

# MAINE STATE LEGISLATURE

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## **DEP's Course of Action Regarding Wood Smoke**

**Briefing to Reps. Duchesne and Beck**

**Maine Department of Environmental Protection**

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**September 28, 2010**

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## **Ongoing Actions Pertaining to Wood Smoke**

### **Maine Air Toxics Initiative**

- 33 organizations formed stakeholder group Air Toxics Advisory Committee (ATAC) in 2003
- *Goal:* Reduce exposure of air toxics in Maine to acceptable levels
- ATAC issued list of 27 priority pollutants in 2007
  - Half of priority pollutants from combustion, including wood smoke
- *Maine Air Toxics Strategy*
  - ATAC recommended pursuing low and no cost solutions to reduce air toxic emissions:
    - Promote energy conservation, incorporate considerations in permit review process
    - Implement federal control technology standards
    - Establish regulatory requirements for OWBs
    - Establish change-out programs for nuisance OWBs and old woodstoves
    - Improve emissions inventory
    - Develop wood smoke monitoring method

### **Outdoor Wood Boiler Regulation**

- Legislation for sale of Phase I (2008) and Phase II (2010) boilers (P.L. 2007 c. 442, effective June 27, 2007)
- Legislation established fund for replacement of nuisance OWBs
- DEP emissions, siting, and nuisance standards (06-096 CMR 150, effective November 9, 2007)
- DEP OWB Buyback Program established (06-096 CMR 160, effective February 25, 2009, sunsets 2013)
- DEP investigates complaints and maintains priority list of nuisance OWBs for replacement when funds become available
- Resolved 41 of 110 complaints received as of April 2010. Many units moved or removed, stack heights increased, and burning practices improved.
- DEP currently working with 10 nuisance OWBs that caused repeat complaints
- Remaining complaints addressed by prioritization based on complainant health conditions, proximity to neighbors, and other factors

### **Woodstove Replacement**

- Legislation established Woodstove Buyback Fund in 2010
- Planning 2011 BEP rulemaking to establish woodstove buyback program
- Request EPA grants to fund buyback program as available
- Developed templates for Supplemental Environmental Project applicants to establish small-scale change-out programs

## **Outreach and Education**

- Webpages, factsheets, brochures:
  - How to minimize emissions and wood consumption
  - Comparing wood burning devices
  - Wood smoke health impacts
  - EPA Burn Wise campaign
- Compiled list of potential partners to distribute materials, including Lung Association, Asthma Council, Center for Public Health. DEP plans to contact and form coalition during 2010/2011 heating season in conjunction with Woodstove Buyback Program rulemaking.

## **Measurement and Monitoring**

- 2008 Maine Lung survey
  - 38% of Mainers burn wood for heat
  - More than 50% of woodstoves are uncertified
- 2009 DEP survey
  - 43% of Mainers burn wood as a primary or supplemental heating source
  - 67% do not perceive residential wood smoke as an air pollution problem
- Greenville monitoring site
  - Began monitoring for PM<sub>2.5</sub> and metals in 2007
  - Site selected due to UMaine and Maine Lung Association projection of increase in wood burning
  - Observed no measurable difference in air quality from other sites. Drop in oil prices may have mitigated expected wood burning activity.
  - Methodology not robust enough to identify wood smoke-specific impacts
- Modeling for citizen complainant
  - A fireplace or uncertified woodstove may cause ambient particulate levels to exceed the 24-hour standard (35 µg/m<sup>3</sup>) within 50 feet of the chimney when added to existing air pollution levels
  - 3-hour impacts within 50 ft average 77 µg/m<sup>3</sup> from fireplace, 63 µg/m<sup>3</sup> from woodstove
- *2010-2012 Wood Smoke Apportionment Project*

