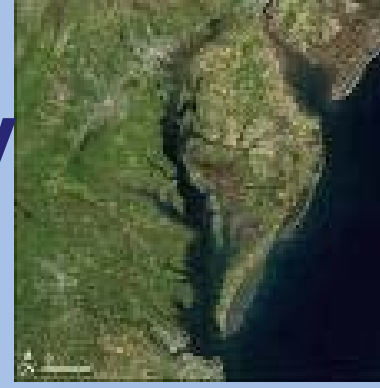


Communicating Air Quality

Educational Outreach

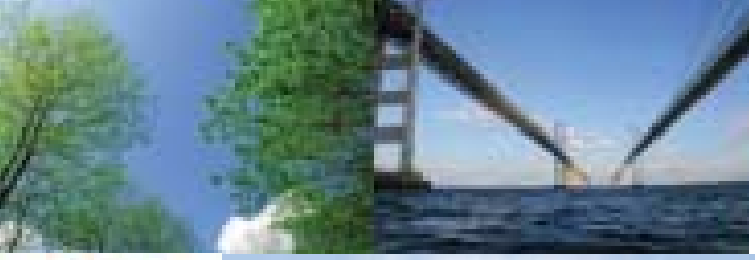
On the Air
Exploring Air Pollution Sources & Solutions

An Innovative Curriculum and Outreach Program in the Metropolitan Washington and Baltimore Areas

CLEAN AIR PARTNERS

Rebecca Davis
Clean Air Partners
Metropolitan Washington Council of Government

Metropolitan Washington Council of Governments



CLEAN AIR PARTNERS

Clean Air Partners (CAP) is a nonprofit partnership chartered by the Metropolitan Washington Council of Governments (MWCOG) and the Baltimore Metropolitan Council (BMC).

Baltimore Metropolitan Council

- **CAP is a public-private partnership committed to improving the health and quality of life of residents in the metropolitan Washington-Baltimore region.**

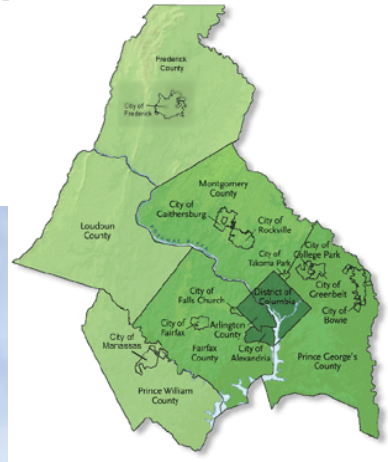
- **For over 10 years, CAP has strived to improve public health and the environment by working with businesses, organizations, and individuals throughout the region to raise awareness and reduce air pollution through voluntary actions.**

- **Clean Air Partners is dependent on the active participation of an informed community. To that end, Clean Air Partners:**
  - **Provides daily air quality forecasts/air alerts.**
  - **Developed, promotes and distributes *On the Air* curriculum and kits.**
  - **Has a strong web presence to maximize communication efficacy.**

CLEAN AIR PARTNERS

Complexity of the Educational Landscape in the Metropolitan Washington-Baltimore Region

Baltimore Metropolitan Council



Amidon ES
Washington, DC

Aiton ES
Washington, DC

- > 20 Jurisdictions, 2 states and DC
- Urban, suburban and rural settings
- > 500 ES & MS Public Schools
- ~ 2000 Science or 6th grade teachers

