

Fine Particle Air Pollution in the Keene Area



Michael Plotczyk.

Overview

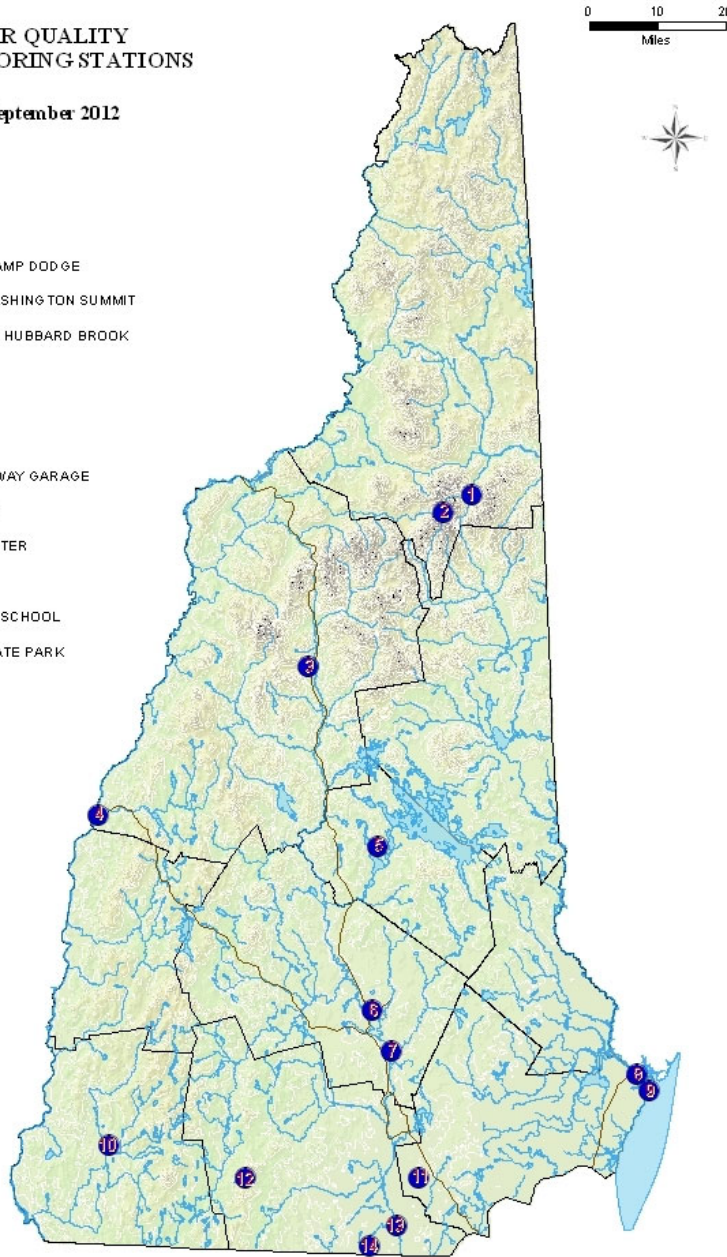
- Air pollution monitoring
- Keene's valley topography
- Fine particle pollution – wood smoke
- Impacts to public health
- Being a part of the solution
 - Burn the right wood
 - Use the right stove
 - Burn the right way!

NH Department of Environmental Services
Air Resources Division

AIR QUALITY MONITORING STATIONS

September 2012

- 1 GREENS GRANT [AMC/DES/USFS], CAMP DODGE
- 2 SARGENTS PURCHASE [DES], MT WASHINGTON SUMMIT
- 3 WOODSTOCK [DES/HBRF/CASTNET], HUBBARD BROOK
- 4 LEBANON AIRPORT [DES]
- 5 LACONIA [DES], GREEN STREET
- 6 CONCORD [DES], HAZEN DRIVE
- 7 PEMBROKE [DES], PEMBROKE HIGHWAY GARAGE
- 8 PORTSMOUTH [DES], PIERCE ISLAND
- 9 RYE [DES], SEACOAST SCIENCE CENTER
- 10 KEENE [DES], WATER STREET
- 11 LONDONDERRY [DES], MOOSE HILL SCHOOL
- 12 PETERBOROUGH [DES], MILLER STATE PARK
- 13 NASHUA [DES], CROWN STREET
- 14 NASHUA [DES], GILSON ROAD



NHDES ARD
11 September 2012

How do we measure Air Pollution in New Hampshire?

