Air Quality Curriculum
Draft Outline of Activities
Metropolitan Council of Governments

Activity 1) Wanted: For Polluting Our Air – An Introduction to the Six Major Air Pollutants

Activity Description:
This activity provides a student-led overview of the common air pollutants. Students work in teams to research the six major air pollutants (ozone, VOCs, 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 their 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. Following a provided template, the wanted posters include all the information as well as a collage of images such as student drawings, magazine cut-outs, or internet prints. Each student team then presents their posters to the rest of the class. Posters are displayed on the classroom wall for the duration of the program.

Materials Provided:
Teacher's activity procedures, teacher background reading, background reading and photo imagery of pollution effects for students, websites and resource information for additional research, EPA brochures, student study guide (includes the guiding questions for student research), template and examples for wanted posters, task list for student team presentations.

Technology Connections:
This link on the EPA's website provides descriptions of the six common pollutants.
http://www.epa.gov/air/urbanair/6poll.html

Air Now is a cross-agency government website on our nation's air quality. Under the link "Air Quality Basics" there are descriptions of Ozone and Particle Pollution.
http://www.airnow.gov/index.cfm?action=airnow.main

Air Pollution What's the Solution? is an online, air pollution curriculum. On this link, they provide a concise matrix description of the major air pollutants.
http://www.k12science.org/curriculum/airproj/docs/major_air_pollutants.pdf

Green Facts provides clear summaries of scientific studies. This link provides information on ozone, particulate matter, and nitrogen dioxide.
http://www.greenfacts.org/air-pollution/index.htm

Students can investigate ozone, AQI and link to additional data at the Clean Air Partners website.
http://cleanairpartners.net/

Ties to the Air Smart Curriculum:
Provide "A Brief History of Air Pollution Control" for teacher background reading. Revise background reading for students. Provide some of the resources and websites from resource sections.

Activity 2) Air Quality Index

Activity Description:
Students are introduced to the Air Quality Index through a teacher-led, interactive discussion using provided charts and other props (AQI charts, newspaper clippings, printout of AQI web data). Students next complete a study guide which covers appropriate AQI colors, index information, discussion questions, and a map activity. The class then conducts a role-play activity in which students act out appropriate actions given different AQI. Students will continue to daily monitor their local AQI using different sources (newspapers, television, and/or internet).

Materials Provided:
Teacher's activity procedures, background reading and AQI props, student study guide, role-play cards, website information.

Technology Connections:
Air Now is a cross-agency government website on our nation's air quality. This link describes the Air Quality Index and leads to real-time data.
http://www.airnow.gov/index.cfm?action=static.aqi

The AirWatch Website provides the public with easy access to local and national air quality information. Here, students can access real time air quality information.
http://www.air-watch.net/airwatch.php?

Students can investigate ozone, AQI and link to additional data at the Clean Air Partners website.
http://cleanairpartners.net/

Ties to the Air Smart Curriculum:
From Lesson 2 "The Color of Air," use AQI information sheets and handouts (with some revisions). Revised "Environmental Action Card" from Lesson 4.

Activity 3) More Than Meets the Eye - Particulate Matter and Fine Particle Pollution

Activity Description:
This activity is introduced with several teacher-led demonstrations on particulate matter (PM). Demonstrations include revealing by-products of combustion, creating smog, and observing fine, air-born particulates. Students next play a game in which nerf balls, representing large and small pollution particles, are thrown at a group of students representing lungs. Students representing cilia surround the lungs and must block the nerf balls to keep them away from the lungs. Students will observe the cilia's ability to block different quantities and sizes of particles from reaching the lungs. Following a general discussion of the game and particulate matter (including its effects on health), students work in teams to create PM monitoring devices. Each team places their PM monitors at a different site around the school. Monitors are checked throughout the week and using a provided scale, accumulated PM is noted on a data sheet. At the end of the week, the PM monitors are brought back to the classroom. Results from the monitors are compared and discussed or the class may choose to do a more indepth analysis of the monitors following the instructions in the *Extensions* section of this unit.

Materials Provided:
Teacher's activity procedures, graphic examples of relative PM sizes, kit of demonstration materials (jars, foil, matches, cotton, plastic bags, vanilla, candles, flour), templates for PM monitors, double-sided sticky tape, PM scales, data sheets, graph paper, web resource information.

Technology Connections:
Air Now is a cross-agency government website on our nation's air quality. This link leads students to their region of the country to see the current conditions for PM 2.5 and ozone.
http://www.airnow.gov/index.cfm?action=airnow.currentconditions

Ties to the Air Smart Curriculum:
"Effects of Air Pollution" from Lesson 3.

Extensions: Using the scientific method, teams analyze, graph, and present data from their Particulater Matter Monitors to the rest of the class.

