Idlers: Please Stop Your Engines!
Grade 3-5, Science and Math

Length of Lesson:
Two to three class periods

National Science Standards:
NS. K-4.1, NS.5-8.1 Science as Inquiry
As a result of activities in grades K-4, and 5-8 all students should develop abilities necessary to do scientific inquiry and understandings about scientific inquiry

NS.K-4.6, NS. 5-8.6 Science in Personal and Social Perspectives
Levels: K-4
- Personal Health
- Changes in Environments

Levels 5-8
- Personal Health
- Natural Hazards

NM-DATA.3-5.1
• design investigations to address a question and consider how data-collection methods affect the nature of the data set;
• collect data using observations, surveys, and experiments;
• represent data using tables and graphs such as line plots, bar graphs, and line graphs;
• recognize the differences in representing categorical and numerical data.

Georgia Performance Standards
S3L2 Students will recognize the effects of pollution and humans on the environment

M3D1 Students will create and interpret simple tables and graphs.

M5D1 Students will analyze graphs

M5D2 Students will collect, organize and display data using the most appropriate graph.

Focus: Air Pollution and Idling
Students will read background information on the main air pollutants and complete a graphic organizer illustrating that information. Students will collect idling data from the school's parking lot or car line for one week. Students will compile the data to create 4 types of graphs illustrating the data. Students will create slogans for mock bumper stickers to encourage no-idling in the car rider line and will display graphs and "bumper stickers" in the hallways of the school to promote no-idling.

Materials:
- Colored pencils, graph paper, card stock paper cut into strips for "bumper stickers"
- Computer and internet access or printed information from websites
- Reproducible #1 Graphic Organizer: Air Pollutants
- Reproducible #2 Collecting Daily Idling Collection
- Reproducible #3 Data Table: Collecting Daily Idling Collection
- Reproducible #4 Analyzing Idling Data
- Reproducible #5 Graphing Idling Data (4 pages)
- Reproducible #6 Graphing Rubric
- Reproducible #7 Bumper Stickers

Vocabulary:
- <u>Air pollution</u>: substances in the airs that have harmful or unpleasant effects.
- <u>Idle or Idling</u>: inactive, not in use, not moving or in operation.
- <u>Other</u>: Line graph, bar graph, pictograph, interval, key, x and y axis

Background:
These websites provide additional background information about pollutants and how idling contributes to air pollution and poor air quality and dispel some common myths about idling.
http://www.cleanaircampaign.com/Air-We-Breathe/Smog-and-Air-Quality/Sources-of-Smog
http://www.cleanaircampaign.com/Air-We-Breathe/Smog-and-Air-Quality/Smog-and-Your-Health

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Learn more at <u>CleanAirCampaign.org.</u>

http://www.cleanaircampaign.com/Air-We-Breathe/The-Truth-About-Idling

Resources:
http://www.epa.gov/air/urbanair
http://epa.gov/airnow/aqikids/index.html
http://www.cleanaircampaign.com/Air-We-Breathe/Smog-and-Air-Quality/Sources-of-Smog
http://www.cleanaircampaign.com/Air-We-Breathe/Smog-and-Air-Quality/Smog-and-Your-Health
http://www.cleanaircampaign.com/Air-We-Breathe/The-Truth-About-Idling
http://www.mass.gov/dep/air/community/schbusir.htm

Procedure:
Warm-up: Idling Introduction and Discussion
1. Ask students to think of times when they observed or were riding in a vehicle that was idling. Solicit as many examples as possible and list them on the board. Some examples may include waiting in a drive-thru line, waiting in a long line to enter a place such as an amusement park, traffic jams, waiting for someone, etc..
2. Ask students why this practice of idling is not good for the air or our health.
3. Ask students if they can think of times they have observed idling at their school. When and where at the school have they observed or do they think the most idling occurs?
4. Ask students if they think they could reduce idling at school? Ask them how they would go about accomplishing that task?
5. Through discussion, students should realize that the car rider line is one place where a high volume of idling occurs. In this lesson, students will work to create education and awareness about idling and begin a campaign to stop idling in the car rider lanes.

