 Volatile Organic Compounds (continued) (concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
Chloroform	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.00	0.1	0.0
	General Coffee	30	0.03	0.1	0.1
	South DeKalb*	58	0.01	0.1	0.1
	NR-285	28	0.00	0.0	0.0
Carbon tetrachloride	Macon-Forestry	29	0.09	0.1	0.1
	Savannah-E. Pres. St.	28	0.10	0.1	0.1
	General Coffee	30	0.09	0.1	0.1
	South DeKalb*	58	0.09	0.1	0.1
	NR-285	28	0.10	0.1	0.1
Trichlorofluoromethane	Macon-Forestry	29	0.21	0.3	0.3
	Savannah-E. Pres. St.	28	0.20	0.3	0.2
	General Coffee	30	0.20	0.3	0.2
	South DeKalb*	58	0.22	0.4	0.3
	NR-285	28	0.20	0.2	0.2
Chloroethane	Macon-Forestry	29	0.01	0.1	0.1
	Savannah-E. Pres. St.	28	0.01	0.1	0.1
	General Coffee	30	0.05	0.1	0.1
	South DeKalb*	58	0.01	0.1	0.1
	NR-285	28	0.01	0.1	0.1
1,1-Dichloroethane	Macon-Forestry	29	0.00	0.1	0.0
	Savannah-E. Pres. St.	28	0.00	0.1	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0
Methyl chloroform	Macon-Forestry	29	0.00	0.1	0.0
	Savannah-E. Pres. St.	28	0.00	0.0	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0

0.02017 Volatile Organic Compounds (continued)					
(concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
Ethylene dichloride	Macon-Forestry	29	0.03	0.1	0.1
	Savannah-E. Pres. St.	28	0.01	0.1	0.1
	General Coffee	30	0.01	0.1	0.1
	South DeKalb*	58	0.02	0.1	0.1
	NR-285	28	0.02	0.1	0.1
Tetrachloroethylene	Macon-Forestry	29	0.00	0.1	0.0
	Savannah-E. Pres. St.	28	0.01	0.1	0.1
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.01	0.1	0.1
	NR-285	28	0.01	0.1	0.1
1,1,2,2-Tetrachloroethane	Macon-Forestry	29	0.00	0.1	0.0
	Savannah-E. Pres. St.	28	0.00	0.0	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0
Bromomethane	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.00	0.1	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0
1,1,2-Trichloroethane	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.00	0.0	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0
Dichlorodifluoromethane	Macon-Forestry	29	0.42	0.6	0.5
	Savannah-E. Pres. St.	28	0.46	0.6	0.5
	General Coffee	30	0.43	0.5	0.5
	South DeKalb*	58	0.44	0.6	0.6
	NR-285	28	0.44	0.6	0.5

2017 Volatile Organic Compounds (continued)					
(concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
Trichloroethylene	Macon-Forestry	29	0.00	0.1	0.0
	Savannah-E. Pres. St.	28	0.00	0.0	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0
1,1-Dichloroethylene	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.08	0.2	0.2
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.1	0.0
	NR-285	28	0.00	0.1	0.0
1,2-Dichloropropane	Macon-Forestry	29	0.01	0.1	0.1
	Savannah-E. Pres. St.	28	0.01	0.1	0.1
	General Coffee	30	0.01	0.1	0.1
	South DeKalb*	58	0.01	0.1	0.1
	NR-285	28	0.01	0.1	0.1
trans-1,3-Dichloropropene	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.00	0.0	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0
cis-1,3-Dichloropropene	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.00	0.0	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0
cis-1,2-Dichloroethene	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.00	0.0	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0

2017 Volatile Organic Compounds (continued)					
(concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
Ethylene dibromide	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.00	0.0	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0
Hexachlorobutadiene	Macon-Forestry	29	0.00	0.1	0.0
	Savannah-E. Pres. St.	28	0.00	0.0	0.0
	General Coffee	30	0.01	0.1	0.1
	South DeKalb*	58	0.00	0.1	0.0
	NR-285	28	0.00	0.0	0.0
Vinyl chloride	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.00	0.1	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.00	0.0	0.0
	NR-285	28	0.00	0.0	0.0
m/p Xylene	Macon-Forestry	29	0.29	1.0	0.7
	Savannah-E. Pres. St.	28	0.34	2.4	0.8
	General Coffee	30	0.02	0.2	0.1
	South DeKalb*	58	0.54	2.7	2.2
	NR-285	28	0.51	1.4	1.4
Benzene	Macon-Forestry	29	0.56	1.5	1.2
	Savannah-E. Pres. St.	28	0.69	2.4	1.2
	General Coffee	30	0.54	2.0	1.1
	South DeKalb*	58	1.07	3.0	2.9
	NR-285	28	1.05	2.0	2.0
Toluene	Macon-Forestry	29	0.90	2.6	2.2
	Savannah-E. Pres. St.	28	0.88	7.7	2.1
	General Coffee	30	0.17	0.4	0.3
	South DeKalb*	58	1.50	7.0	6.4
	NR-285	28	1.92	16.8	3.7

