An Overview of Air Pollution Issues

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Three “Problems” --

1. “Criteria” Air Pollutants
2. “Air Toxics”
3. Climate Change/“Greenhouse Gases”
Welcome to the Air Pollution Control Division

The Vermont Air Pollution Control Division (APCD) of the Department of Environmental Conservation (DEC) implements state and federal Clean Air Acts. As part of this implementation, the APCD monitors air quality and air pollution sources, proposes regulations to improve existing air quality, ensures compliance with the regulations, and issues permits to control pollution from sources of air contaminants across the state.


Air Toxics Information on air toxic sources, health effects, ambient monitoring, reduction efforts and other related information.

Monitoring: Real-time data, air-monitoring site info, air quality maps and reports.

Planning: Point source registration program, climate change planning activities, atmospheric modeling, emissions inventory and state implementation plan work.

Mobile Sources: Provides technical expertise on transportation-related air pollution activities.

Permitting: Access information on air pollution control permits. Permits available online in PDF format.

Compliance: Ensures compliance with air quality regulations and air pollution control permits.

Contact Us: Addresses, emails and phone numbers.
Air Quality Monitoring Network

http://www.anr.state.vt.us/air/
National Ambient Air Quality Standards

§ 109 CAA: “… to protect human health..”

six air contaminants:

Carbon Monoxide (CO)
Sulfur Dioxide (SO₂)
Lead (Pb)
Nitrogen Dioxide (NO₂)
Particulate Matter (PM)
Ozone (O₃)
What makes Ozone (smog)?

VOC + NOx

Heat + Sunlight
NAAQS -- Ozone

Unrounded Ozone Three-Year Averages of Annual Fourth Maximum Daily Maximum 8-Hour Averages

To show trend, data was not rounded from three to two decimal places as required to determine compliance.

National standard of 0.08 parts per million

World Health Organization Guideline
PM$_{2.5}$ particles are so small that 30 of them side-by-side would barely equal the width of a human hair (graphic courtesy of U.S. Department of Energy)
Primary and Secondary Forms of PM$_{2.5}$

Examples of Primary PM
- Diesel soot
- Boiler Fly Ash
- Mechanical abrasion processes

Examples of Secondary PM
- Sulfur Dioxide (gas) $\rightarrow$ Sulfate
- Nitrogen Oxides (gas) $\rightarrow$ Nitrate
PM$_{2.5}$ -- Visibility/Haze:
PM$_{2.5}$ Chemical Speciation for Thursday June 26, 2003 in Burlington.

PM$_{2.5}$ FRM Concentration = 37.6 µg/m$^3$  Sum of Chemical Species = 34.2 µg/m$^3$

- Sulfate: 14.175 (38%)
- Nitrate: 0.747 (2%)
- Ammonium: 5.333 (14%)
- Organic Carbon: 9.354 (25%)
- Elemental Carbon: 0.511 (1%)
- Trace Elements: 0.96 (3%)
- Unknown: 6.44 (17%)
PM$_{2.5}$ Chemical Speciation for Monday March 1, 2004 in Burlington.

PM$_{2.5}$ FRM Concentration = 38.4 $\mu$g/m$^3$  Sum of Chemical Species = 34.9 $\mu$g/m$^3$

- Sulfate: 6.625 (17%)
- Nitrate: 13.777 (36%)
- Ammonium: 6.49 (17%)
- Organic Carbon: 6.537 (17%)
- Elemental Carbon: 0.868 (2%)
- Trace Elements: 0.478 (1%)
- Unknown: 3.493 (9%)
PM$_{2.5}$ Chemical Speciation for Sunday July 7, 2002 in Burlington.

PM$_{2.5}$ FRM Concentration = 61.4 µg/m$^3$  Sum of Chemical Species = 37.1 µg/m$^3$

- Sulfate: 1.046 (2%)
- Nitrate: 0.956 (2%)
- Ammonium: 0.881 (1%)
- Organic Carbon: 32.773 (54%)
- Elemental Carbon: 0.349 (1%)
- Trace Elements: 0.665 (1%)
- Unknown: 24.268 (40%)
Data points are running three-year averages of annual average data. Compliance with the annual average standard is assessed relative to these running averages. As of 2005, the PM2.5 annual average standard is 15 micrograms per actual cubic meter.
Data points are the running three year average of annual 98th percentile sample data. Compliance is assessed relative to these running averages.
Air Toxics:

Levels of certain Toxic Air Pollutants do exceed state standards and recognized risk levels.
Air Toxics:

Benzene Concentrations in Vermont
1993 to 2003

Date
01/31/93 11/27/93 09/23/94 07/20/95 05/15/96 03/11/97 01/05/98 11/01/98 08/28/99 06/23/00 04/19/01 02/13/02 12/10/02 10/06/03