NH Department of
Environmental Services

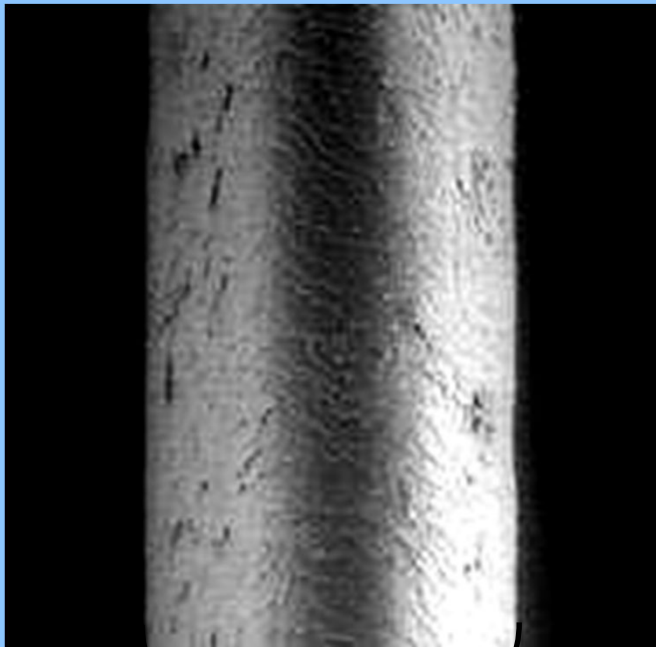
Air Monitoring Stations

- 14 different locations
- Measure various pollutants and meteorological parameters

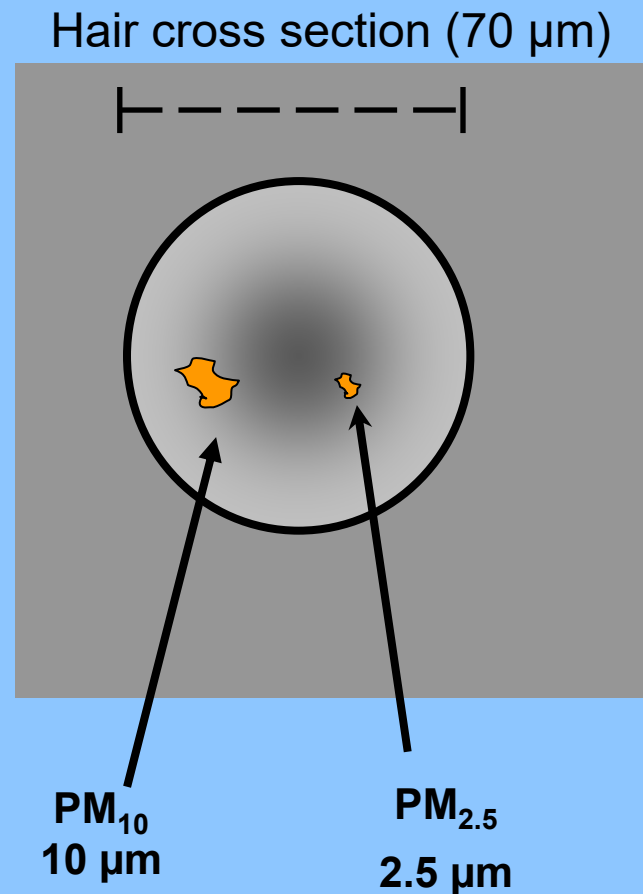


Fine Particle Pollution: What is It?