## Wood Smoke Apportionment Project

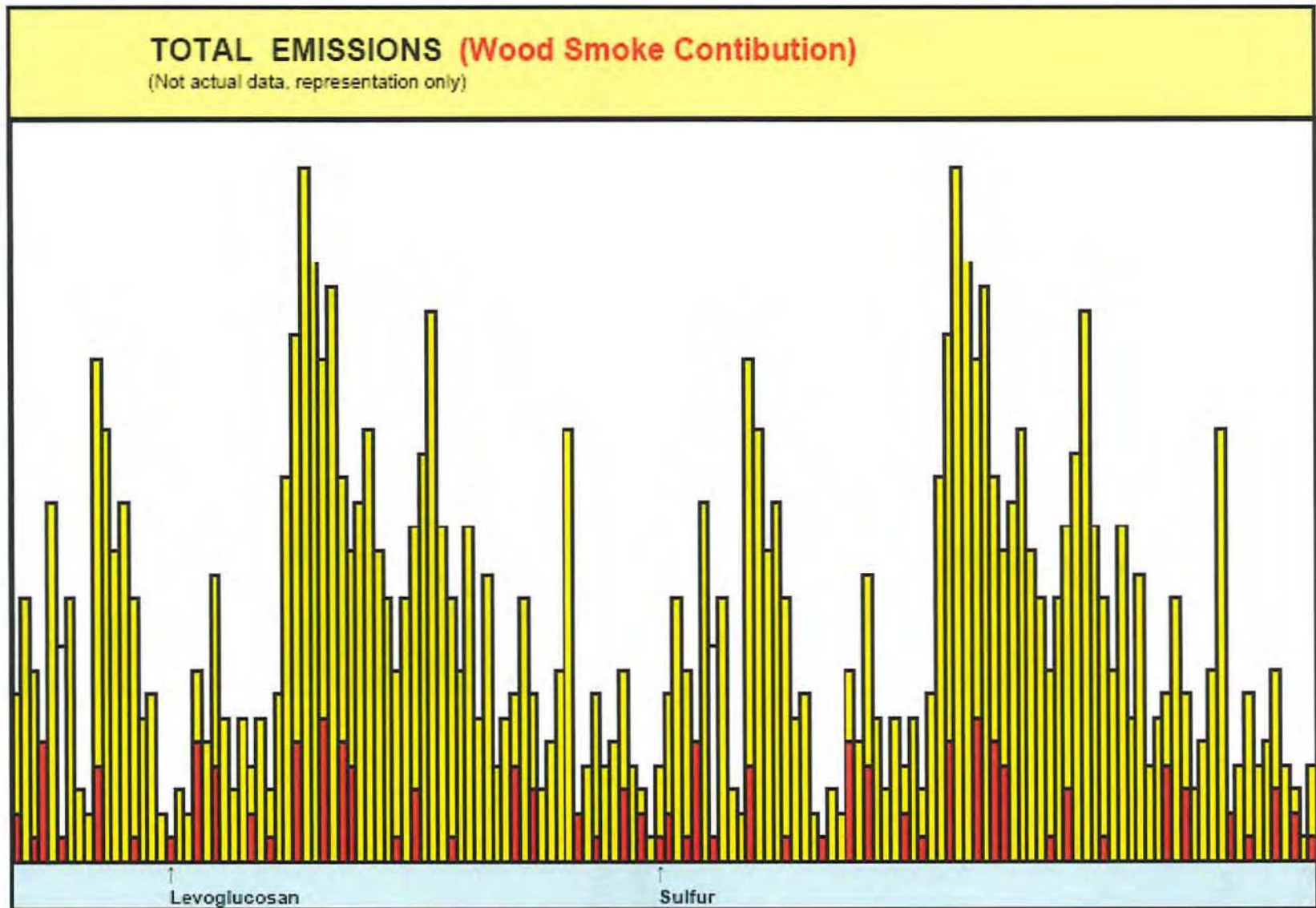
### Goals:

- Establish a “fingerprint” for wood smoke based on the relative apportionment of individual pollutants attributable to wood smoke from total ambient concentrations
- Develop capability to determine severity of wood smoke problem in selected geographic areas (e.g. complaint response) and to appropriately target resources and emission reduction strategies
- Develop parameters for unhealthful or nuisance conditions to apply in complaint response and mitigation efforts

**Problem:** Most pollutants found in wood smoke are also released by traditional fuel combustion. No method currently exists to determine how much of a pollutant’s concentration in ambient air is from wood burning.