Activity 4) Ozone and Us – (Good Up High, Bad Nearby)

Activity Description:
This activity first introduces how ozone is made through a role-playing demonstration in which students take on the roles of the sun, moon, Volatile Organic Compounds (VOC), Nitrous Oxides (NO_2), and Ozone (O_3). Students are also directed to the internet to view "Recipe For Ozone" which animates how ozone is made. The teacher next leads a review / discussion of the demonstration and health effects of ozone. In Part Two of this activity, student teams are provided ozone and weather data for their (or a local) community (from actual archived data) which they graph over time (one day). The student teams then compare their results and discuss how time of day and weather affect ozone. Student are then directed to online resources where they may obtain real-time ozone information for their community.

Materials Provided:
Teacher's activity procedures, ozone and weather data for student activity, student data sheets, graph paper, web resource information.

Technology Connections:
Air Info Now provides online, air quality activities. This "A Recipe for Ozone" link requires a flash player and provides an animated description of how ozone is made.
http://coep.pharmacy.arizona.edu/air/#ozone

Air Now is a cross-agency government website on our nation's air quality. This link leads students to their region of the country to see the current conditions for ozone and PM 2.5.
http://www.airnow.gov/index.cfm?action=airnow.currentconditions

Ties to the Air Smart Curriculum:
Use some background information from Lesson 1, "Ozone: Good Up High, Bad Nearby" for teacher reading.

Extensions:
Students select sites to place ozone detectors (Eco-badges) around their school. After either one day or one hour (depending on the type of detector), the badges are collected and analyzed.

Activity 5) Our Lungs, Our Air, Our Health – The Health Effects of Air Pollution

Activity Description:
The first part of this activity introduces students to the human respiratory system. Using a provided poster of the human respiratory system and a life-like model of human lungs, the teacher leads a review of how air moves into and through the body. Students will also be directed to online animations depicting the respiratory system. Students next conduct before and after measurements on each other to see the effects that exercise has on their own heartbeat and breathing rates. Students measure each others resting heart and breathing rates, exercise for a specific amount of time, then re-measure and note body changes. Results are discussed and related to human activity on ozone-alert days and the AQI. (This will be revisited in those activities as well.) Students will also be directed to several websites which depict the affect of air pollution on lungs.

Materials Provided:
Teacher's activity procedures, poster of the human respiratory system, high quality model of human lungs, stethoscope, stop-watch, data sheet for recording heart beat and breathing rate information, websites and resources for additional information.

Technology Connections:
Air Info Now provides online, air quality activities. This "Lung Attack" link requires a flash player and provides an animated description of how pollution affects the lungs.
http://coep.pharmacy.arizona.edu/air/#lung

Ties to the Air Smart Curriculum:
From Lesson 2 "Most Frequently Asked Questions About Ozone - What is Risk?" and "Effects of Air Pollution" from Lesson 3.

Extensions:
Students work in teams to construct a working model of lungs using one liter soda bottles, rubber tubing and balloons. Each team then conducts a test to determine how their lungs respond to different situations. Student tests include the effects of mucus (made by the students), particles (from flour), reduced capacity (smaller balloons), and rapid breathing (simulated by moving their "diaphragm" rapidly). Student teams then demonstrate their tests and share their results with the rest of the class.

Activity 6) Community Pollution Sources and Solutions

Activity Description:
Students work in teams to research specific pollution sources (power plants, fuel burning, factories, and vehicles). Teams complete a research guide which includes describing source examples, specific pollutants from each source, percent of occurrence of those sources in their state, local examples of sources, and local effects. Student teams share their findings with the rest of the class. During the class presentations, a matrix and map summarizing all data are completed. Students then return to their teams to research and review pollution solutions which include summaries of clean air acts and regulations, personal actions (e.g., "Things You Can Do for Cleaner Air"), and trade-offs. Each team then comes up with a description of potential solutions for each of the different pollution sources. The teacher then leads a class discussion in which students share their solutions for each pollution source.

Materials Provided:
Teacher's activity procedures, student research guides, pollution sources information packets for each team, website information for internet research, summary matrix and map, pollution solutions charts and readings, pollution solution student form, guide to student action projects.

Technology Connections:
Air Pollution, What's the Solution? provides a map which leads to information about the sources of pollutions for each state. Selected charts then show tons per year of the different types of pollutants emitted by each source.
http://www.k12science.org/curriculum/airproj/3dchart/map.html

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.
http://www.scorecard.org/

Ties to the Air Smart Curriculum:
"Things You Can Do for Cleaner Air" from Lesson 4. "Eight Acts to Regulate the Environment" and "Environmental Agencies and Organizations" from the Appendix.

Extensions:
Based on their pollution solution findings and discussion, students choose an action project (e.g., creating a pollution awareness PSA, writing the EPA or their elected officials, posting a daily AQI forecast at their school, etc.).