Our Strategy to Address Outdoor Wood-Fired Hydronic Heaters aka “Outdoor Wood Boilers”

Front View of Typical Unit

Common Firebox Design

Air Quality (AQ) Impacts

- Dispersion modeling by Michigan:

  >1,000ug/m^3 (1-hr max)
  > 600ug/m^3 (24-hr max)

- AQ monitoring data by NESCAUM:

  >1,500ug/m3 with seasoned wood]

Note: Current 24-hour $PM_{2.5}$ NAAQS is 65ug/m^3

December 20, 2005 proposal is 35ug/m^3

Petition to Administrator (8/11/05)

- 6 northeastern States plus Michigan & NESCAUM
- Asks for NSPS for OWB or to revise woodstove NSPS to include OWB
- Argues that Federal regulation is needed to avoid patchwork of State and local regulations
- Numerous additional States, local agencies, and citizens have expressed interest in EPA action

Actions Underway by States

- VT has proposed emission limits for new OWB
- CT, IN, MI, MN, NC, OR “considering” regulations
- WI has developed a model ordinance
  (setbacks, stack height, opacity)
- Many towns in various States have banned new OWB
- WA has stated that their “woodstove” rule also applies to OWB
- NESCAUM has been leading 12-State workgroup that wants test method and model rule this fall
- NY Attorney General assessing “consumer fraud”

Our 2-Part Stakeholder Strategy

- Part 1 - Incentivized Voluntary Program (IVP)

- Part 2 – Model Rule (MR) for States to use as appropriate

- Parts 1 and 2 are in parallel and complementary.
- We kicked-off Stakeholder Process on 6/15/06.
- We expect Stakeholder Process to be complete by 12/15/06 and implementation to begin by 4/07.

Part 1 -- IVP
Incentivized Voluntary Program

- We have encouraged manufacturers to make public commitments to voluntarily sell new models with significantly reduced emissions.
- Targets will be established during the IVP development process.
- We have met with top manufacturers and the trade association and they have agreed to have cleaner models for sale by April 2007.
- Manufacturers are developing and shaking-down new designs now.

Part 2 -- Model Rule (MR)

- In parallel with IVP, we have convened a Stakeholder Process to provide information for a NESCAUM-led effort to develop a MR for States to use as appropriate.

The MR may address:

- New Units - emission limits, zoning, stack height, operation and maintenance, labels, notice to buyers
- Existing Units – operation and maintenance, real estate transfers, funds to solve nuisance units
- Issues – mass/time versus mass/energy or both, lead time, phasing, residential versus small business

Our Concerns

- Schedule is extremely ambitious
- Stakeholders do not trust each other
- Test method is not finalized nor validated yet
- IVP targets will be based on engineering judgments and predictions rather than data
- Saving graces:
  - Manufacturers are motivated to avoid bans
  - IVP implementation will be based on actual data

Stakeholder Issue Teams

Cross-section of industry, States, labs, and EPA developed options and pros/cons for full Stakeholder Group discussions on July 19-20:

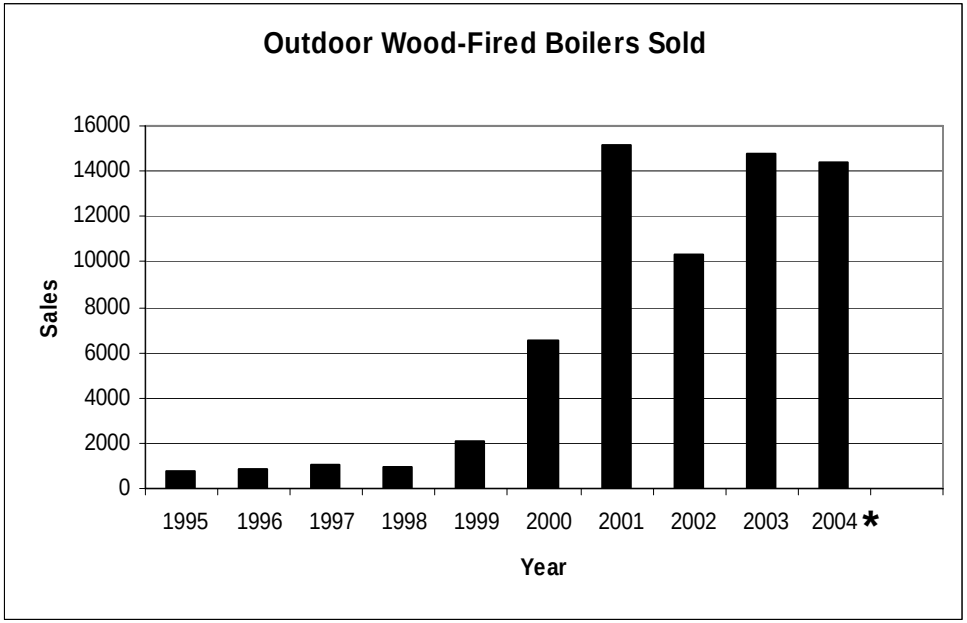
- 1 - Testing Implementation
  - QA/QC audits, 3rd party testing, etc.
- 2 - Benchmarks
  - 2a - Format of the Standards & IVP
  - 2b - Target levels and dates for Phase 1