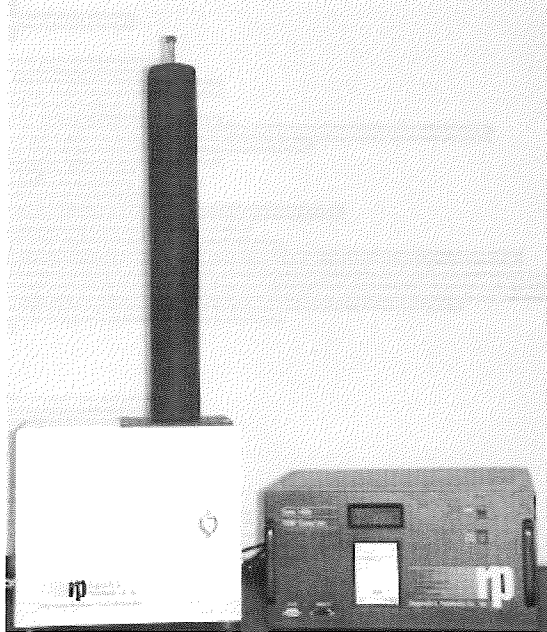
### Approach:

1. Identify which pollutants are released by combustion of each material or fuel type, and in what relative proportion
2. Collect air samples for analysis using 7 different methods
  - *Tapered Element Oscillating Microbalance (TEOM)*  
Continuous (24/7) electronic measurement of PM<sub>2.5</sub>
  - *Federal Reference Method for PM<sub>2.5</sub>*  
Manual filter-based particulate sampler will collect daily 24-hour samples
  - *X-Ray Fluorescence Spectrometer (XRF)*  
Analyzes for trace metals associated with wood combustion collected on particulate filters; and to measure sulfur as a diesel indicator.
  - *Aethalometer*  
Continuous measurement of carbon black, elemental carbon; indicators of diesel and wood smoke.
  - *TO-15*  
Sub-ambient sample collection in canisters over 24 hours, followed by analyses for volatile organic compounds (VOCs) of selected air toxics (e.g. benzene, toluene, ethylbenzene, etc.) using gas chromatography/mass spectroscopy (GC/MS). These compounds will help separate out gasoline and diesel from the total combustion signature.
  - *High Pressure Liquid Chromatography (HPLC)*  
Analyses of 24-hour filter samples for levoglucosan, a cellulose combustion product; indicator of biomass burning.
  - *Sorbent Tube Sampler*  
Collects 24-hour samples on sorbent followed by analyses of Polycyclic Aromatic Hydrocarbons (PAHs), such as benzo (a) pyrene, using GC/MS; each fuel type has a unique PAH fingerprint.
3. Conduct multivariate analysis of 7 data sets to determine how much of pollutant load comes from combustion of each fuel type (e.g. 20% wood, 30% gasoline, 35% diesel)
4. Develop fingerprint and conduct additional monitoring to test
5. Publish report for peer review



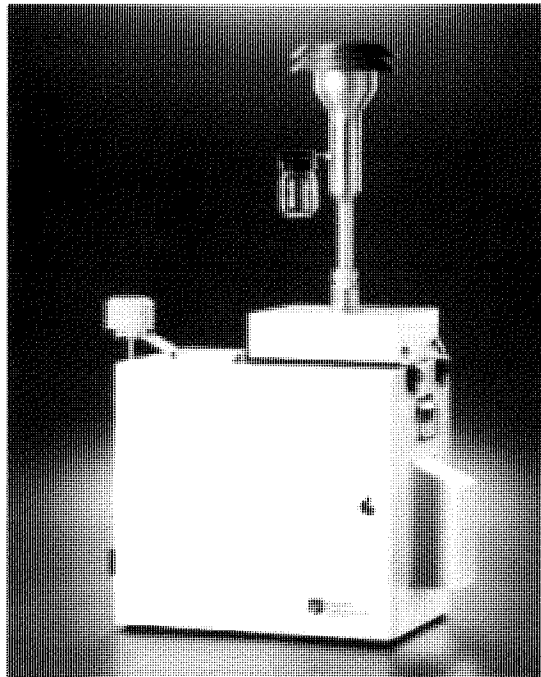
## **Tapered Element Oscillating Microbalance (TEOM)**

Continuous measurement of particulates related to all combustion types and airborne dust.



## **Federal Reference Method for PM<sub>2.5</sub>**

Twenty-four hour particulate samples will be collected on filters.



## **X-Ray Fluorescence (XRF) Spectrometer**

Used to measure trace metals associated with wood combustion on particulate filters and to measure sulfur as a diesel indicator.



## **Aethalometer**

Instrument used to measure black carbon and elemental carbon; indicators of diesel and wood smoke combustion.



