



Air Pollution in Metro Atlanta and Georgia

Students will use the Internet to investigate the role human beings play in creating air pollution (particularly ground level ozone and smog). Students will identify the major components of air pollution in metro Atlanta as ground level ozone combined with particulate matter. They will recognize that ground-level ozone is a major component of smog. Students will also demonstrate how the Air Quality Index (AQI) and Smog Alerts are used to inform the public about air quality, by using an Interactive AQI Calculator to determine when public health is at risk and issuing smog alerts for the imaginary land of Atlantis. A Teacher Resource Manual, PowerPoint presentations, and other lesson resources are included. This is the first lesson in the "Ground Level Ozone" unit. (Environmental Education)

*Education
Committee*

*The Clean Air
Campaign*

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Primary Learning Outcomes

What are the major components of air pollution in metro Atlanta and in Georgia? In what ways do human beings contribute to air pollution? How does burning fuel affect the atmosphere?

Additional Learning Outcomes

What is the Air Quality Index(AQI)? What is a Smog Alert? How do Smog Alerts and the AQI inform the public about air quality?

Assessed GPS Standards:

Grade: 6

Science Standards:

S6E5i: Students will investigate the scientific view of how the earth's surface is formed.

- i. Explain the effects of human activity on the erosion of the earth's surface.
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Non-Assessed GPS Standards:

Grade: 6

Math Standards:

M6D1: Students will pose questions, collect data, represent and analyze the data, and interpret results.

- a. Formulate questions that can be answered by data. Students should collect data by using samples from a larger population (surveys), or by conducting experiments.
- b. Using data, construct frequency distributions, frequency tables, and graphs.
- c. Choose appropriate graphs to be consistent with the nature of the data (categorical or numerical). Graphs should include pictographs, histograms, bar graphs, line graphs, circle graphs, and line plots.
- d. Use tables and graphs to examine variation that occurs within a group and variation that occurs between groups.
- e. Relate the data analysis to the context of the questions posed.

M6P4: Students will make connections among mathematical ideas and to other disciplines.

- a. Recognize and use connections among mathematical ideas.
- b. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.
- c. Recognize and apply mathematics in contexts outside of mathematics.

M6P5: Students will represent mathematics in multiple ways.

- a. Create and use representations to organize, record, and communicate mathematical ideas.
- b. Select, apply, and translate among mathematical representations to solve problems.
- c. Use representations to model and interpret physical, social, and mathematical phenomena.

Procedures/Activities

Step: 1 Duration: Teacher Preparation

Introduction

The Clean Air Campaign is pleased to provide Georgia standards-based air quality unit plans for the 4th through 8th grades. We hope that you will implement the following 8th grade lesson plan and offer your feedback. Teacher input and suggestions will be reviewed and incorporated into future updates of this lesson plan. We look forward to hearing from you at mail@cleanaircampaign.com

Review the Teacher Resource Manual

The Teacher Resource Manual provides background information on the lesson topic and other lesson resources which may be used to answer students' questions and facilitate class discussions. Review all steps in this lesson prior to beginning so that you will know what to prepare in advance for your class. Be sure to collect all the items listed in the materials section, and to make transparencies and hand-outs (as attached throughout the lesson) ahead of time. Find out if your school has a policy regarding recess, sports practice, or band practice during Smog Alert days (see step 5).

Note: This lesson is the first in a unit focusing on ground level ozone and weather. Upon completion of the unit, students will recognize the role that humans play in causing air pollution, know which components make up smog, understand the correlation between weather and ground-level ozone, and identify strategies for preventing and reducing air pollution. Web resources listed below are hyper-linked in the Teacher Resource Manual, attached at this step.

Web Resources for Step 1

Title: 8th Grade Teacher Resource Manual

URL: http://eeingeorgia.org/content/ee/docs/8th_CAC_Manual.doc

Annotation: The Teacher's Resource Manual provides background information on the lesson topic and other lesson resources which may be used to answer students' questions and facilitate class discussions. Please review this manual thoroughly before beginning the lesson. Graphics courtesy of www.epa.gov. Web sites listed in this document are also linked in the Web Resources section at this step.