Parkville MS,
Baltimore County MD

William H. Lemmel MS, Baltimore City, MD

Mayfield Intermediate
Manassas City, VA

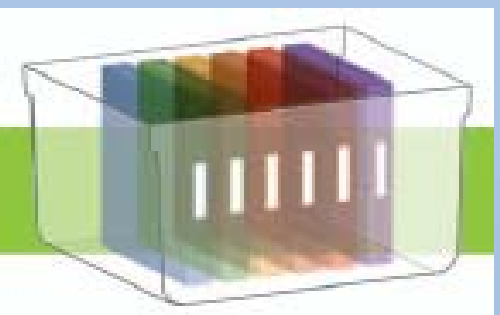
CLEAN AIR PARTNERS

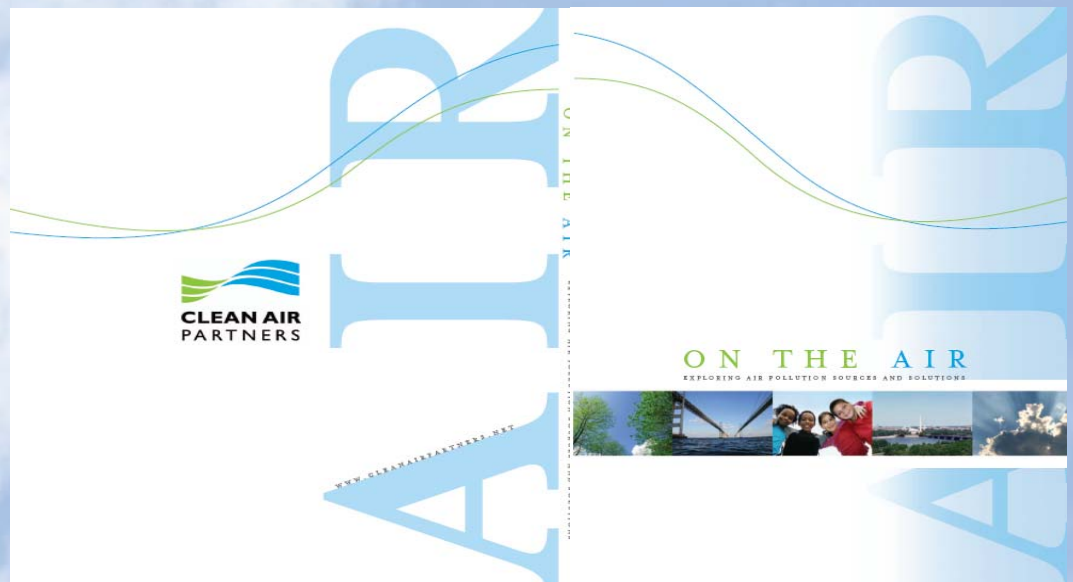
On the Air - Exploring Air Pollution Sources and Solutions

Curriculum and Kits

http://cleanairpartners.net/

- Unit 1- Wanted For Polluting Our Air- An Introduction to the Six Major Pollutants
- Unit 2- Air Quality Index
- Unit 3- More than Meets the Eye- Particulate Matter and Fine Particle Pollution
- Unit 4- Ozone and Us: Good Up High, Bad Nearby
- Unit 5- Our Lungs, Our Air, Our Health: The Health Effects of Air Pollution
- Unit 6- Community Pollution: Sources and Solutions
- Unit 7- Climate Change





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Teachers in Traditional Setting

State & Local initiatives Green Schools

On the Air
Exploring Air Pollution Sources and Solutions
Outreach

CLEAN AIR PARTNERS

After School Programs/ Clubs

Summer camps & Summer Schools

CLEAN AIR PARTNERS

Media
- *Radio*
- *Print*

Conferences
- *Environmental Education*
- *Science Education*
- *Environment*

Mailing
- *E-mails*
- *Snail mail*
- *Points of Contacts*

Workshops
- *Professional Learning Units PLU*
- *Conference workshops*

Teachers in Traditional Setting

Public/Charter/Private

Administrators
- *Science Directors PS*
- *Science curriculum developers*
- *Principals/ Asst principals*
- *Corporate-school partnerships*
- *State-local policy*
- *Elected officials*
- *PTAs*

Allies/Partners-Competitors
- *Professional Associations*
- *NGOs*
- *Government*

