

# MY NASA DATA Lesson:

## Carbon Monoxide and Population Density

### Purpose:

To investigate the Carbon Monoxide level at a fixed latitude to determine if there is a relationship to population density.



**Grade Level:** 10

Image courtesy Environmental Protection Agency (EPA)

### Estimated Time for Completing Activity:

80 minutes

### Learning Outcomes:

- To be able to download data sets and generate a graph.
- To be able to find locations using the Earth's coordinate system.
- To be able to determine a link between human activity and Carbon Monoxide level.
- To be able to develop possible solutions to reducing Carbon Monoxide levels.

### Prerequisite

- Students should be familiar with Excel, including use of the chart wizard.
- Students should be familiar with latitude and longitude.
- Students should be familiar with air pollution.

### Tools

- Internet access
- Excel or other graphing program
- Map of North America with Latitude and Longitude, including major cities
- Printer

### AP Environmental Science Topics

- Air pollutants
- Carbon cycle
- Ecosystem impacts on urbanization
- Environmental risk analysis
- Exponential growth of energy consumption
- Fossil fuels
- Global climate change
- Latitude and longitude
- Major air pollutants
- Primary and secondary pollutants
- Reducing climate change
- Resource use as impacts of population growth

**Vocabulary:**

- [carbon monoxide](#)
- [dependent variable](#)
- [fossil fuel](#)
- [independent variable](#)
- [population density](#)

**Lesson Links:**

- [Importing data into an Excel spreadsheet tutorial](#)
- [EPA – enter carbon monoxide in search box](#)
- [EPA Fact sheet on Carbon Monoxide](#)
- [Live Access Server \(Advanced Edition\)](#)

**Background:**

Carbon monoxide, or CO, is a colorless, odorless gas that is formed when carbon in fuel is not burned completely. It is a component of motor vehicle exhaust, which contributes about 56 percent of all CO emissions nationwide. Higher levels of CO generally occur in areas with heavy traffic congestion. In cities, 85 to 95 percent of all CO emissions may come from motor vehicle exhaust. Other sources of CO emissions include industrial processes (such as metals processing and chemical manufacturing), residential wood burning, and natural sources such as forest fires.(www.epa.gov)

Carbon monoxide is poisonous even to healthy people at high levels in the air. It can affect people with heart disease and affect the central nervous system. ([www.epa.gov](http://www.epa.gov))

Carbon monoxide also has an indirect effect on global climate change, and is a criteria pollutant. ([www.mtpc.org](http://www.mtpc.org))

**Procedure:**

1. Click on the Live Access Server (Advanced Edition) link in the Lesson Links section above.
2. Click on 'Choose Dataset' in the top left corner of the screen if it does not already appear.
3. Select Atmosphere, Air Quality, and then Select Monthly Daylight Column Carbon Monoxide (MOPITT)
4. Above the map in the upper left hand corner of the screen, click on the double downward arrow and choose 'North America' from the drop down menu.
5. Under 'Line Plots' Click on 'Longitude'. Click on 'Update Plot' to produce your line plot.
6. Above the line plot in the menu bar select 'Save As', under 'Select Format' menu and select 'ASCII', use the Default date of March 2000, and click 'ok' to produce your text file to save for use in Excel.
7. Open Excel and import the data set.
8. Create a graph of carbon monoxide vs. longitude, print a copy of your graph.
9. Complete questions.

**Questions:**

1. Look at your graph of Carbon Monoxide and longitude. Is there a relationship between the two variables? State evidence that supports your answer. Identify the dependent and independent variables.
2. Select four points on your graph, two points should represent peaks in CO and two should represent drops in CO. What type of population density is found at these locations (urban or rural)? Based on your knowledge of CO sources do the peaks and drops match your expectations? If yes explain why. If no, what may have caused this outcome?
3. Identify two ways to reduce CO emissions in your everyday life. Develop a public service announcement to educate people on reducing CO emissions.

**Extensions:**

1. Write a position paper that supports your opinion on President G.W. Bush's decision not to sign the Kyoto agreement.
2. Divide students into groups and assign each group a different REGION (all groups use

the same latitude). Complete the same procedures as above, when completed all groups prepare a presentation of their findings. Students will then be able to compare population density and carbon monoxide globally.

*Lesson plan contributed by Barbara Barker, Rochester, NY*

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