Title: Ambient Monitoring Program

URL: <http://www.air.dnr.state.ga.us/amp>

Annotation: This Web site is hyper-linked in the 8th Grade Teacher Resource Manual linked at this step. It is managed by the Georgia Department of Natural Resources, and offers current and recent (past three days) data on concentration levels of major air pollutants.

Title: Ambient Monitoring Program Database Query

URL: http://www.air.dnr.state.ga.us/amp/amp_query.html

Annotation: This Web site is hyper-linked in the 8th Grade Teacher Resource Manual linked at this step. Its interactive database, provided by the Georgia Department of Natural Resources, allows users to select a location, date, one of six pollutants, and one of four weather conditions, to obtain data about air quality. Used in lesson 2 of this unit: "Weather and Ground Level Ozone"

Title: The Clean Air Campaign Web Site

URL: <http://www.cleanaircampaign.com>

Annotation: This Web site is hyper-linked in the 8th Grade Teacher Resource Manual attached at this step. The Clean Air Campaign has created this and other lessons on air quality for grades 4 through 8. For more information, please visit the web site.

Title: Speaker's Bureau

URL:

http://www.cleanaircampaign.com/index.php/cac/about_us/request_a_speaker

Annotation: This Web site is hyper-linked in the 8th Grade Teacher Resource Manual linked at this step. It allows the user to request a speaker from the Clean Air Campaign. Teachers may wish to make arrangements for a speaker to visit their classrooms.

Title: Environmental Education in Georgia Web Site

URL: <http://www.eeingorgia.org>

Annotation: This Web site is hyper-linked in the 8th Grade Teacher Resource Manual linked at this step. Additional lessons on environmental education, including the Clean Air Campaign's air quality lessons for grade 4 - 8, can be accessed from this web site.

Title: EPA's Air Quality Index Web Site

URL: <http://www.epa.gov/airnow>

Annotation: This EPA Web site is hyper-linked in the 8th Grade Teacher Resource Manual linked at this step. It provides information on current and forecasted air quality conditions for the United States.

Title: Air Quality Index for Kids

URL: <http://www.epa.gov/airnow/aqikids/index.html>

Annotation: This EPA Web site is hyper-linked in the 8th Grade Teacher Resource Manual linked at this step. It explains air pollution, the Air Quality Index (AQI) and pollution solutions to children.

Title: Ozone Maps

URL: <http://www.airnow.gov>

Annotation: This EPA Web site is hyper-linked in the 8th Grade Teacher Resource Manual linked at this step. It provides archived maps of ozone concentrations across the United States. Useful to see the impact of ozone from metropolitan areas on the entire region.

Title: Interactive AQI Calculator

URL: http://cfpub.epa.gov/airnow/index.cfm?action=aqi.conc_aqi_calc

Annotation: This Web site is hyper-linked in the 8th Grade Teacher Resource Manual attached at this step. Scroll down to the AQI (Air Quality Index) Calculator on this EPA web site, to easily convert ambient pollution concentrations to index values, or vice versa. This interactive database is used in lesson 1: "Air Pollution in Metro Atlanta and Georgia."

Step: 2 Duration: 10 minutes.

Ask students to brainstorm possible sources of outdoor air pollution in their community. List these possible sources on the board or on a large sheet of paper. Include all responses, correct or incorrect.

Step: 3 Duration: 30 minutes.

Show the attached PowerPoint presentation, "Metro Atlanta's Air Quality," to provide students with an overview of metro Atlanta's air pollution problem. (In lieu of viewing this information as a PowerPoint presentation, transparencies can be made from the slides prior to the start of class, and shown on an overhead projector). Have students take notes and/or give each student copies of the presentation as handouts.

Attachments for Step 3

Title: Metro Atlanta's Air Quality **FileName:** [Metro Atlanta's Air Quality 1.ppt](#)

Description: This PowerPoint presentation provides an overview of metro Atlanta's air pollution problem. Graphics from Microsoft Office.

Step: 4 Duration: 30 minutes.

Distribute a copy of the handout titled "Sources of Pollutants that Create Smog" (attached below) to each student. This chart will be used for note-taking by students. Make a transparency of the same handout prior to the start of class. Write notes for the class to see on this transparency, during the discussion. Instruct students to take notes on their handouts, and to place each of the items from the list of possible sources of pollutants (generated at Step 2) on their charts, in one of the five categories. Using the attached teacher key as a guideline, discuss pollution sources with your students.

