Name: _____

Date:_____

Task: National Sulfur Dioxide Trend **Unit:** Aerosols DATA **Module:** Atmosphere

The data set was obtained from the EPA (Environmental Protection Agency) website. The spreadsheet contains the annual mean for U.S. SO₂ emissions from 1980 to 2016. Air monitors throughout the country are used to collect SO₂ concentration data, in addition to other pollutants, to monitor air quality. On the EPA web site: https://www.epa.gov/so2-pollution there is information about the standards used to monitor air quality. Information about the monitors locations can also be found on the website. The data for this lab was obtained at: https://www.epa.gov/air-trends/sulfur-dioxide-trends#sonat. Updated versions of the spreadsheet can be obtained the EPA website.

The EPA has two standards for SO₂ monitoring, a primary and a secondary. The unit used for monitoring SO₂ **primary standard** was developed for health protection, especially for at risk populations – asthmatics, children and the elderly. The **primary standard** of 75 ppb (parts per billion) is calculated within 99 percentile of one hour of daily maximum concentrations, averaged over three years. This means that for every hour of readings of a monitor 99% of the timed concentrations averaged over 3 years cannot exceed 75 ppb. There is also a secondary emission standard for public welfare, protection against decreased visibility, and damage to crops, vegetation, animals and buildings. In a 3 hour averaged time of emission the SO₂ level should not exceed 0.5 ppm (parts per million) this occurrence cannot happen more than once per year. This is according to the National Ambient Air Quality Standards (NAAQS).

Part I

Create a spreadsheet using the file: National SO_2 Emissions Trend.csv This file is within the data spreadsheet files for the Aerosol Data Unit.

Step I

- 1. Open Excel and go to File Menu and open a **New Workbook**.
- 2. Go to File and select **Import**
- 3. The pop up screen will appear: What type of File you want to import? Select **csv**. **Note:** the file name at the end has the initials **.csv**, some times it will be a text file, in that case at the end of the file after the period will appear .txt) This how you can tell what type of file your importing.
- 4. Search for the File Name: National SO₂ Emissions Trend.csv
- 5. The Text Import Wizard window will open.
- 6. Click on **Delimited** then click **Next**
- 7. Select: ✓ **Tab:** ✓ **Space:** ✓ **Comma** then click next.
- 8. On Column Data Format: select General
- 9. Import Data: click OK then click Finish

10. <u>Save the spreadsheet</u> with the same file name and your initials at the end or follow instructions on how to save the spreadsheet. Save it in a folder in a drive that can easily be accessed.

Step II Data Analysis -

- 1. <u>Create a trend graph</u> that also shows an SO₂ emission standard line, the mean; the lower limit and the upper limit of emissions per site in a time series.
 - a. The spreadsheet has several columns with values, become acquainted with them. Try to interpret what they mean and what the numbers are doing.
 - b. Answer the questions before graphing.
 - a. To the best of your knowledge what do the columns mean?

 - 4. Column D ______.
 5. Column E ______.
- <u>Add National Standard Line.</u> In order to add a line representing the National Standard of 75ppb in column F label the column 75 ppb in cell 1 and in cell 2 right the number 75. **Short cut**: Instead of typing 75 in each cell enter the number 75 in cell 2 place the cursor on the blue box and drag it down so that its parallel to the cell of the last year of the data 2018 (cell 38).
- 3. <u>Time to Graph:</u>
 - a. **Highlight**, **Column A and Column B**, simultaneously at the same time.
 - b. Holding the command button down (Ctrl. for PC) **highlight Column D, E, and F**. Make sure **not to highlight Column C**.
- 4. <u>Select Type of Graph</u>. Go to Chart Menu select **Scatter**, then **Smoothed Line Scatter** and a graph with 4 lines, should appear.
- <u>Change the X-Axis minimum value to start at 1980</u>. Click on the X-Axis twice and the Format Axis screen will pop up. Click on Scale change the minimum value to 1980 (1st year of data). Change the Maximum to 2016 (last year of data).
- 6. <u>Change the angle of the years on graph.</u> In the same X-Axis Format Box look on the menu to the left and select **Text Box, Change the Direction** of the text (years) click on the down arrow and **select Rotate to 90° Counterclockwise.** Notice how the years on the X-Axis shift to 90° degree angle, now they can me read. Expand the chart by placing the cursor on the four dots on either side of the blue frame of the graph. Make sure the cursor is a bar not a cross, click holding down and move the cursor in the direction that will stretch the graph.

- 7. <u>Label the Graph</u>. Go to **Chart Layout** click on **Axis Titles** select X Axis and when the text box pop ups on the graph wright Year. Do the same for the Y-Axis, label it SO₂ Concentration, ppb.
- 8. <u>Add a Title to the graph</u>. Go to Chart Layout and click on **Chart Title**. Select **Title** from Above write SO₂ Air Quality 1980 -2016 – Annual 99th Percentile of Daily Max 1- hour Average – National Trend Line on 42 Sites.
- 9. <u>Identify each line of the graph.</u> Try to figure out which color line represents which. Notice that Each line will have a different color and on the legend to the right it will be labeled series 1, series, 2 and so on. What data do the series lines represent?
 - *a.* Series 1 line _____
 - b. Series 2 line _____
 - c. Series 3 line _____
 - d. Series 4 line _____
- 10. <u>*Click on line to verify responses.*</u> Place the cursor on each line then click and the data used to produce that line will highlight on the spreadsheet. Check your answers.
- 11. If helpful *add trendlines* to each of the data lines. Go to Charts Layout and select Trendline, click on Linear Trendline.

Part III. Graph Analysis

- 1. Mean Line: Add a trendline to the mean line, which lies in the middle traversing the national standard line. Describe the meaning of this line. What is the line showing?
- 2. What is the trend of the mean SO_2 emissions?
- 3. What year did the average SO_2 emissions dip below the national standard of 75 ppb?
- 4. Which line had the steepest decline?
- 5. Which line had the least decline?
- 6. What do you think the 10th percentile line means?
- 7. What do you think the 90th percentile line means?
- 8. Under which category do you think most of the sites fall under? The 10th percentile or the 90th percentile?
- 9. What do you attribute to the substantial reduction of SO₂ emissions?
- 10. Compare the emissions of the Bronx site to the National Average (mean) emissions?
- 11. What do you think might be the implications the trend of the National Data has for the Sahel?