WEB
- Knowledge-resource
- EE Databases

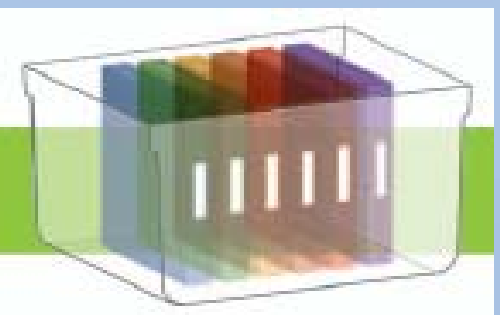
On the Air
1-1 ½ hr Outreach Program

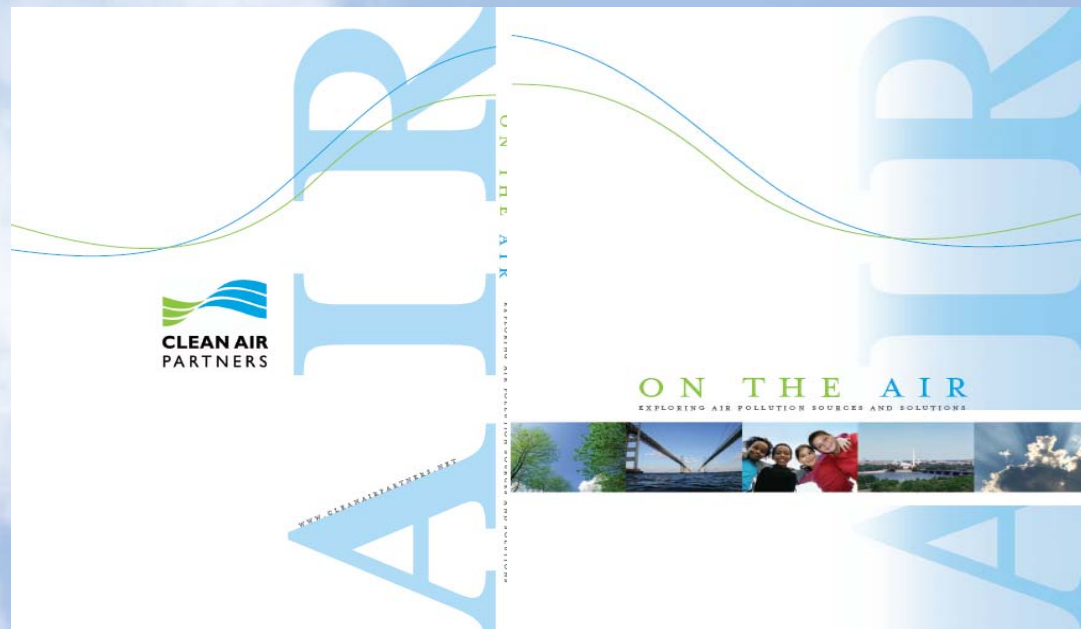
CLEAN AIR PARTNERS

On the Air - Exploring Air Pollution Sources and Solutions

Curriculum and Kit

- Unit 1- Wanted For Polluting Our Air- An Introduction to the Six Major Pollutants
- Unit 2- Air Quality Index
- Unit 3- More than Meets the Eye- Particulate Matter and Fine Particle Pollution
- Unit 4- Ozone and Us: Good Up High, Bad Nearby
- Unit 5- Our Lungs, Our Air, Our Health: The Health Effects of Air Pollution
- Unit 6- Community Pollution: Sources and Solutions
- Unit 7- Climate Change





CLEAN AIR PARTNERS

On the Air is Tied to 6th grade Curriculum and Cross Referenced to State Standards VA, MD and DC.

Curricular Ties for Virginia, Maryland, and the District of Columbia

(Education standards are articulated in Appendices A, B, and C.)

UNIT 1	VIRGINIA	MARYLAND	DISTRICT OF COLUMBIA
SCIENCE	6.1.i 6.6.g 6.9.a	1.6.A.1.d 1.6.C.1.b 1.6.C.1.f 6.6.A.1.c 6.6.A.1.d 6.6.A.1.e 6.6.B.1.a 6.6.B.1.b 6.6.B.1.c	6.1.6 6.1.7 6.1.8 6.6.3 6.6.4 6.6.5
HEALTH	6.1.c	1.6.A.3.a	
COMPUTER/ TECHNOLOGY	C/T 6-8.6 C/T 6-8.7	see Appendix B	
LANGUAGE ARTS	6.2.c 6.3.d 6.5.a	1.6.D.1.a 1.6.D.1.b 1.6.D.3.c 1.6.D.3.d 2.6.A.1.a 2.6.A.1.b 6.6.A.1.a 6.6.A.1.b 6.6.A.1.c 7.6.A.1.a 7.6.A.1.c 7.6.A.1.e 7.6.A.1.f	6.LD-D.1 6.LD-0.6 6.LD-V.10 6.IT-E.1 6.R.1
SOCIAL STUDIES		6.6.D.1.a 6.6.D.1.c 6.6.D.1.d 6.6.F.3.a	6.5.11 6.6.1

Appendix A

Virginia Standards of Learning for Grade Six

Education Standards Correlated to *On the Air: Exploring Air Pollution Sources and Solutions*

Science

Scientific Investigation, Reasoning, and Logic

6.1 The student will plan and conduct investigations in which
- c) precise and approximate measurements are recorded;
- f) a method is devised to test the validity of predictions and inferences;
- i) data are organized and communicated through graphical representation (graphs, charts, and diagrams)

Matter

6.6 The student will investigate and understand the properties of air and the structure and dynamics of the Earth's atmosphere. Key concepts include
- d) how the atmosphere changes with altitude;
- g) the importance of protecting and maintaining air quality.