**A complex mixture of extremely small particles
and liquid droplets**



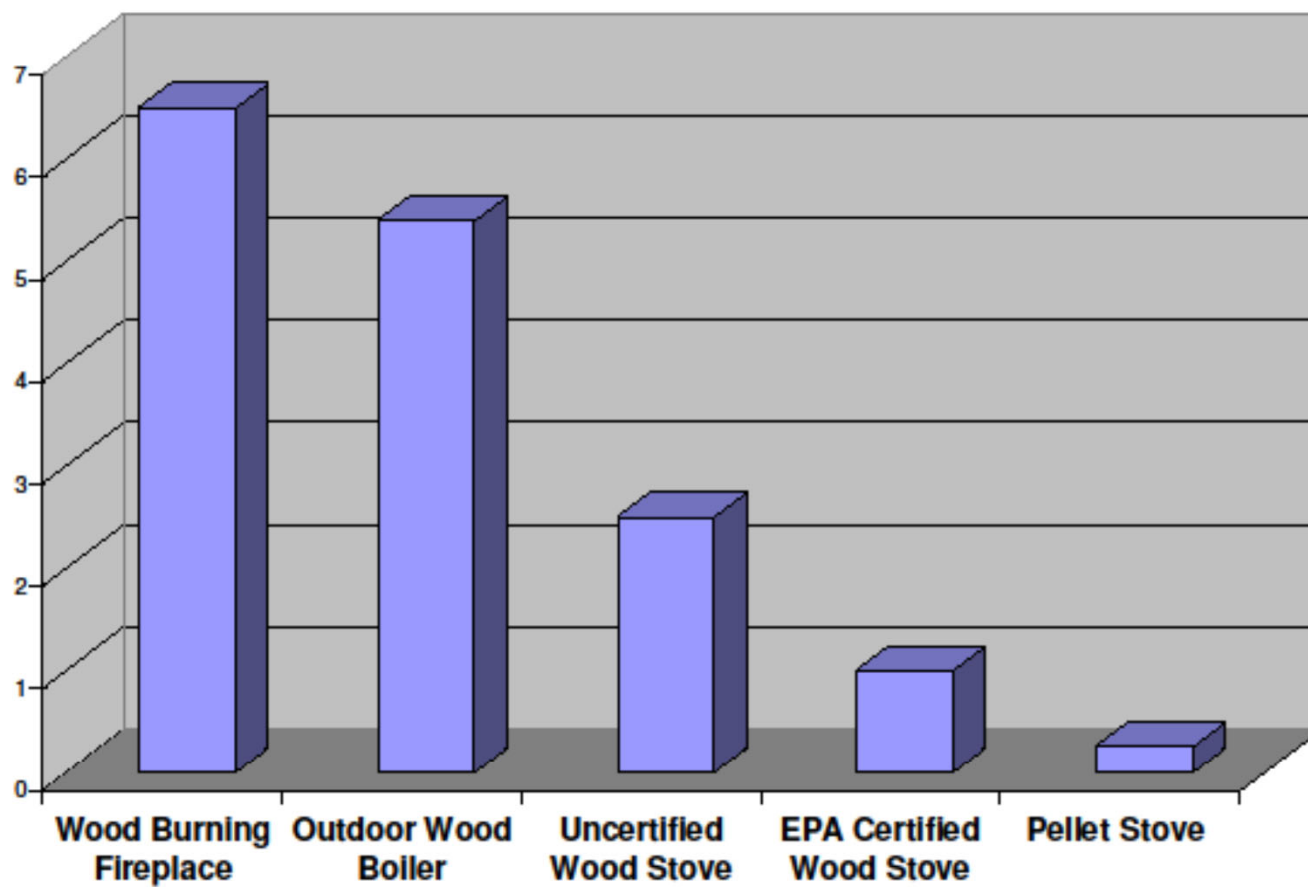
Human Hair
(70 microns in diameter)



Where does Particle Pollution come from?

- Car, truck, bus and off-road vehicle (e.g., construction equipment, snowmobile, ATVs, trains) exhausts
- Burning of fuels such as wood, heating oil or coal and natural sources such as forest and grass fires.
- The reaction of gases or droplets in the atmosphere from power plants. These chemical reactions can occur miles from the original source of the emissions.
- Can be carried long distances, so wildfires or volcanic eruptions can raise fine particle concentrations hundreds of miles from the event.
- Also produced indoors. Some indoor sources of fine particles are tobacco smoke, cooking (e.g., frying, sautéing, and broiling), burning candles or oil lamps, and operating fireplaces and fuel-burning space heaters (e.g., kerosene heaters).

Relative emissions of PM 2.5



Keene's Valley



Calm winds and the inversion result in poor air quality.



❶ The winter sun, low in the sky, supplies less warmth to the Earth's surface.

❷ Warmer air aloft acts as a lid and holds cold air near the ground.

