Measurement of Ozone Concentration in Camarillo, CA during late Spring 2010

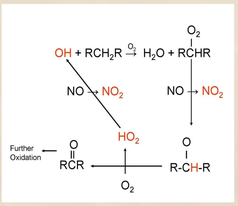
Rosie M. Alvarez, Gardy Borromeo, Irene G. Rebamonte and Simone Aloisio

Department of Chemistry, California State University Channel Islands, Camarillo, California 93012

Introduction

Ozone (O_3) is both a natural and man-made product that occurs both in the stratosphere and troposphere. Stratospheric ozone makes up the ozone layer, which shields the surface of the earth from harmful ultraviolet radiation. Tropospheric O_3 is the result of pollution and is harmful to human health. For this research project we collected tropospheric O_3 concentration data for the past three weeks to determine how the local weather affects air quality.

Tropospheric Ozone



$NO + RO_2 \rightarrow NO_2$

$NO_2 + h\nu\ (\lambda < 430\ nm) \rightarrow NO + O$

$O + O_2 + M \rightarrow O_3 + M$

NO_2 is photolyzed, to reproduce NO (catalytic) and make ozone, O_3

Ozone Concentration Index (ppb)	Air Quality Descriptor	Health Risk
0-59	Good	Air quality is considered satisfactory, and air pollution poses little or no risk.
60-75	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
76-95	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
96-115	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
116-375	Very Unhealthy	Health alert: everyone may experience more serious health effects.

- NO_x + VOC + hν → smog (ozone)
- O_3 secondary pollutant
- O_3 and particulate matter determines the Air Quality Index.

Instrumentation

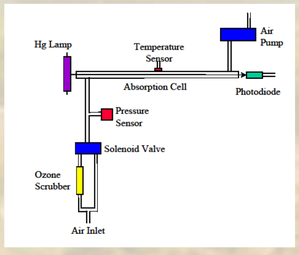
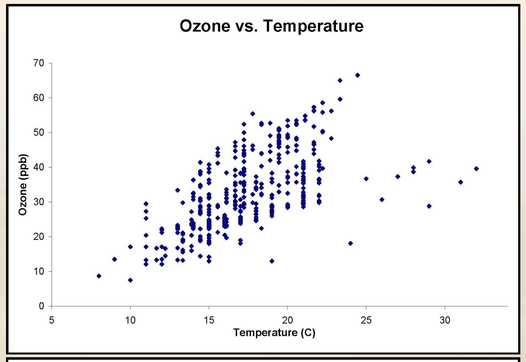


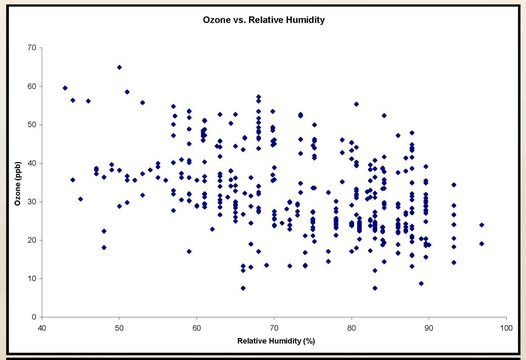
Figure 1: Diagram[2] and picture of ozone monitor, model 202 (2B Technologies).

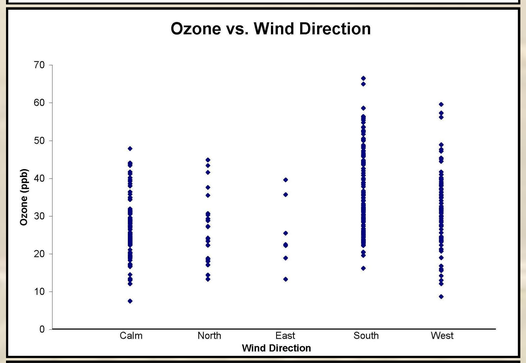
The ozone monitor operates by UVvis spectroscopy. A mercury lamp is used which emits at 254 nm, where ozone absorbs strongly. Absorbance is measured using a 15 cm cell path and concentration is determined using the Beer-Lambert Law.