Tell students that the relative proportion of air pollution generated by each source depends on the geographic area and period of time one is considering. As controls are applied to various sources, the relative weight of the contribution from that source will vary. Show the attached PowerPoint presentation, "Sources of Nitrogen Oxide- a Precursor to Ground Level Ozone" to provide information on how smog is formed. (As an alternative to PowerPoint, transparencies can be made from the presentation slides in advance, and shown on an overhead projector). Tell students that because many volatile organic compounds (VOC's) are naturally occurring or "biogenic," most air pollution prevention and reduction efforts focus on those things that can be controlled, such as nitrogen oxides.

Attachments for Step 4

Title: Sources of Pollutants that Create Smog **FileName:** [Sources of Pollutants that Create SMOG.doc](#)

Description: This is the chart for student note-taking. Graphics from Microsoft Office.

Title: Sources of Pollutants that Create Smog **FileName:** [Sources of Pollutants that Create SMOG Key.doc](#)

Description: This is the teacher key to the "Sources of Pollutants that Create Smog" note-taking chart below. Graphics from Microsoft Office.

Title: Sources of Nitrogen Oxide- a Precursor to Ground Level Ozone **FileName:** [Sources of Pollutants that Create Smog.ppt](#)

Description: This PowerPoint presentation identifies sources of nitrogen oxides, which can subsequently form ground-level ozone in metro Atlanta. Graphics from Microsoft Office.

Step: 5 Duration: 45 minutes.

Working in teams of two, have students visit the Air Quality and Health section of The Clean Air Campaign® Web site to find out how the Air Quality Index (AQI) is used during smog season to provide information to the public about air quality in metro Atlanta. Students should also investigate what a Smog Alert is. Select several teams to orally summarize their findings for the rest of the class. Show and discuss the attached PowerPoint presentation, "The AQI" with students. (As an alternative, a transparency can be made from the presentation prior to the start of class, for use on an overhead projector). Ask students how they and their acquaintances react when they learn that a day has been branded a "Smog Alert day." Teachers should share with the class any school policy limiting outdoor activities during Smog Alerts.

Web Resources for Step 5

Title: The Clean Air Campaign

URL: <http://www.cleanaircampaign.com>

Annotation: This Web site provides information on air quality in metro Atlanta, including information about air quality and related health issues.

Attachments for Step 5

Title: The AQI **FileName:** [The AQI.ppt](#)

Description: This is the Air Quality Index (AQI) chart. Source of graphic: www.epa.gov

Step: 6 Duration: 45 minutes

Tell students that the Georgia Department of Natural Resources, Environmental Protection Division, measures ground level ozone concentrations through its ambient monitoring program. Explain that ozone is measured in parts per million (or ppm) at several monitoring stations around the state. Use the presentation titled "Monitoring Air Quality in Georgia" to show students where these stations are located. If no projection source is available, transparencies can be made prior to the beginning of this step, for use on an overhead projector.

Tell students that they are going to 1) use ambient monitoring data to determine the AQI for ozone and 2) provide health advisories to the public in the imaginary city of Atlantis. Give each student a worksheet: "Ambient Monitoring in Atlantis." Have students work in pairs while they complete the worksheet. Show students how to access the AQI Calculator and use it. (Review the Teacher Manual for more information and practice using the AQI Calculator before starting this step. It is easiest to use the calculator feature online, but it may also be downloaded from the website and loaded onto each student computer. Students should turn in worksheet for assessment. Afterwards, discuss student responses to worksheet items.

Web Resources for Step 6

Title: AQI Calculator

URL: <http://www.airnow.gov>

Annotation: Scroll down to the interactive AQI Calculator. This is a program which allows users to convert ambient ozone concentrations (parts per billion or parts per million) to AQI values and vice versa. The calculator reflects a complex formula. It may be used online or downloaded to a computer for use offline.

Attachments for Step 6

Title: Ambient Monitoring in Atlantis Key **FileName:** [Ambient Monitoring in Atlantis Key.doc](#)

Description: This is the key to the "Ambient Monitoring in Atlantis" activity.