2017 Volatile Organic Compounds (continued)					
(concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
Ethylbenzene	Macon-Forestry	29	0.17	0.5	0.4
	Savannah-E. Pres. St.	28	0.09	0.6	0.2
	General Coffee	30	0.00	0.1	0.0
	South DeKalb*	58	0.16	0.7	0.6
	NR-285	28	0.15	0.4	0.3
o- Xylene	Macon-Forestry	29	0.16	0.4	0.4
	Savannah-E. Pres. St.	28	0.11	0.8	0.3
	General Coffee	30	0.00	0.1	0.0
	South DeKalb*	58	0.22	1.0	0.8
	NR-285	28	0.18	0.4	0.4
1,3,5-Trimethylbenzene	Macon-Forestry	29	0.00	0.0	0.0
	Savannah-E. Pres. St.	28	0.00	0.1	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.02	0.2	0.2
	NR-285	28	0.01	0.1	0.1
1,2,4-Trimethylbenzene	Macon-Forestry	29	0.06	0.2	0.2
	Savannah-E. Pres. St.	28	0.08	0.5	0.4
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.21	1.1	0.7
	NR-285	28	0.17	0.5	0.4
Styrene	Macon-Forestry	29	0.80	2.6	1.7
	Savannah-E. Pres. St.	28	0.01	0.1	0.1
	General Coffee	30	0.00	0.1	0.0
	South DeKalb*	58	0.66	5.5	5.3
	NR-285	28	0.03	0.1	0.1
Benzene,1-ethenyl-4-methyl	Macon-Forestry	29	0.00	0.1	0.0
	Savannah-E. Pres. St.	28	0.00	0.1	0.0
	General Coffee	30	0.00	0.0	0.0
	South DeKalb*	58	0.03	0.3	0.2
	NR-285	28	0.01	0.1	0.1

2017 Volatile Organic Compounds (continued)					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Chlorobenzene	Macon-Forestry	29	0.03	0.2	0.1
	Savannah-E. Pres. St.	28	0.03	0.1	0.1
	General Coffee	30	0.05	0.2	0.2
	South DeKalb*	58	0.03	0.2	0.1
	NR-285	28	0.02	0.1	0.1
1,2-Dichlorobenzene	Macon-Forestry	29	0.02	0.1	0.1
	Savannah-E. Pres. St.	28	0.01	0.1	0.1
	General Coffee	30	0.01	0.1	0.1
	South DeKalb*	58	0.01	0.1	0.1
	NR-285	28	0.01	0.1	0.1
1,3-Dichlorobenzene	Macon-Forestry	29	0.06	0.4	0.3
	Savannah-E. Pres. St.	28	0.01	0.1	0.1
	General Coffee	30	0.01	0.1	0.1
	South DeKalb*	58	0.02	0.2	0.1
	NR-285	28	0.01	0.1	0.1
1,4-Dichlorobenzene	Macon-Forestry	29	0.04	0.1	0.1
	Savannah-E. Pres. St.	28	0.02	0.1	0.1
	General Coffee	30	0.02	0.1	0.1
	South DeKalb*	58	0.10	0.3	0.3
	NR-285	28	0.08	0.2	0.2
Benzyl chloride	Macon-Forestry	29	0.01	0.1	0.1
	Savannah-E. Pres. St.	28	0.01	0.1	0.1
	General Coffee	30	0.01	0.1	0.1
	South DeKalb*	58	0.01	0.2	0.2
	NR-285	28	0.00	0.1	0.0
1,2,4-Trichlorobenzene	Macon-Forestry	29	0.05	0.2	0.2
	Savannah-E. Pres. St.	28	0.05	0.2	0.2
	General Coffee	30	0.08	0.2	0.2
	South DeKalb*	58	0.04	0.2	0.2
	NR-285	28	0.04	0.1	0.1

*Sample collected every 6 days

2017 Black Carbon							
(concentrations in micrograms per cubic meter)							
Site ID	City	County	Site Name	Hours Measured	Annual Mean	1st Max	2nd Max
130890003	Decatur	DeKalb	NR-285	8704	2.225	249.78	249.78
131210056	Atlanta	Fulton	NR-GA Tech	8715	2.146	16.88	13.45

2017 Carbonyl Compounds, 8-hour					
(concentrations in ppbC)					
Name	Site	#Samples	Avg.	1st Max	2nd Max
Formaldehyde	South DeKalb	81	2.09	6.7	6.0
Acetaldehyde	South DeKalb	81	1.01	2.5	2.5
Butyraldehyde	South DeKalb	81	0.5017	2.481	2.140

2017 Carbonyl Compounds, 24-hour					
(concentrations in ppbC)					
Name	**Site**	**#Samples**	**Avg.**	**1st Max**	**2nd Max**
Formaldehyde	Savannah-E. Pres. St.	26	0.30	0.7	0.5
	South DeKalb*	57	1.39	3.9	3.0
Acetaldehyde	Savannah-E. Pres. St.	26	0.15	0.3	0.3
	South DeKalb*	57	1.14	2.7	2.2
Propionaldehyde	Savannah-E. Pres. St.	26	0.01	0.1	0.1
	South DeKalb*	57	1.17	7.4	6.2
Butyraldehyde	Savannah-E. Pres. St.	26	0.0119	0.060	0.048
	South DeKalb*	57	0.3157	1.975	1.888
Acetone	Savannah-E. Pres. St.	26	0.60	1.5	1.5
	South DeKalb*	57	1.23	5.4	5.3
Benzaldehyde	Savannah-E. Pres. St.	26	0.03	0.3	0.1
	South DeKalb*	57	0.11	0.7	0.6
Acrolein (with canister method)	Savannah-E. Pres. St.	28	0.44	1.2	0.8
	NR-285	28	0.46	1.4	1.1
	Macon	29	0.80	1.8	1.4
	General Coffee	30	0.37	0.9	0.7
	South DeKalb*	58	0.53	1.5	1.1

* Sample collected every 6 days