



## What is Bad Ozone?

**Subject:** Science

**Grade Level:** 8<sup>th</sup> Grade

**Rational or Purpose:**

For the students to compare ozone levels in different cities in the United States of America to develop a sense of what bad ozone are and why we should not have it. Also students will develop skills in discussion and comparison and discuss what makes good or bad ozone.

**Materials needed:**

- Computer with Internet Access.
- Printer

**Lesson Duration:** 50 minutes

**Source:**

[http://myinasadata.larc.nasa.gov/L9\\_Murphy.html](http://myinasadata.larc.nasa.gov/L9_Murphy.html)

**TEKS:**

(3) (A-E), (4) (A-B), (9) (A), (12) (C)

**Background:**

Today there are different ways to think about our atmosphere. The Earth's atmosphere can be divided into several layers. The bottom layer is called the troposphere which extends from the ground to about 10 km. Next is the stratosphere which starts 10 km up to about 50 km. The next atmospheric layer is the mesosphere which extends from 50km to 80km. The last atmospheric layer, called the thermosphere ranges from 80 km until it reaches space. Scientists have noticed many things when dealing with the layers of the atmosphere. They have noticed many temperature fluctuations in each layer which can give us information about what is going on in the atmosphere. The stratosphere has a higher temperature relative to the other layers, since this layer houses the ozone layer. The ozone layer causes an increase in temperature as it absorbs the UV light from the sun. The ozone in the Stratosphere is what we refer to as "Good" Ozone. This layer protects us from the harmful UV rays and reflects and absorbs most of the heat from the sun. It is known that about 98% of the UV rays are absorbed by the ozone layer. However, with pollution on the rise, ozone is also showing up in the troposphere, the lowest layer of the atmosphere, where we live. This ozone also produces warmth on the surface of the Earth in conjunction with the extra pollutants. This also aids in overall global warming. The majority of the pollutants are known as Volatile Organic Compounds (VOC). These compounds are mostly of carbon and hydrogen and also contain halogens. Halogens also help aid in breaking down

stratospheric ozone. This depletion of ozone is what we called the “hole in the ozone layer”. With more pollution in the atmosphere, the ozone hole increases and the protection offered to us by the stratospheric ozone decreases. CFC’s are a VOC that have a significant impact on the ozone layer. CFC’s are relatively stable until it rises into the stratosphere to come in contact with the UV rays. There they are broken down releasing Halogens (specifically chlorine) which can react with ozone and destroy it. One molecule of chlorine is estimated to degrade over 100,000 molecules of ozone before it is removed from the stratosphere. By regulating CFCs, we can make sure the ozone does not get destroyed and we can be protected.

**Activity:**

Students will be able to use computers with internet access to extract information regarding different cities and their ozone levels, define ozone and when it is good and bad, and compare levels of ozone in different cities to determine why some have higher concentrations of “bad” ozone than others.

**Procedure:**

1. Have students organized into groups of four. Tell the students that they will be researching using the computer to see the different “Bad” Ozone regions in popular cities.
2. Each group will be assigned a different city in which they have to find data on the amount of ozone in the troposphere atmosphere. This is known as the bad ozone.
3. Once everybody has found their data, each person in the group should print a graph or copy of the data.
4. Now all the groups will split and form different groups with each group having all the cities in them.
5. Have the students analyze the data and see the differences between the different regions of the USA.
6. The group will then write down what they think is the problem in the city with the most pollution and why the amount of ozone is different.
7. Then have the class get together and discuss what they all think and come up with a consensus of what is the problem and solution to it.

A good way to gather the ozone data is using NASA Data. Students will collect and graph their city's tropospheric ozone residual monthly climate for a one-year period. The website for NASA Data is <http://mynasadata.larc.nasa.gov/data.html>.

**To access data:**

1. Access MY NASA DATA website
2. Go to Live Access to Data (Advance)
3. Go to Live Access to Server
4. Go to Atmosphere
5. Go to Air Quality
6. Go to Monthly Tropospheric Ozone Residual Climatology (TOR)

7. Click Next

**To create a graph, select the following:**

1. Select View: Time Series
2. Select Output: Line Plot
3. Select Region: North America
4. Either type in your latitude and longitude or move the indicator on top of the city that was given to you.
5. Select Range: Begin-January Average, End-December Average
6. Click Next
7. Print one copy of the Tropospheric Ozone Residual Monthly Climatology graph for each member of the expert group.

**Questions to ask the class:**

1. What city had the highest peak of Bad Ozone?
2. How would you classify your city? Good or Bad?
3. When is the highest peak of Ozone?
4. How would you have a lower amount of Ozone?
5. Does any of the cities do something about the CFCs or pollution? If so does it help?

**Cities to Use:**

Austin, Texas  
New York, New York  
Seattle, Washington  
Columbus, Ohio  
Las Angeles, California  
Miami, Florida  
Washington D.C.  
Houston, Texas