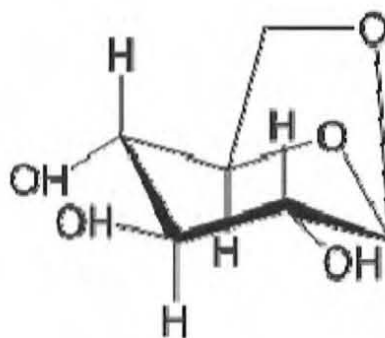
## TO-15

Sub-ambient collection of volatile organic compounds in canisters, followed by analyses using GC/MS for measurement of individual fuel combustion components.



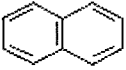
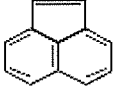
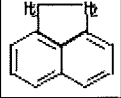

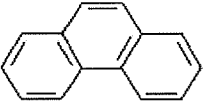
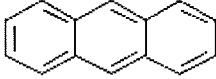
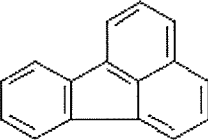
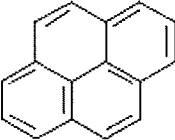
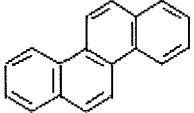
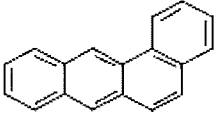
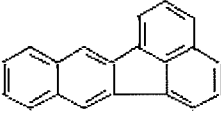
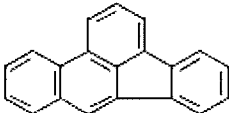
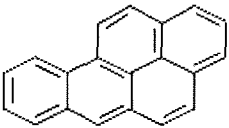
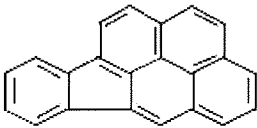
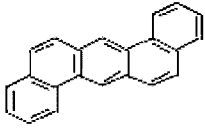
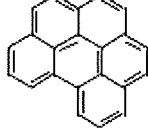
## HPLC for Levoglucosan - $C_6H_{10}O_5$

Produced from the burning of cellulose; biomass indicator (wood, wood pellets, vegetation - brush and grasses); has a short half-life, rapidly degrades.



## Sorbent Tube Sampler for PAHs (Polycyclic Aromatic Hydrocarbons)

Produced from combustion of coal-fired heat and power generation, wood burning, and to a lesser extent, automobile and diesel exhaust; stable, long half-life.

 <p>Naphthalene MW = 128.2 MP = 80.2 °C BP = 217.9 °C</p>	 <p>Acenaphthylene MW = 152.2 MP = 92 - 93 °C BP = 265 - 275 °C</p>	 <p>Acenaphthene MW = 154.2 MP = 95 °C BP = 279 °C</p>	 <p>Fluorene MW = 166.2 MP = 116.5 °C BP = 295 °C</p>
 <p>Phenanthrene MW = 178.2 MP = 100 °C BP = 340 °C</p>	 <p>Anthracene MW = 178.2 MP = 218 °C BP = 342 °C</p>	 <p>Fluoranthene MW = 202.3 MP = 110.8 °C BP = 393 °C</p>	 <p>Pyrene MW = 202.3 MP = 156 °C BP = 393 °C</p>
 <p>Chrysene MW = 228.3 MP = 255 °C BP = 448 °C</p>	 <p>Benzo(a)anthracene MW = 228.3 MP = 160 °C BP = 435 °C</p>	 <p>Benzo(k)fluoranthene MW = 252.3 MP = 215.7 °C BP = 480 °C</p>	 <p>Benzo(b)fluoranthene MW = 252.3 MP = 168.3 °C BP, No Data</p>
 <p>Benzo(a)pyrene MW = 252.3 MP = 178.5 °C BP = 311 °C (at 10 torr)</p>	 <p>Indeno(1,2,3-c,d)pyrene MW = 276.3 MP = 163.6 °C BP = 530 °C</p>	 <p>Dibenzo(a,h)anthracene MW = 278.4 MP = 262 °C BP, No Data</p>	 <p>Benzo(g,h,i)perylene MW = 276.3 MP = 273 °C BP = 550 °C</p>

Complex ratios that correspond to the various fuel types; the more sources you have, the more difficult it is to extract the individual contributions.