Brattleboro
Burlington
Rutland
Underhill

ug/m³
Climate Change:

Percent of Years (out of the previous 10 years) that Lake Champlain Did Not Freeze Over

- 2001: 70%
- 1991: 60%
- 1981: 50%
- 1971: 40%
- 1961: 30%
- 1951: 20%
- 1941: 10%
- 1931: 0%
Motor Vehicle Air Pollution and Fuel Consumption
Motor Vehicle Contribution to Air Pollution in Vermont

- Largest source of Carbon Monoxide (61%)
- More than 120,000 tons of Carbon Monoxide are emitted annually from motor vehicles in Vermont
Motor Vehicle Contribution to Air Pollution in Vermont

- Largest source of hydrocarbons (48%)
- More than 10,000 tons of hydrocarbons are emitted annually from motor vehicles in Vermont
Motor Vehicle Contribution to Air Pollution in Vermont

- Largest Source of Nitrogen Oxides (NOx) (79%)
- More than 15,000 tons of NOx are emitted annually from motor vehicles in Vermont
Climate Change:

Percent of Years (out of the previous 10 years) that Lake Champlain Did Not Freeze Over

- 2001: 70%
- 1991: 60%
- 1981: 70%
- 1971: 60%
- 1961: 60%
- 1951: 60%
- 1941: 60%
- 1931: 60%
- 1921: 60%
- 1911: 60%
- 1901: 60%
- 1891: 60%
- 1881: 60%
- 1871: 60%
- 1861: 60%
- 1851: 60%
- 1841: 60%
- 1831: 60%
Vermont Greenhouse Gas Emissions by Source

- Transportation Fossil Fuel Combustion: 44%
- Residential Fossil Fuel Combustion: 18%
- Commercial Fossil Fuel Combustion: 7%
- Industrial Fossil Fuel Combustion: 7%
- Electric Utility Fossil Fuel Combustion: 0.8%
- Livestock, manure, fertilizer: 9%
- Biomass Combustion: 10%
- Landfills: 4%
- Livestock, manure, fertilizer: 9%
- Residential Fossil Fuel Combustion: 18%

Photo courtesy of SEAWIFS
Greenhouse Gases:

Figure 3.III.11  Vermont Delivered Energy Use by Sector

TBTU

- Transportation
- Residential
- Commercial
- Industrial
Greenhouse Gases:

Figure 3.III.25  Vermont Emissions from Energy Use

Tons

- Carbon monoxide
- Ozone precursors
- Acid rain precursors
- Particulates
- Greenhouse gases

Thousands of tons

Millions of tons of CO₂ equivalent

Carbon gases

Improving Air Quality

Therefore if the Public Policy of Vermont is to:

• Remain in Attainment of National Ambient Air Quality Standards
• Reduce levels of Airborne Toxins
• Manage Greenhouse Gases

Need a Four Part Strategy:

Improved Air Quality = “Clean Cars” + “Good Maintenance” + “Clean Fuels” + “Wise Use”
U.S. EMISSION HISTORY, VEHICLE FUTURE PROSPECTS
(in grams of reactive hydrocarbon emissions per mile driven)

Vehicle Emissions Levels (FTP)

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<td>Pre-control</td>
<td>10.6</td>
<td>4.1</td>
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- Catalysts introduced
- Advanced 21st Century Technology

Honda
- Civic
- EV PLUS
- Fuel Cell Vehicles

Practically Zero

PZEV ATPZEV ZEV
Air Pollution Control In Vermont: “Good Maintenance”

OBDII

SERVICE ENGINE SOON!

CHECK ENGINE

CHECK

DTC Structure Identification

P 0 3 0 1

0 = GENERIC (SAE)
1 = MANUFACTURER SPECIFIC

P = POWERTRAIN
B = BODY
C = CHASSIS
U = NETWORK

1 = FUEL AND AIR METERING
2 = FUEL AND AIR METERING (INJECTOR CIRCUIT MALFUNCTIONS ONLY)
3 = IGNITION SYSTEM OR MISFIRE
4 = AUXILIARY EMISSION CONTROLS
5 = VEHICLE SPEED CONTROL AND IDLE CONTROL SYSTEM
6 = COMPUTER AND AUXILIARY OUTPUTS
7 = TRANSMISSION
8 = TRANSMISSION
Air Pollution Control In Vermont: “Clean Fuels”

- Unleaded Gasoline
- Oxygenated Gasoline
- Reformulated Gasoline/Low Sulfur
- Reformulated Diesel/Low Sulfur
- Alternative Fuels
Alternative Fuels

- Natural Gas
- Propane
- Ethanol
- Bio Diesel
- Electricity
- Hydrogen

Cleaner, but not Renewable
Renewable, but not necessarily Cleaner
May be Cleaner and may be Renewable
Thank you for this opportunity to talk with you about air quality in Vermont.

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