Resources

6.9 The student will investigate and understand public policy decisions relating to the environment. Key concepts include
- a) management of renewable resources (water, air, soil, plant life, animal life);
- c) the mitigation of land-use and environmental hazards through preventive measures;
- d) cost/benefit tradeoffs in conservation policies.

Health

Knowledge and Skills

6.1 The student will apply critical thinking skills and personal management strategies to address issues and concerns related to personal health and well-being. Key concepts/skills include:
- c) the effects of environmental influences on personal health.

Information Access and Use

6.6 The student will access and analyze information for the purpose of improving personal and family health. Key concepts/skills include
- a) assessment of personal and family wellness.

UNIT 1

Wanted For Polluting Our Air

An Introduction to the Six Major Air Pollutants

ACTIVITY DESCRIPTION

This activity provides an overview of the common air pollutants. Students work in teams to research the six major air pollutants (ozone, nitrogen dioxide, carbon monoxide, particulate matter, sulfur dioxide and lead). Students are provided with background readings and websites for information. Each team first completes a study guide about its assigned pollutant which includes pollutant description (what it is and where it comes from); major sources; effects of their type of pollution (on visibility, property, and health of humans and the environment); laws pertaining to their pollutant; and control measures. Using the information obtained, teams next complete a "wanted poster" of their pollutant. The wanted posters include all the pertinent information as well as a collage of images such as student drawings, magazine cut-outs, or Internet prints. Each student team then presents its poster to the rest of the class. Posters are displayed on the classroom wall for the duration of the program.

curricular ties

See page viii for the list of this lesson's curricular ties to District of the Columbia, Maryland, and Virginia education standards. All Education Standards are articulated in the Appendices.

time needed

Two, 45 minute class periods (plus ~20 minutes up front for the introduction video)

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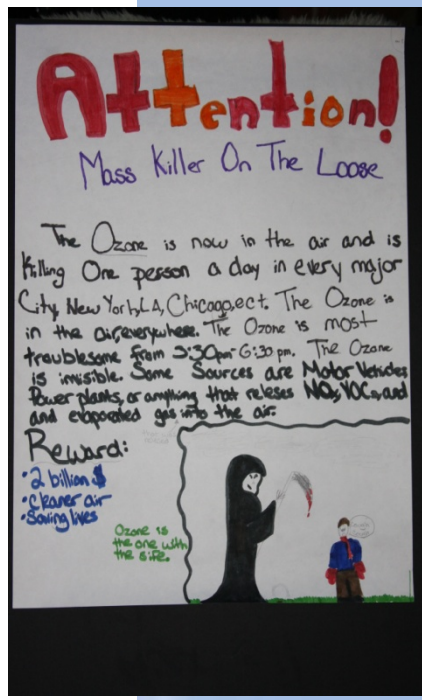
Unit 1- Wanted For Polluting Our Air- An Introduction to the Six Major Pollutants

National Ambient Air Quality Standards

	Primary Standards		Secondary Standards	
Pollutant	**Level**	**Averaging Time**	**Level**	**Averaging Time**
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour [1]	None	
	35 ppm (40 mg/m^3)	1-hour [1]		
Lead	0.15 µg/m^3 [2]	Rolling 3-Month Average	Same as Primary	
	1.5 µg/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm (100 µg/m^3)	Annual (Arithmetic Mean)	Same as Primary	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour [3]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual [4] (Arithmetic Mean)	Same as Primary	
	35 µg/m^3	24-hour [5]	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour [6]	Same as Primary	
	0.08 ppm (1997 std)	8-hour [7]	Same as Primary	
	0.12 ppm	1-hour [8] (Applies only in limited areas)	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (Arithmetic Mean)	0.5 ppm (1300 µg/m^3)	3-hour [1]
	0.14 ppm	24-hour [1]		