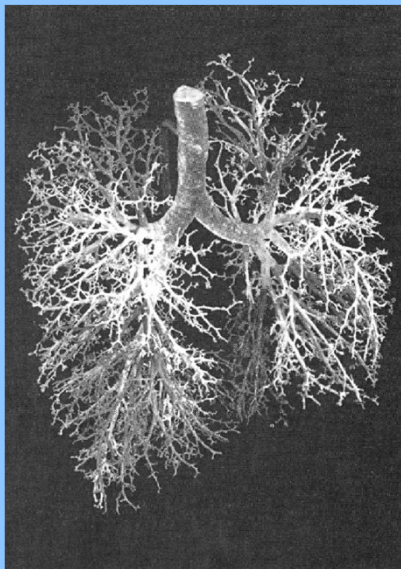
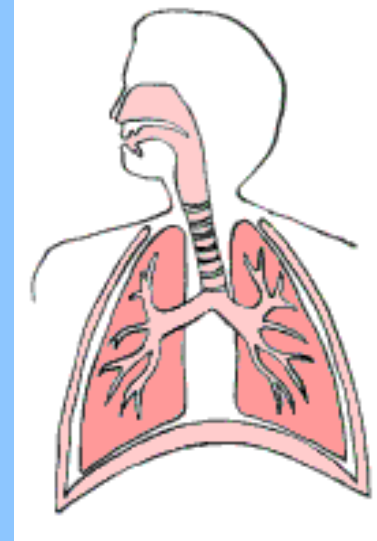
❸ Pollution from wood fires and cars are trapped by the inversion.

❹ Mountains can increase the strength of valley inversions



Particle Pollution Deposition

- Larger particles ($> PM_{10}$) deposit in the upper respiratory tract
- Smaller, inhalable particles penetrate into the lungs ($PM_{2.5}$)



- Smallest particles (ultrafines, $PM_{0.1}$) may enter bloodstream
- Deposited particles may accumulate, react, be cleared or absorbed

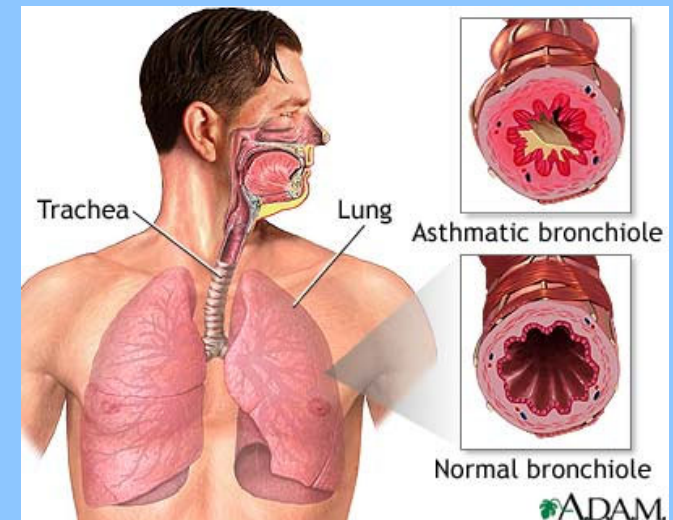
Effects on Public Health

- Hospital and emergency room admissions
- Doctor office visits
- School and work absences
- Medication usage
- Premature deaths from heart and lung disease
- Emerging evidence
 - Lung cancer mortality
 - Infant mortality
 - Developmental effects in children (e.g., low birth weight, slowed lung function growth)



Respiratory System Effects

- **Adverse effects**
 - Increased cases of chronic bronchitis
 - Increased asthma attacks and bronchitis
- **Other observed issues**
 - Increases in respiratory symptoms
 - Decreased lung function
 - Inflammation of airways



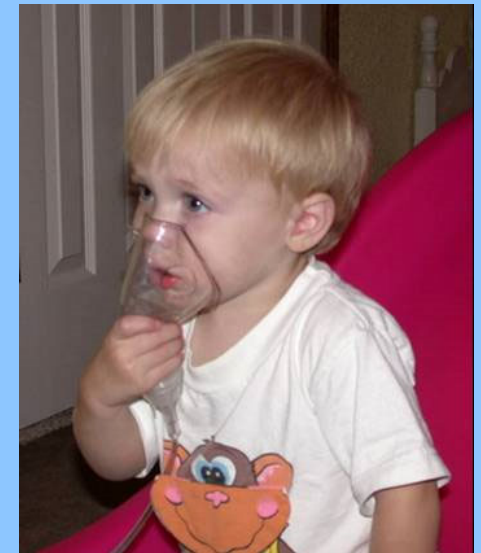
Cardiovascular System Effects

- Adverse effects
 - Heart attacks
 - Cardiac arrhythmias
- Other observed issues
 - Heart rate variability
 - Blood component changes – systemic effects