Stakeholder Issue Teams continued…

Two more teams are kicking off this week to develop options and pros/cons for full Stakeholder Group discussions on September 12-13:

- 3 - Consumer issues
  - IVP infrastructure, market incentives, labels, comparisons with other products, “burning smart”
- 4 - Existing Units
  - Health, AQ modeling, location, best burning practices, solutions for nuisance units

Sales Data



* 2004 sales are projected

Known cumulative sales are <u>72,423</u> units

Basis: Region I Information Collection Request and Industry Contacts
[NESCAUM states that real value is >125,000 units and growing faster]

Test data caveats

- Draft ASTM consensus test method has just been developed — currently going through ASTM review and balloting process – final expected in April 2007
- Test data vary widely due to different methods, test conditions, and models

PM2.5 Emissions and Efficiency Comparisons

	Per Time (grams/hr)	Per Wood Burned (pounds/Ton) [pounds/MM BTU]	Efficiency (%)
Outdoor Wood-fired Boilers (OWB)	30-390	6-60 [0.5-5]	~30-55
Old Wood Stoves	25-50 or more	~90-150 [7.5-12.5]	~54
NSPS Wood Stoves 40CFR60 Subpart AAA	7.5 Non-Catalytic 4.1 Catalytic	~30 [2.5] ~16 [1.4]	~67
Washington State Wood Stoves	4.5 Non-Catalytic 2.5 Catalytic	~18 [1.5] ~10 [0.8]	~70-80
Pellet Stoves	~1	4.2 [0.3]	~70-80
Fireplaces		34.6 [2.8]	~10
Oil-fired Furnaces		NA [0.012]	~90
Natural Gas Furnaces		NA [0.0075]	~90
Small ICIB		NA [0.025]	>98

Estimated National Emissions

Sources	**TPY of PM 2.5 (direct)**
Residential Open Burning	165,000
Highway Diesel	124,000
Non-road Diesel	174,000
Woodstoves and Fireplaces	420,000
OWB	1,450-37,000 NESCAUM: perhaps 250,000

Source: NEI for All Categories Except OWB

Control Technology Assessment

- Commercially available units utilize poor combustion technology
- No “best demonstrated technology” – but most manufacturers have prototypes
- General belief of potential for 50-90% emission reduction with redesign and possibly catalyst
- Key is separate air-to-water heat exchanger

Obstacles to Developing a Federal Rule for OWB Now

- Insufficient data for Federal rule now

- Quantification of Baseline Emissions
  - No consensus test method yet -- ASTM effort recently sped up; expect near consensus by 12/06 and final by 4/2007*
  - Estimate of number of OWB is uncertain (on low-side and growing)

- Quantification of the Reductions Believed Achievable
  - No commercially available “best demonstrated technology” (BDT)**
  - Cannot quantify benefits and costs absent BDT

*We offered $60K to help last year, but industry and States stepped up instead.
Our $500K grant to CT for wood smoke monitoring & OWB characterization may also help this year and next.

**SBIR RFA and discussions with catalyst manufacturers should help some but big advance is the IVP and MR efforts.

NESCAUM "Assessment of Outdoor Wood-fired Boilers"

Findings:

- OWBs generally do not use catalytic or non-catalytic emission control devices that other residential wood-fired combustion devices, such as indoor woodstoves, commonly employ
- Use has become more prevalent and continued increase is likely
- Emit significantly more PM than other residential woodburning devices and short term spikes can be extremely high
- Could contribute almost 900,000 tons of PM by 2010
- Local populations are likely subject to elevated PM levels
- Current regulations do not provide surrounding areas with adequate protection…
- There is lack of information relating to air toxics

Unique issues:

- Year-round operation -- summer hot water, swimming pools, spas
- Cyclic operation -- contributes to incomplete combustion
- Short stack heights -- poor dispersion, more likely fumigation
- Oversized firebox --allows inappropriate materials. "Enforcement programs have discovered OWBs burning tires, large bags of refuse, and railroad ties."