Sulfur Dioxide injury to raspberry

Ozone injury to soy

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Unit 2- Air Quality Index

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AIR QUALITY ACTION GUIDE

Your "how to" guide for cleaner air

Air Quality Rating	Steps to Protect Your Health and Our Environment
GOOD 0-50	Enjoy the great outdoors
MODERATE 51-100	Some Pollution – poses risk to the highly sensitive · Carpool, use public transit, bike, or walk · Limit driving, consolidate trips · Reduce car idling
UNHEALTHY for Sensitive Groups 101-150	Pollution levels harmful to children, the elderly, and anyone with respiratory or heart conditions – limit activity outdoors · Follow all action steps above · Refuel after dusk, use fuel-efficient vehicles · Avoid driving, use transit, telework · Avoid using aerosol products
UNHEALTHY 151-200	Pollution levels harmful to all – sensitive groups should avoid outdoor activities, others should limit outdoor exertion · Follow all action steps above · Avoid using any gas-powered equipment · Wait to paint until air quality improves
VERY UNHEALTHY 201-300	Pollution levels very unhealthy for everyone – avoid any physical activity outdoors

Visit cleanairpartners.net to get your daily air quality forecasts and discover simple steps you can take each day to protect your health and our environment.

AQI AIR QUALITY INDEX

200
150
100
50

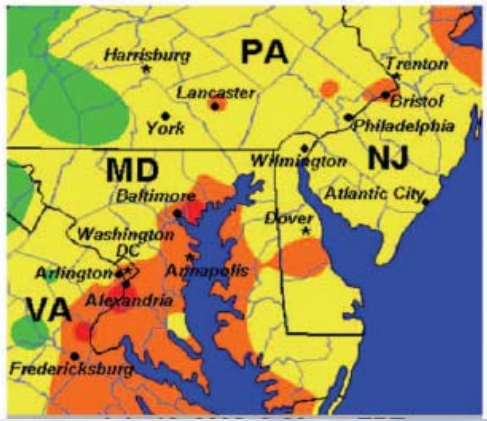
Today's Forecast: Red

Quality: Unhealthy

Sensitive groups should avoid outdoor physical activities. Everyone else should limit prolonged outdoor exertion.

Situation: You and your friend have an overdue book and need to return it to the library. The library is three (3) blocks away. How will you get there?

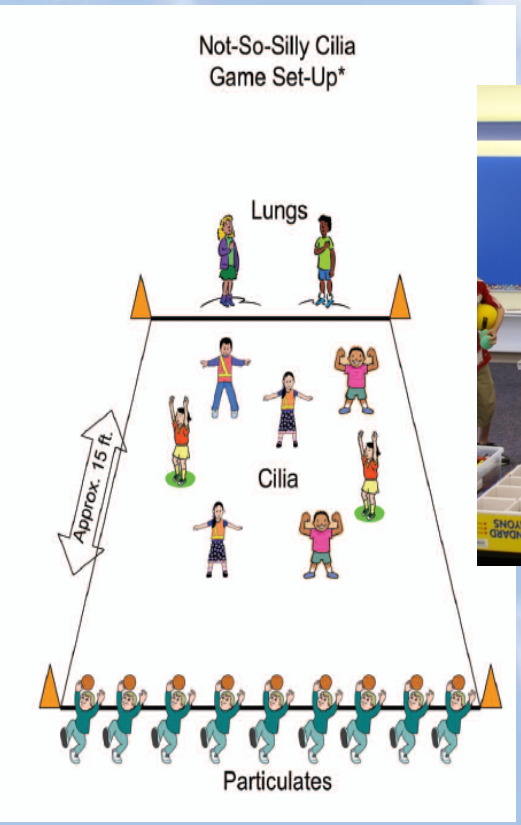
This map depicts the AQI for ozone on July 18, 2006:



http://www.airnow.gov/

CLEAN AIR PARTNERS

Unit 3- More than Meets the Eye Particulate Matter and Fine Particle Pollution



Part I—PM Demonstrations (all material provided in kit unless otherwise noted):

- *Teacher Demonstration Instructions—Particulate Matter*

Demonstration 1—combustion

- 1 utility candle
- 1 tin can (soup can)
- matches
- paper towel or rag
- pot holder

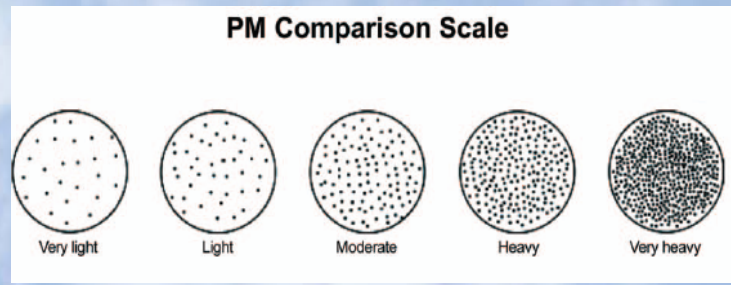
Demonstration 2—smog

- 1 large glass jar
- aluminum foil
- 2-3 ice cubes (not provided)
- plastic
- water (not provided)
- paper strips
- matches