Activity One: Researching Pollutants
http://www.epa.gov/air/urbanair
http://www.epa.gov/airnow/aqikids/index.html
1. Break students into groups of 3 or 4. Assign each group one of the 6 air pollutants.

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2. Provide each student with Reproducible #1 Six Major Air Pollutants. Have each group use the following websites to research the causes and effects of the air pollutant they have been assigned:

http://www.epa.gov/air/urbanair
http://www.epa.gov/airnow/aqikids/index.html

3. Students will share their findings with the class and compile information into one graphic organizer on the board. All students should add missing information to their own organizer.

4. As a class, discuss the information and talk about how reducing idling would decrease pollutants in the air.

Activity Two: Collecting Data from the Car Rider Lanes

1. For this activity, break students into lab groups of three to five students. Each lab group will need Reproducible #2: Daily Data Collection for Car Rider Lane, a clipboard and a pencil. You will need a separate copy of Reproducible #2 for each day you will collect data.

2. Each group should collect data for thirty minutes at the same time each morning and each afternoon for one week. They will document the type of vehicle, weather and time(s) the data was collected. *If students are unable to collect data at designated times, an alternative would be to have adults collect the data and students compile the data.

3. After data has been collected for the week, provide each student with a copy of Reproducible #3: Data Table: Compiling Idling Data and complete as a class on the board. Each student should copy down the information from the board into their own table.

Activity Three: Analyzing Data

1. Each student should use their data table to independently answer the questions about the idling data table found on Reproducible # 4 Analyzing Idling Data. This worksheet will be part of assessment.

Activity Four: Graphing Idling Data

1. Provide each student with Reproducible #5 Graphing Idling Data

2. Students will work in groups to complete graphs and questions. Students will represent the data using pictographs, double bar graphs, line graphs, and pie graphs. As well, they will each formulate two questions related to the graphs and then trade papers to answer the questions.

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3. After creating the graphs on their worksheets, each group will create the 4 graphs on poster board (1 of each type) to display in the halls of the school. For assessment, you may collect Reproducible #5 and/or grade the graphs on poster using Reproducible #6: Graphing Rubric.

Activity 5: Bumper Stickers
1. Provide each student with Reproducible #7 Bumper Stickers
2. Have students work in groups of 3 or 4 to produce a bumper sticker to encourage No Idling.
3. The worksheet instructs the students to brainstorm/list ideas and choose/list the ideas that will be used for the bumper sticker. As well, there is space provided for the students to draw their bumper sticker. You may choose to use the provided space for a rough draft or final. We suggest using cardstock paper to make the final bumper stickers.
1. What are the 6 major air pollutants?
2. How does idling contribute to air pollution?
3. Are graphs an effective way to communicate information about idling at our school?
4. Did you see trends and/or patterns when you analyzed the data?
5. How do you think education and awareness will reduce idling at our school?
6. What else can we do to promote No Idling at our school?
At the conclusion of this lesson, students will be able to identify the six major air pollutants, discuss how idling contributes to air pollution, create graphs to represent actual data collected form their school, and begin a campaign to reduce idling at your school.

Extension: Clean Air No Idling Campaign Toolkit
Students will extend the No-Idle Campaign by obtaining a toolkit available from The Clean Air Campaign including signage and pledge cards.
http://www.cleanaircampaign.org/Kids-Schools/The-Clean-Air-Schools-Program/Program-Components/No-Idling-Program

Assessment:
- Participation in class discussion and group work.
- Completion of Reproducible #4 Analyzing Idling Data.

- Completion of Reproducible #5 Graphing Idling Data
- Posters of Graphs- See Reproducible #6: Graphing Rubric
- "Bumper Stickers" on card stock paper and/or Reproducible #7: Bumper Stickers

Follow-Up:
After you have taught this lesson plan, please tell the Clean Air Schools program about your efforts in a brief, 60-second online survey at CleanAirCampaign.org. The information you provide is invaluable in helping this non-profit education program direct its resources to improving these lesson plans and creating new materials for your students. Thanks!