Published 3/06, revised 5/06

NESCAUM Recommendation

in “Assessment of Outdoor Wood-fired Boilers”

“Given the significant health effects OWB emissions may pose and the lack of action on the Federal level, NESCAUM believes that States should take action immediately to control OWB emissions by establishing technology-forcing standards that will lead manufacturers to develop cleaner-burning OWBs.”

“Health Effects of Breathing Wood Smoke”

What is the concern about wood smoke exposure?

- Numerous scientific studies report potentially serious adverse health effects from breathing wood smoke emitted by residential wood combustion (RWC). The smoke emitted from RWC is the product of incomplete combustion, and is possible even in the most modern wood burning devices when they are operated incorrectly. In addition to that amount released directly inside the home, a large percentage (i.e., 70%) of outdoor wood smoke from chimneys actually reenters the house and permeates neighborhood dwellings (Pierson et al., 1989). Since individuals typically spend 60-70% of their out-of-work time at home, indoor wood smoke potentially represents a major source for human exposure (Szalar , 1972; Chapin , 1974; Sexton et al., 1986).

- The emissions from wood-burning stoves and fireplaces consist of a complex mixture of gases and particles including inhalable PM (particulate matter of diameter less than or equal to 10 micrometers, or PM10), the finer respirable PM (PM2.5) and contaminants that contribute to poor air quality and smog, for example sulfur oxides (SOx), nitrogen oxides (NOx) and carbon monoxide (CO). RWC emissions also contain potentially carcinogenic compounds, including polycyclic aromatic hydrocarbons (PAH), benzene, formaldehyde and dioxins (NEIPTG , 2000; Larson and Koenig , 1994; ERMD , 2000). Many of these substances can adversely impact health.

“Health Effects of Breathing Wood Smoke”

What happens when people breathe wood smoke?

- Some of the health effects of exposure to inhaled particles in wood smoke that researchers have found include irritation and inflammation of the upper and lower respiratory tract resulting in rhinitis, cough, wheezing, and worsening of asthma, as well as a link to chronic bronchitis. Many studies have concluded that young children living in homes heated by a wood-burning stove had a greater occurrence of moderate and severe chronic respiratory symptoms than children of the same age and sex who did not live in homes heated with a wood burning stove. The following conclusions were taken from a review article by Judith T. Zelikoff that appeared in the Journal of Toxicology & Environmental Health in 2002.

- More specifically, with regard to adults, studies show that prolonged inhalation of wood smoke contributed to chronic bronchitis (Rajpandey , 1984), chronic interstitial lung disease, pulmonary arterial hypertension (Sandoval et al., 1993), and altered pulmonary immune defense mechanisms (Demarest et al., 1979; Ramage et al., 1988). While adverse effects on adults are notable, children appear to be at greatest risk. Exposure of preschool children living in homes heated with wood burning stoves or in houses with open fireplaces yielded these effects (Zelikoff 8): decreased pulmonary lung function in young asthmatics (Koenig et al., 1993); increased incidence of acute bronchitis and severity/frequency of wheezing and coughing (Butterfield et al., 1989); and increased incidence, duration, and possibly severity of acute respiratory infections (Honicky et al., 1983, 1985; Rajpandey9, 1984; Morris et al., 1990; Collings et al., 1990; Honicky and Osborne , 1991; Kammen et al., 1998).

Cowboy Hot Tubs

Snorkel Tubs

Our Position

- OWB emissions are a State and local concern
  - Air quality complaints from neighbors
  - Improper design and/or operation
- OWB team coordinating emissions reductions through industry voluntary and State regulatory efforts

Two-Part Stakeholder Strategy

- Parallel and complementary
- Stakeholder Process kick-off on 6/15/06
  - Expected completion by 12/15/06
  - Implementation of Phase 1 by 4/07

Stakeholder Decisions

- Testing
  - ASTM Method
  - 3rd party testing, QA/QC audits, etc.
- Benchmarks – format, levels, dates
  - 0.6 #/MMBTU heat input for Phase 1 IVP --4/2007
  - 0.44 #/MMBTU heat input for Phase 1 MR --4/2008
  - ~0.3 #/MMBTU heat output for Phase 2 MR --4/2010

Our Concerns/ Next Steps

- Schedule is extremely ambitious
- Test method consensus meeting -- 10/23-24
- Stakeholder meeting --11/16/06 in RTP
- Public roll-out -- 12/15/06
- Test method validation -- 1/07
- Phase 1 IVP Implementation -- 4/07
- Saving graces:
  - Manufacturers are motivated to avoid bans
  - States are motivated to use MR