Demonstration 3—Airborne Particulates

- A small amount of flour
- flashlight

Unit 3- Particulate Matter and Fine Particle Demonstration



Unit 3- Particulate Matter and Fine Particle Monitoring Station

Unit 3- More than Meets the Eye; Particulate Matter and Fine Particle Pollution pg 74

CLEAN AIR PARTNERS

Unit 4- Ozone and Us: Good Up High, Bad Nearby

Student Handout
Student Data Sheet—Tracking a Code Red Day

Directions: In this activity, you will track the levels of ozone during a summer day in Alexandria, Virginia. The AQI maps you will use are real, archived data available on the Internet. Copies of the AQI Ozone Maps have been captured from the Internet and prepared for your use for this activity. You will also need a Temperature Graph for the Washington D.C. Area. You will also need to refer to the mini-poster, Understanding the AQI (which should be on display) to find the AQI Colors and Value Range.

Note: If you are obtaining your data online, go to: **http://www.airnow.gov/index.cfm?action=airnow.displaymaps&StateID=10&Pollutant=OZONE** and enter the map date: July 18, 2006. (You will need to hit the escape key to stop the animated loop at the specified time.)

1. Find Alexandria, Virginia on your AQI Ozone Maps. Note how the AQI color around Alexandria changes over time. Determine the AQI color for Alexandria for each hour presented on the maps. Enter the AQI color for each hour on the table below.
2. Next, refer to the *Understanding the AQI* mini-poster to complete the table below by entering the corresponding Level of Health Concern, AQI Value Range, and AQI Value Average for each color and hour presented.

   (Note: To calculate the AQI Value Average, find the average between the two numbers of the AQI Value Range. The first one is done for you with Green's air quality being good and the AQI Value Range being from 0—50 with an average of 25.)
3. Refer to the Temperature *Graph for the Washington D.C. Area.* Enter the temperature for each hour presented in the table below.

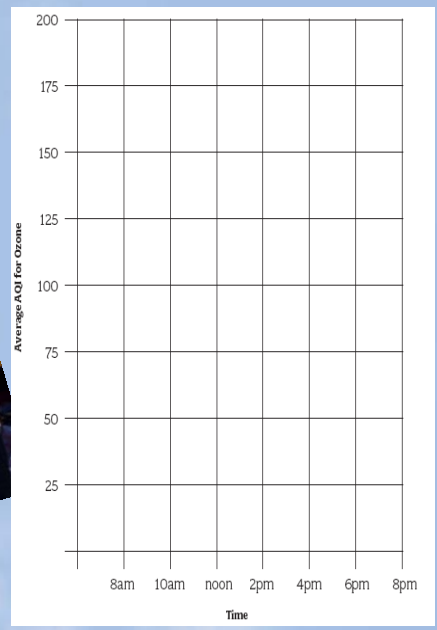
Note: If you are obtaining your data online, go to: **http://www.wunderground.com/history/airport/KDCA/2006/7/18/DailyHistory.html?req_city=NA&req_state=NA&req_statename=NA**

Table of Ozone AQI and Temperature Data for Alexandria, Virginia on July 18, 2006

Time	AQI Color	Health Concern	AQI Value Range	AQI Value Average	Temperature (°F)
8:00 am	Green	Good	0—50	25	83
10:00 am					
12 noon					
2:00 pm					
4:00 pm					
6:00 pm					
8:00 pm					

4. When you have completed your table, use your data to create two line graphs. One graph should show Ozone vs. Time. The other graph should show Temperature vs. Time. Your graph templates are provided for you.