Six Major Air Pollutants

Pollutant	Causes	Effects
Ozone		
Carbon Monoxide		
Nitrogen Oxides		
Sulfur Dioxide		
Particulate Matter		
Lead		

7/21/2009

Data Collection for Car Rider Lane:

Date _____ Start Time_____ End Time_____
Weather_____

Vehicle	Idling Y or N	Truck	Car	SUV
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

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Data Table - Compiling Idling Data:

Materials:
Raw data collected from car rider line for one week
Data table
Procedure: Use data collected over the past week and compile into the data table.

Day of Week	# Vehicles Idling a.m.	Weather a.m.	# Trucks Idling a.m.	# Cars Idling a.m.	# SUVS Idling	# Vehicles Idling	Weather p.m.	# Trucks Idling	# Cars Idling	# SUVS Idling

Analyzing Idling Data

Directions: Use the Idling Data to Answer the Following Questions.

On which day of the week did most of the idling occur?

Did more idling occur in the morning or the afternoon?

Did the type of weather seem to contribute to how much idling occurred?

Which type of vehicle was observed idling the most _____ and least_____?

What percentages of vehicles were idling?
    Monday   _____
    Tuesday   _____
    Wednesday_____
    Thursday   _____
    Friday   _____

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Graphing Idling Data - Student Directions

Student Directions:
1. Your team should create 4 graphs using the data table complied by the class. Each student should draw all graphs and answer/ask questions stated.
2. Each graph should be clearly labeled with a title, x and y axis, intervals, and appropriate keys.
3. Write 2 questions that can be answered by interpreting the data in each of your graphs.
4. As a team, create 1 of each type of graph enlarged on poster board to display in the hall.

Graph 1:
Create a pictograph to show how much idling occurred on each day.
Use the following key: 1 tire=20 cars ½ tire= 10 cars
Why is a pictograph effective to show this data?
Questions about this Graph:
1.
2.

Graph 2:
Create a double bar graph to show how many vehicles were idling in the morning vs. the afternoon.
Why is a bar graph good to show this data?
Questions:
1.
2.

Graph 3
Create a line graph to show which type of vehicle was idling on each day (car, truck, SUV).
Why is a line graph a good graph to use to reflect this data?
Questions:
1.
2.

Graph 4
Create a circle or pie graph to illustrate the percentage of vehicles idling on each day of the week.
Why is a circle or pie graph good for showing this data?
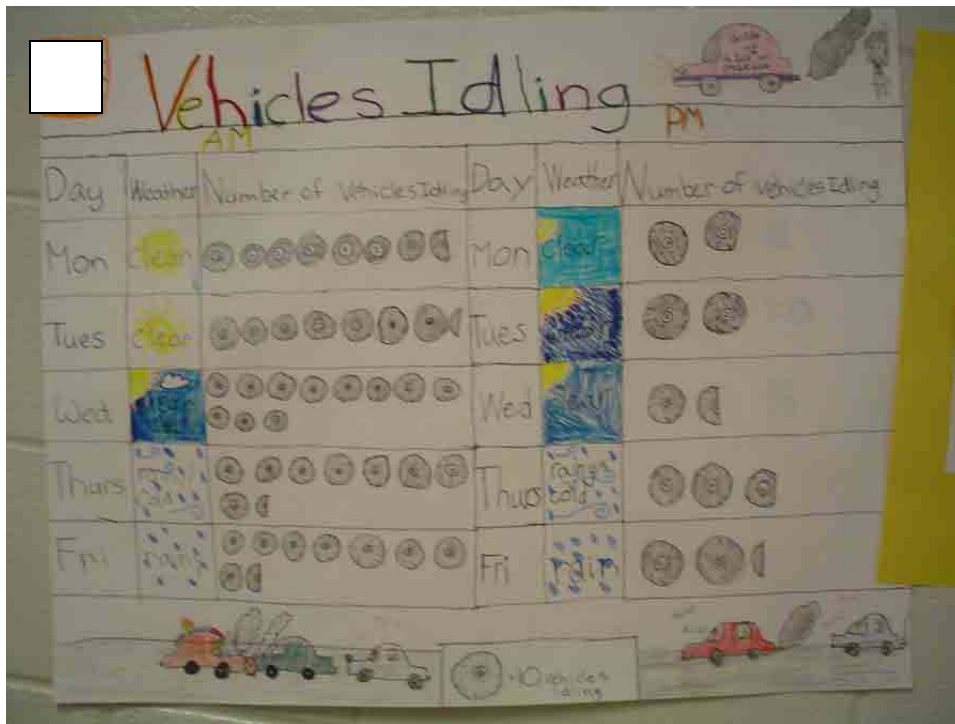Questions:
1.
2.