Groups At Risk

- People with heart or lung disease
 - Conditions make them vulnerable
 - Greater particle deposition with chronic obstructive pulmonary disease (COPD)
- Older adults
 - Greater frequency of heart and lung disease
- Children
 - More likely to be active
 - Greater particle deposition than adults breathe faster
 - Developing bodies make them vulnerable



Particle Pollution in Winter



- Over the past few years we have seen an increase in small particle pollution in the Keene area during the winter
- Residential wood burning has been linked with high levels of small particles in Keene on some cold and calm winter nights

How is fine particle pollution measured?

- Filter-based samplers - filters taken out every few days, sent to a lab for analysis
- Continuous monitor - monitors levels hourly 24 hrs/day
- Mobile monitoring - equipment in a car, can collect more local data



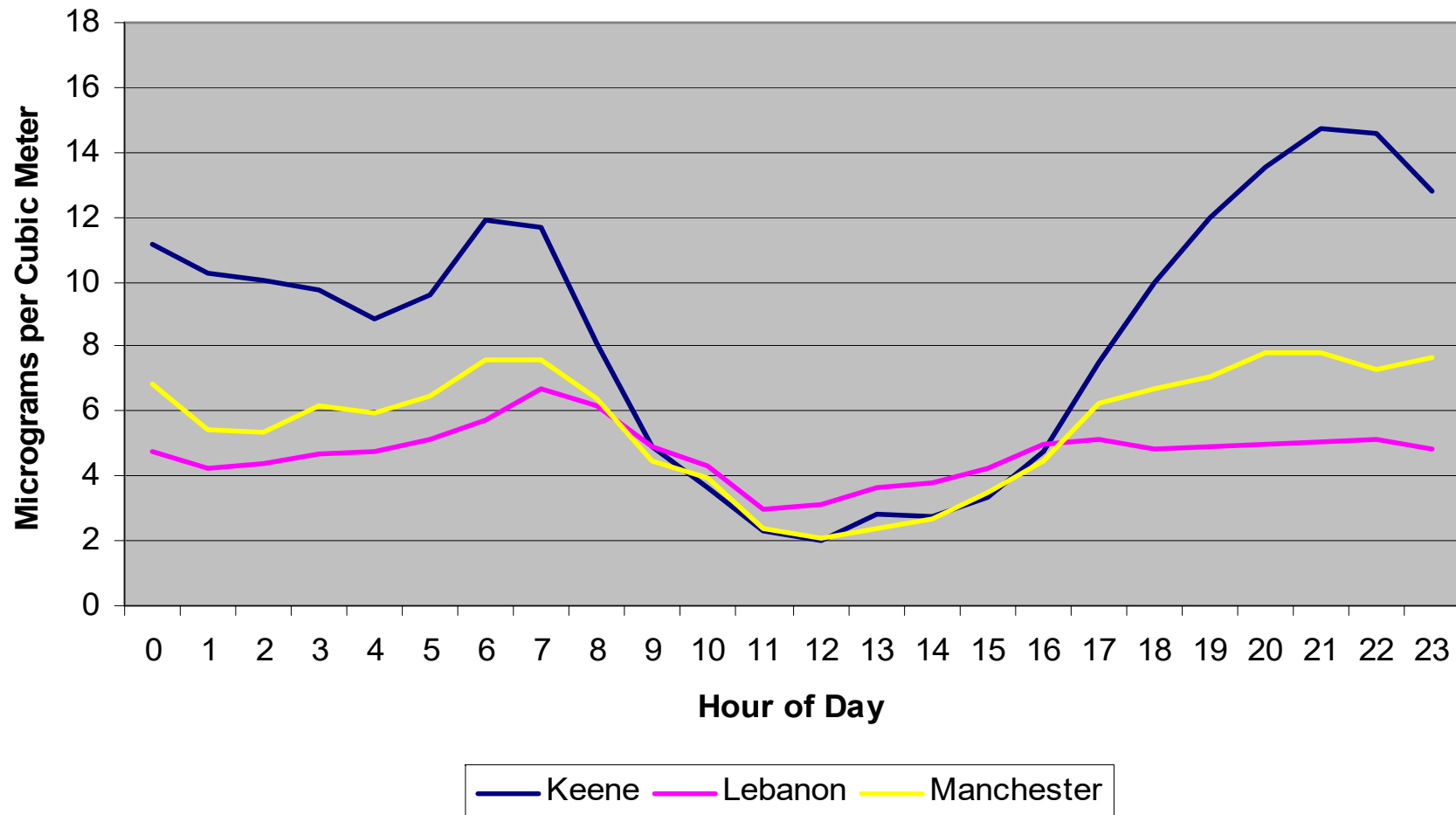
Regulatory Issues

- There are health based standards set for particle pollution
- Currently the Keene area meets these standards
- On some calm, cold winter nights Keene has gone over the standard
- If the standard is exceeded (3 years of data), there could be economic and transportation issues facing the Keene area

Distinct PM_{2.5} Increases at Night

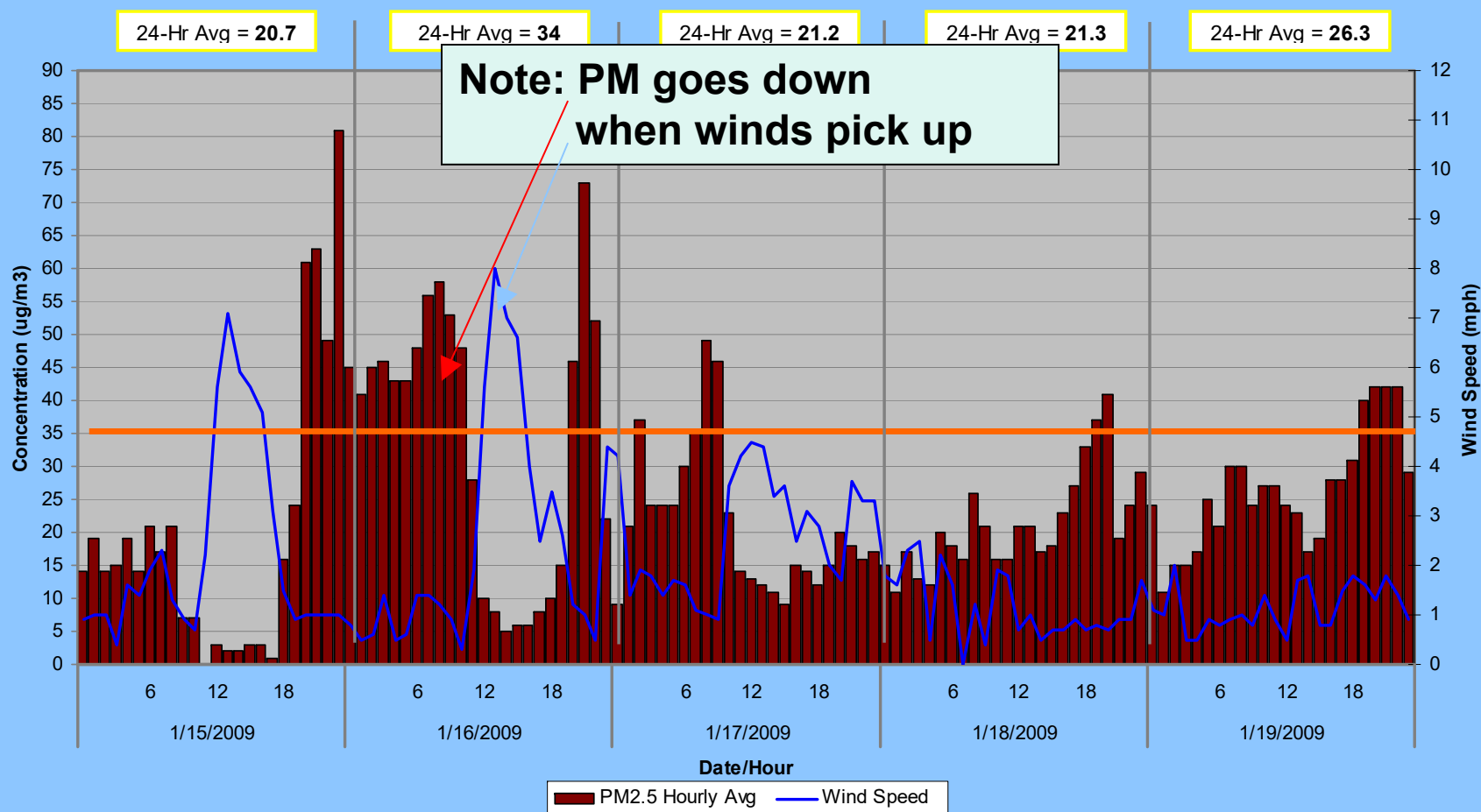
Builds in evening, then dips and rebuilds during waking hours