The Ozone Revue
Player Instruction Card—Narrator



Student Handout
Student Graph—Average AQI for Ozone vs. Time

Student Handout
Student Data Sheet—Tracking a Code Red Day

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Unit 5- Our Lungs, Our Air, Our Health: The Health Effects of Air Pollution

ACTIVITY PROCEDURES

Part I– Review of the Respiratory System and How Air Pollution Affects the Lungs

Part II– Student Experiment: Effects of Exercise on Heartbeat and Breathing Rate

Average Measurements	Resting	Active
Heart Rate		
Breathing Rate		

Unit 5 Our Lungs, Our Air, Our Health pg 121

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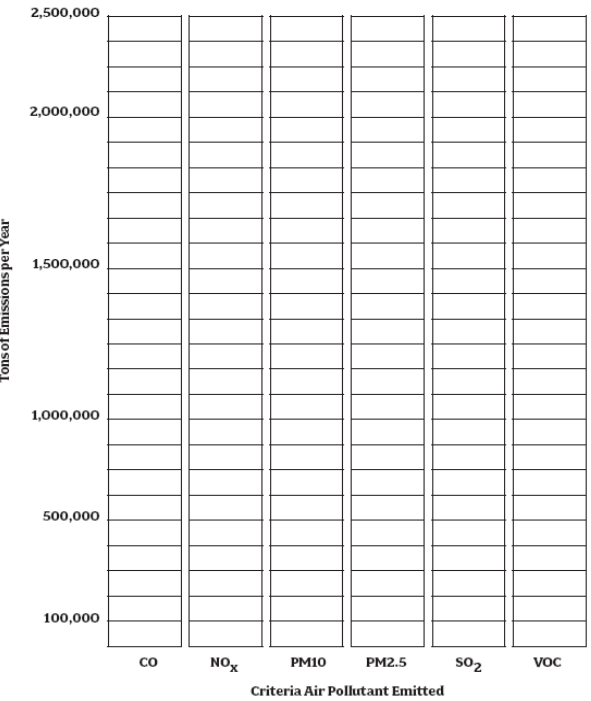
Unit 6- Community Pollution: Sources and Solutions

Student Handout
Graph Template–Pollutant Emission in Tons Per Year

Pollution Source_____



- » D.C. Area Outpaces Nations in Pollution
- • A Study in Carbon

D.C. Area Outpaces Nations in Pollution

High Carbon Emission Blamed On Coal Plants

By David A. Fahrenthold
Washington Post Staff Writer
Sunday, September 30, 2007; Page C01

The Washington area produces more carbon dioxide than several medium-size European countries, according to a new estimate of local emissions, as the region's crawling traffic and coal-fired power plants give it a pollution "footprint" out of proportion to its size.

The estimate, by the Metropolitan Washington Council of Governments, seems to be the first official attempt to put a number on the region's contributions to climate change. And the number is big: 65.6 million metric tons of carbon dioxide were emitted here in 2005. That was more than in all of Hungary, Finland, Sweden, Denmark or Switzerland, each of which has more people.

Unit 6- Graph Template Pollutant emissions in tons/year pg 129

http://www.scorecard.org/

Scorecard provides information about sources of pollutants. Upon entering their zip code, students can get a list of top polluters contributing to smog and soot in their county.