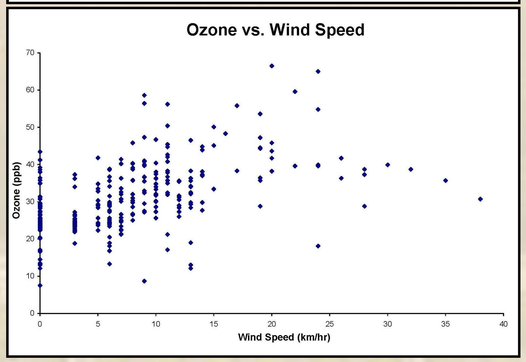
$$A = \log_{10}(I_0/I) = \varepsilon l c$$

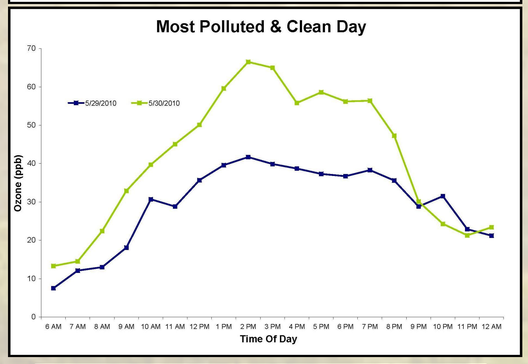
Results

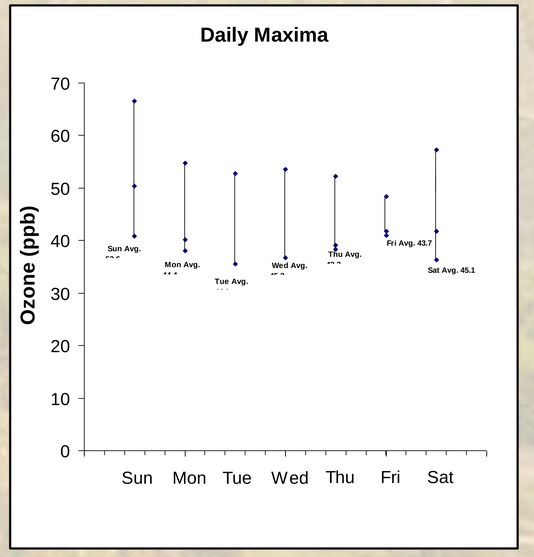












Daily High Temperature and Peak Ozone Concentration

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				5/27 20°C (38.3 ppb)	5/28 21°C (41.7 ppb)	5/29 32°C (41.7 ppb)
5/30 24°C (66.5 ppb)	5/31 22°C (54.8 ppb)	6/1 20°C (52.7 ppb)	6/2 21°C (53.5 ppb)	6/3 19°C (52.3 ppb)	6/4 21°C (48.4 ppb)	6/5 22°C (57.3 ppb)
6/6 23°C (50.4 ppb)	6/7 21°C (38.1 ppb)	6/8 22°C (35.5 ppb)	6/9 22°C (36.7 ppb)	6/10 22°C (39.1 ppb)	6/11 22°C (41.0 ppb)	6/12 22°C (36.3 ppb)
6/13 22°C (40.8 ppb)	6/14 22°C (40.2 ppb)					

Conclusions

- Relatively clean air for the time period measured.
- Strong correlation between O_3 and temperature.
- Inverse relationship between O_3 and relative humidity.
- Possible relationship between O_3 and wind speed/direction.

Health Effects of Ozone

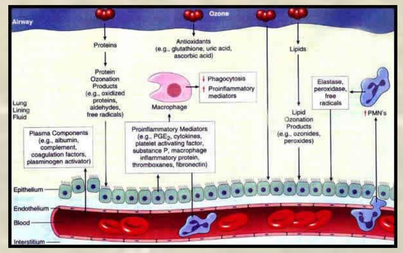
When ozone is inhaled, it interacts with epithelial cells lining the respiratory tract by inflammation.

Short term exposure effects. (i.e. cough, deep inspiration, and shortness of breath)

Long term exposure effects. (i.e. worsens chronic diseases, cardiovascular disease)

At Risk Groups[1] for Ozone in Ventura County	
Total Population	797,740
Pediatric Asthma	19,470
Adult Asthma	49,794
Chronic Bronchitis	25,737
Emphysema	9,699
Cardiovascular Disease	212,173
Diabetes	52,697
Children under 18	206,833
Adults over 65	91,279
Poverty	68,486

[1] State of the Air Report 2010, American Lung Association



References

1. American Lung Association www.lungusa.org
2. The Weather Channel www.weather.com
3. Air Now www.airnow.gov
4. Weather Underground www.wunderground.com
5. US Environmental Protection Agency www.EPA.gov

Acknowledgements

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