Average Diurnal Pattern for PM_{2.5} - October 2008



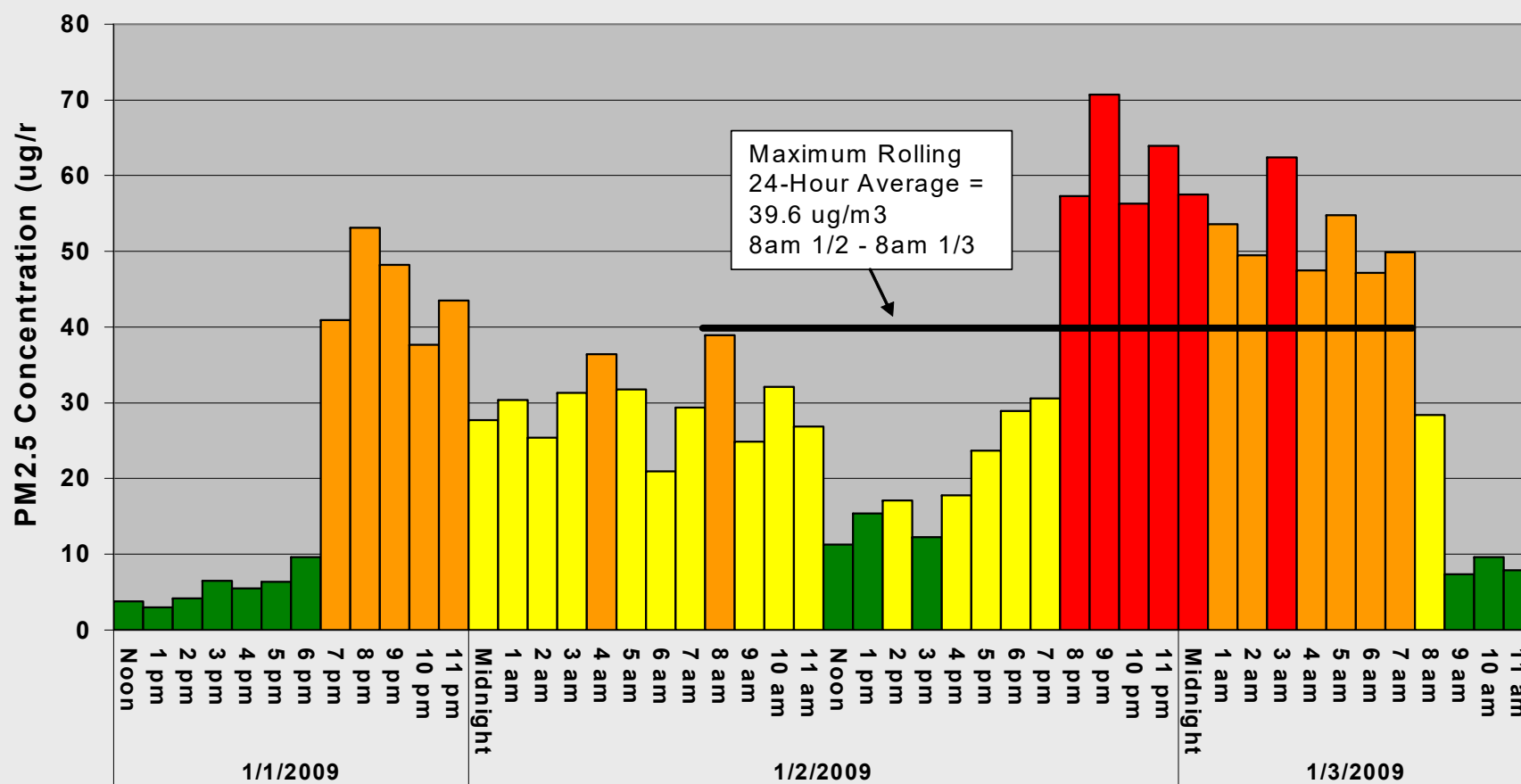
January 15-17, 2009 Event

Keene: Hourly Average PM2.5 and Wind Speed
Thursday January 15 - Monday January 19, 2009
(Note: data is not quality assured)



