

Laboratory Week 11

Environmental Science 101, Pollutant Movement through Air, Land and Water

AIR QUALITY SAMPLING

Purpose:

1. Demonstrate various air sampling techniques
2. Obtain ozone data for analysis (for Underhill)
3. Determine if northern VT meets air quality standards for ozone

1. Demonstrate various air sampling techniques

A tour of the Vermont Air Pollution Control Division's Air Monitoring station for Burlington, VT will be provided. The equipment includes:

- o Meteorological station
- o PM2.5, continuous (TEOM)
- o PM10 (high volume)
- o BTEX, semi-continuous
- o Carbon monoxide (CO)
- o Volatile Organic Compounds (VOC)
- o Carbonyls
- o Aethelometer

2. Obtain ozone data for analysis for May and September 2007 (for Underhill)

Method

Advanced Pollution Instruments (API) Model 400 Ultraviolet Absorption Ozone analyzer: The State of Vermont APCD operates two continuous ozone monitoring sites within the state (Underhill and Bennington). The instrument samples local ambient air quality 24 hours a day, 365 days a year. Averaging intervals of 1, 5, 60, 480 minutes are automatically logged with the data acquisition systems. The unit is setup and operated to monitor ambient ozone concentrations up to 500 parts per billion. The one hour ozone and running eight hour averages from the two monitoring sites are compiled and presented on a hourly basis on this web site.

Principle Utilized: The instrumental operation utilizes the principle of "Ultraviolet Absorption" that is based on the fact that ozone molecules absorb ultraviolet energy at a known wave length of 254nm. The UV light available for detection is proportional to the amount of ozone in the sample chamber.

Quality Assurance/Quality Control (See Appendix 1)

Each day a midnight 2 known concentrations are introduced to the ozone analyzer. The concentrations are:

Zero = 0 ppb
SPAN = 450 ppb

During the data validation review, the expected and actual concentrations are compared and confirmed to be within 5%. If the values are within 5%, the data for the preceding day are considered to be valid. If they are not within 5%, additional data validation procedures need to be followed, such as checking equipment maintenance logs, instrument operation, analytical flags, etc..

*Note: SPAN down for maintenance May 11-May 15

Data & Data Review

The ozone season runs from April 1 to September 30th of each year. Samples are collected hourly. For this lab report we will only be reviewing data from May and September.

Review the ozone data for May and September 2007. The “-999” data values represent periods of invalid data that may be caused by the following reasons:

- Every midnight a zero and span is introduced to the unit to challenge precision of the unit.
- One every two weeks precision audit points are introduced (known concentration).
- Once a quarter accuracy audit points are introduced. (range of known concentrations, independent system) Calibration (scheduled as required).
- General maintenance (manifold cleaning, instrument maintenance).
- Power outages
- Miscellaneous (Instrument out of control, machine malfunction, data acquisition malfunction etc)

Procedures

- a. QA/QC the data, and remove any invalid data from the database. This includes verifying that the “zero” and “SPAN” are within 5%, and checking the data for invalid data (i.e., -999).
- b. Graph May and September ozone data vs date (date on x axis). Also, identify the NAAQS of 80 ppb on this graph.
- c. What are the five highest hourly ozone concentrations in May? September? What are the five lowest?
- d. What was the average ozone concentration in May? September?

Discussion

- a. What process would you go through to determine if the ozone data from May 11-May 15 is valid? Explain your reasoning.

For the following questions, assume the data from May 11-May 15 is valid.

- b. How many days in May had hourly averages that exceeded 80 ppb? How many days in September?
- c. During what part of the day are ozone concentrations highest? Why?
- d. If the ozone average concentration over 8 hours is expected to be 87.0 ppb, what would the corresponding Air Quality Index (AQI) be?
- f. Why aren't we required by the EPA to monitor for ozone in October-March?

3. Determine if northern VT meets air quality standards for ozone

The NAAQS for ozone is 80 ppb averaged over an 8 hour period. According to EPA, to demonstrate compliance with this standard (i.e., attainment or non-attainment), the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

Yikes!

For purposes of this lab, we have summarized data from 2005, 2006 and 2007 (see attached.) Use the EPA method to determine if VT meets the EPA ozone standard of 80 ppb in Underhill.

The ozone standard is in the process of being revised to become protective of public health. If the new standard becomes 70 ppb, based on 2005, 2006 and 2007 data, would VT meet the standard?