Title: Ambient Monitoring in Atlantis **FileName:** [Ambient Monitoring in AtlantisF.doc](#)

Description: Based on data provided, students will determine AQI and provide appropriate health advisories for the city of Atlantis.

Title: Monitoring Air Quality in Georgia **FileName:** [Monitoring Air Quality in Georgia.ppt](#)

Description: This PowerPoint transparency master shows the location of ambient monitoring stations in Georgia.

Step: 7 Duration: 15 minutes

Give each student a copy of the quiz: "Air Pollution in Metro Atlanta and Georgia" (attached). Students should turn in quiz to be scored. See Key attached at Assessment section.

Attachments for Step 7

Title: Air Pollution in Metro Atlanta and Georgia Quiz **FileName:** [Air Pollution in Metro Atlanta and Georgia Quiz.doc](#)

Description: This quiz can be used to assess student learning. Graphics from Microsoft Office.

Step: 8 Duration: Teacher Feedback

The Clean Air Campaign is pleased to provide standards-based air quality lesson plans for 4th through 8th grades. Please offer your feedback after implementing this lesson plan, as there is no substitute for real classroom experience. Send teacher name, school name and address, grade level, lesson name, comments or suggestions, and the number of students who completed the lesson to: schools@cleanaircampaign.com. Each teacher who responds will receive a Clean Air Campaign goody bag as a 'thank you.'

Materials and Equipment

1. Sources of Pollutants that Create Smog handout (one per student)- attached at Step 4
2. Ambient Monitoring in Atlantis handout (one per student) - attached at Step 6
3. One computer with Internet connection or pre-loaded Interactive AQI

Calculator (see Teacher Resource Manual) for each pair or group of three students

4. LCD projector or TV hookup and the attached PowerPoint presentations

5. Markers for overhead projector transparencies

6. Overhead projector

Total Duration

2 hours, 55 minutes

Technology Connection

The teacher will use an LCD projector or TV hookup to show the attached PowerPoint presentations, which review major causes of air pollution and show students where monitoring stations are located. (As an alternative, the teacher may print the PowerPoint slides as transparencies and show them on an overhead projector). An overhead projector will also be used for the teacher to demonstrate note-taking during a class discussion. Computers which are Internet-connected or pre-loaded with Interactive AQI Calculator Software will be used by teams of students to convert data from pollutant concentration levels to index values and vice versa.

Assessment

Completion of Ambient Monitoring in Atlantis activity (attached at Step 6) and the Air Pollution in Metro Atlanta and Georgia Quiz (attached at Step 7) will be used to assess student learning. Answer keys are attached below.

Attachments

Title: Air Pollution Quiz Key **FileName:**

[AirPollutionQuizKeyv.doc](#)

Description: Key to the "Air Pollution in Metro Atlanta and Georgia Quiz" attached at Step 7.

Title: Ambient Monitoring in Atlantis Key **FileName:**

[Ambient Monitoring in Atlantis Key.doc](#)

Description: This is the key to the "Ambient Monitoring in Atlantis" activity.

Extension

Remediation

Accommodation

For students with exceptional needs, what changes can be made in instruction and teaching delivery to enhance student participation and learning? Each area below is a direct link to general classroom accommodations.

[Non-readers](#) [Physical Impairments](#) [Sensory Impairments](#)
[Attention/Behavior](#) [Gifted](#)

Each disability below is a direct link to general classroom accommodations specific for that disability.

[Autism](#)

[Deaf - Blind](#)

[Deaf/Hard of Hearing](#)

[Emotional and Behavioral Disorder](#)

[Mild Intellectual Disability](#)

[Orthopedic Impairment](#)

Other Health Impairments:

[Attention Deficit Disorder/Attention Deficit Hyperactivity Disorder](#)

[Tourette Syndrome](#)

[Significant Development Delay](#)

[Specific Learning Disability](#)

[Speech - Language Impairment](#)

[Traumatic Brain Injury](#)

[Visual Impairment](#)

Modification

For students with significant disabilities, what changes can be made in instruction and teaching delivery to allow students to participate in classroom instruction while working on IEP objectives and off grade level GPS standards. Below are suggested modifications correlated to the procedures of this lesson plan.