1/3/2009 PM_{2.5} Exceedance in Keene

PM_{2.5} Hourly Concentrations in Keene
48-Hour Period Ending @ Noon on January 3, 2009



If we go over the standard...

Under the Clean Air Act, the Environmental Protection Agency would require:

- Additional controls on industrial sources at a potentially significant cost to industry
- Transportation projects to reduce vehicle emissions (more carpooling and public transit) with no direct funding

Control of the likely cause (residential wood smoke) will be a significant challenge with no current funding source

**We want to avoid going over the standard
and keep our air healthy to breathe!**

- Outreach Campaign
 - Help people to understand the issue
 - Help people to “burn the right wood, the right way, in the right type of stove”
 - Help people get access to Air Quality Forecasts
 - Help sensitive populations get Air Quality information in a timely manner!

Message

- **Burn the right wood** – burn only dry seasoned hardwood
- **Use the right stove** – it is best to use an EPA certified stove.
If you can't buy a new woodstove keep yours cleaned at least yearly.
- **Burn the right way** – maintain a hot bright fire. Smoldering wood is inefficient and makes more smoke!



Air Quality Forecasts

- www.airquality.nh.gov
- NH's Air Quality Information line
1-800-935-SMOG
- www.airnow.gov
- www.enviroflash.info/

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Thursday, October 4, 2012

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Sign-up for email, cell phone, or pager air quality notices

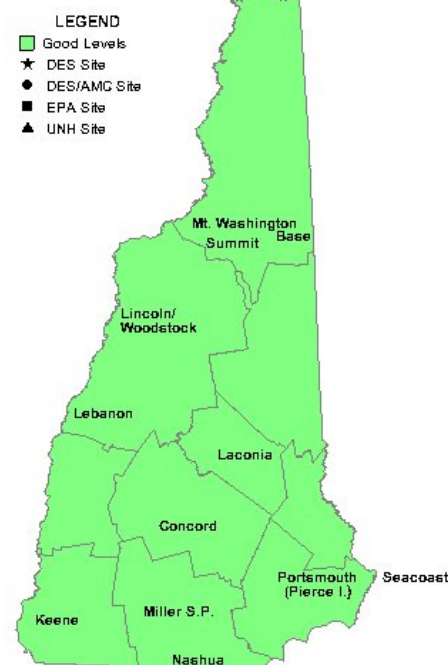
The table below shows current air quality concentrations at New Hampshire's air monitoring sites for two air pollutants: **ground-level ozone** and **particle pollution** (fine particles). Full monitoring, reporting, and forecasting for ozone occurs from April through September; monitoring and reporting of fine particles occurs year-round. The information in the table is updated every hour and includes wind speed, wind direction, and outside temperatures (if data are available). A map of monitoring site locations is shown at the right.

DES operates the majority of these sites and regularly monitors data quality. The University of New Hampshire operates additional sites as part of their [AIRMAP](#) program, the [Appalachian Mountain Club](#) (AMC) maintains three monitors in northern New Hampshire, and the [Hubbard Brook Research Foundation](#) (HBRF) maintains one station in cooperation with the EPA. The data from HBRF may be downloaded from [CASTNET](#).

The table and map are color coded according to EPA's [Air Quality Index](#), which relates air pollutant concentrations to health effects and recommended actions.

[Health Guide and Recommended Actions](#)

Map of Current Air Quality (Ozone and Fine Particles)



Relative Pollutant Levels Chart Comparison



Ozone and Fine Particles Real-Time Monitoring Data

Placing your cursor over the table cell displays the health message; *Clicking* on the table cell displays a graph of pollutant levels over the previous 48 hours.

Partners in Project

- Cheshire Medical Center
- Greater Monadnock Public Health Network
- Keene State College
- NH Department of Environmental Services
- Southwest Region Planning Commission