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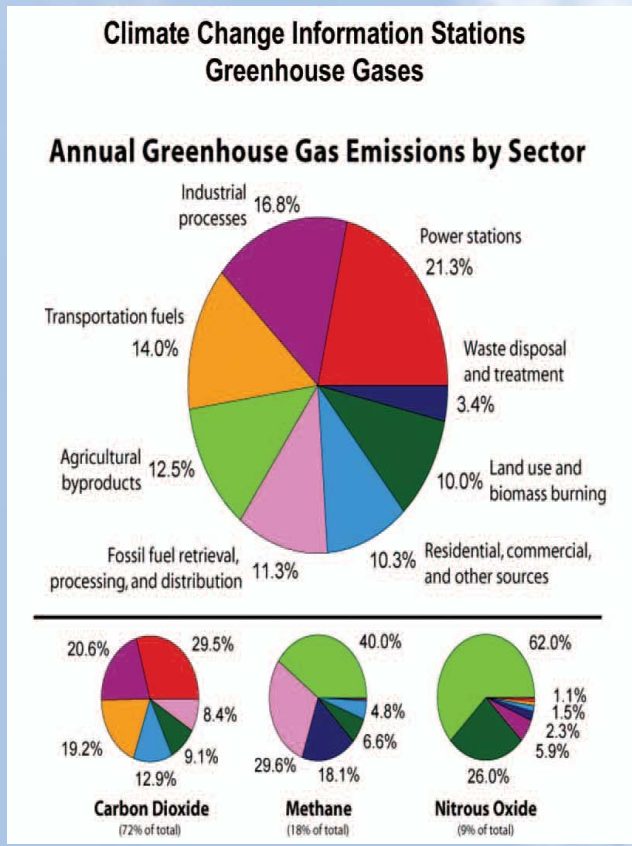
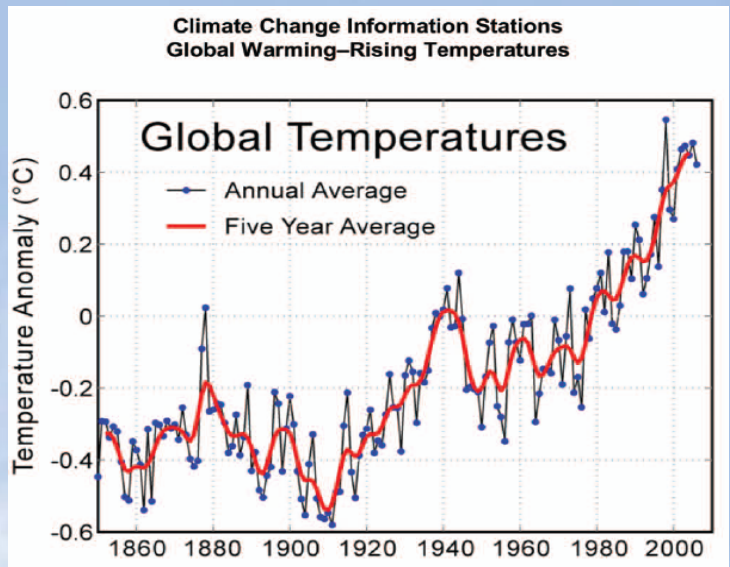
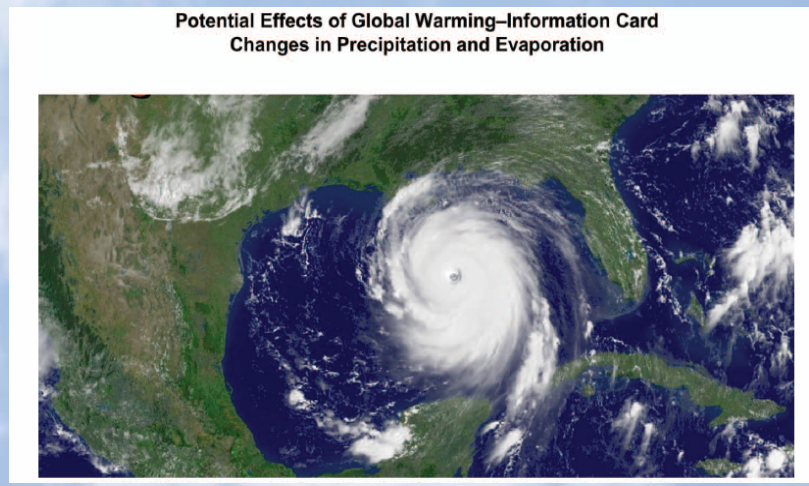
Unit 7- Climate Change





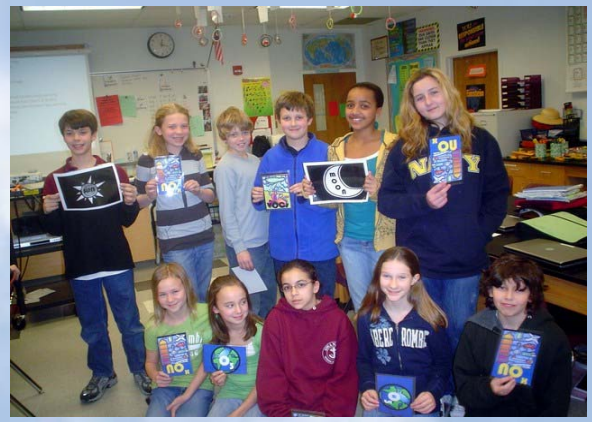


Unit 7-Climate Change gathering information from a variety of Climate Change Stations

CLEAN AIR PARTNERS

On the Air in the Community

Unit 4- Ozone and Us pg 100



Unit 3- More than Meets the Eye

Unit 5- Our lungs, Our Health, Our Air

Outreach at conferences science fairs

Virginia Science Standards Institute 6th grade teachers

Open Source Curriculum/ WEB outreach

CLEAN AIR PARTNERS

Metropolitan Washington Council of Governments
Clean Air Partners

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