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Graphing Rubric

Graphing Rubric	Labels 0-3 pts	Intervals and Keys 0-3 pts	Data Display 0-3 pts	Neatness and organization 0-3
Line Graph	0=no labels 1= 1 of 3 labeled (title, x, y axis) 2=2 of 3 labeled (title, x, y axis) 3=3 of 3 labeled (title, x and y axis)	0=no interval, no keys 1= reasonable interval or key labeled. 2=reasonable interval and correctly labeled interval or correctly labeled key. 3=reasonable interval and correctly labeled interval and correct key labeled.	0=all data incorrectly displayed 1=most data incorrectly displayed 2=most data correctly displayed 3=all data correctly displayed	0=lack of neatness and organization 1=somewhat neat and organized 2=adequate neatness and organization 3=very neat and organized
Pictograph	0=no labels 1= 1 of 3 labeled (title, x, y axis) 2=2 of 3 labeled (title, x, y axis) 3=3 of 3 labeled (title, x and y axis)	0=no interval, no keys 1= reasonable interval or key labeled. 2=reasonable interval and correctly labeled interval or correctly labeled key. 3=reasonable interval and correctly labeled interval and correct key labeled.	0=all data incorrectly displayed 1=most data incorrectly displayed 2=most data correctly displayed 3=all data correctly displayed	0=lack of neatness and organization 1=somewhat neat and organized 2=adequate neatness and organization 3=very neat and organized
Bar Graph	0=no labels 1= 1 of 3 labeled (title, x, y axis) 2=2 of 3 labeled (title, x, y axis) 3=3 of 3 labeled (title, x and y axis)	0=no interval, no keys 1= reasonable interval or key labeled. 2=reasonable interval and correctly labeled interval or correctly labeled key. 3=reasonable interval and correctly labeled interval and correct key labeled.	0=all data incorrectly displayed 1=most data incorrectly displayed 2=most data correctly displayed 3=all data correctly displayed	0=lack of neatness and organization 1=somewhat neat and organized 2=adequate neatness and organization 3=very neat and organized
Circle Graph	0=no labels 1=title 2=title and partial sections labeled. 3=Title and all sections labeled.	0=no key 1=an incorrect key 2=partially correct key 3=correct key	0=all data incorrectly displayed 1=most data incorrectly displayed 2=most data correctly displayed 3=all data correctly displayed	0=lack of neatness and organization 1=somewhat neat and organized 2=adequate neatness and organization 3=very neat and organized

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Bumper Stickers

Divide students into groups of 4 or 5 to create artwork and/or a slogan to stop idling in the car rider line at your school.

1. Brainstorm ideas with your group.

2. Select an idea or combination of ideas.

3. Create a "bumper sticker" here or on the cardstock provided.

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Teacher Commentary: 5th grade class
-Great way to utilize math skills and work on a school-wide project - wonderful way to integrate science concepts with necessary math skills
-Wonderful culminating activity for a graphing unit using real-life problems and data that not only analyzes data, but works toward finding solutions
-Students were completely engaged in this lesson knowing they were using authentic data from their school and sharing the data could influence air pollution!
-On their own, they noticed and shared trends in the data. Great lesson!

Sample Student Work:

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