

Burn Wood Good:

Fostering Pollution Accountability for Outdoor Wood Boilers

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Middlebury College
Environmental Studies Senior Seminar 0401
Spring 2007

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Executive Summary

Our Spring 2007 Environmental Studies Senior Seminar focused on healthy communities and renewable resource use, particularly the use of wood as a heating fuel in Vermont. Wood has seen a surge of interest in recent years in response to rising oil prices and concerns about climate change and dependence on foreign oil. As wood is both a locally abundant “contemporary carbon” fuel and the cheapest fuel per unit energy content, many Vermont residents see using wood as a way they can both save money and personally do their part to address these issues. But while using wood is an important way to alter the scale and sources of our energy supplies, the unintended consequences of these efforts need to be carefully considered: we must be careful that solutions to national problems do not create new local problems.

Our class teamed up with the American Lung Association of Vermont, People for Less Pollution, and the Air Pollution Control Division of the Vermont Department of Environmental Conservation to investigate the environmental and health impacts of Outdoor Wood Boilers (OWBs), an increasingly popular wood heating technology. We worked to share information between these organizations, mobilize their constituents and the general public to secure the passage of Vermont’s new rule regulating OWB emissions, and educate the public about OWB issues.

OWBs are large wood-fired water heaters housed in a weatherproof outdoor structure. They consist of a large firebox in which wood is burned to heat water, which is then circulated through insulated underground piping. Because they are outside, OWBs eliminate the mess and indoor air pollution associated with wood stoves. They can also be used to heat multiple buildings, domestic hot water, and swimming pools. Their large fireboxes reduce the labor of sawing and splitting wood and allow long burn times between refueling. However, the primitive design of most OWB models results in inefficient and partial combustion of wood, releasing large quantities of smoke and other toxic pollutants. Since most models have low smokestacks, these pollutants are released close to ground level where they pose a significant health hazard. Although the technology to create cleaner, more efficient OWBs is readily available, in the absence of regulation very few manufacturers have opted to improve their designs or even bother to collect emissions and efficiency data.

Vermont has had stack height and setback restrictions on the installation of OWBs since 1997 and first proposed an emissions rule in 2005, but its passage was stalled by outcry from OWB manufacturers and the public. In March 2007 the revised rule was re-submitted, but again it was threatened by the OWB industry’s backroom dealing and public protest motivated by false claims that Vermonters’ “right to burn wood” was about to be revoked. Thanks in part to support mobilized

by our class, the revised rule passed on April 6, 2007. The rule requires all OWBs sold or installed in Vermont after March 31, 2008 to meet an emissions limit of 0.44 lbs/million BTU of heat input and requires that a new rule tightening this limit to 0.32 lbs/million BTU heat output or some other level be proposed no later than March 31, 2008.

Since the emissions limit does not take effect until March 31, 2008, manufacturers and dealers unfortunately have a strong incentive to dump their old stock before that time. Also, existing OWBs are exempt from the emissions regulations. Thus there remains a need to educate the public about good burning practices and encourage the purchase of clean OWB models. To this end our class developed a good wood burning practices fact sheet that includes information on the importance of burning only clean, seasoned wood, the health impacts of wood smoke, and the advantages of clean OWB models. We also prepared an economic analysis that shows the financial benefits of clean OWB models. Clean models are more expensive than equivalent dirty models, but since they are also up to twice as efficient this difference is quickly recouped in savings on fuel. Depending on the initial price difference, for the average Vermont user the initial additional cost of a clean OWB is paid back in as little as one year or up to seven.

These efforts are an important contribution towards ensuring that Vermont's shift to increased wood heating does not impact public health. Whether this shift is sustainable or not depends on whether responsible forest management practices are followed. The local leadership, knowledge, and passion embodied in the Vermont Fuel for Schools program, under which 20% of Vermont's public school students are heated with wood chips, give us hope that rather than being ignored, these issues are being considered and successfully addressed.

Ultimately, our seminar's efforts have successfully helped to foster healthier local Vermont communities, both in terms of clean, efficient combustion of a local renewable fuel and in terms of community knowledge and engagement. In the process, we have discovered the complexities and dynamics of legislative processes, as well as the importance of community networking on all levels—ranging from the public to the governmental sphere—in order to encourage and successfully enforce responsible and sustainable wood burning practices.

Project Background

Renewable Energy

The issue of renewable energy and energy independence has become increasingly important both in the United States and abroad. With the sensational popularity of Al Gore's *An Inconvenient Truth* and the start of the 2008 presidential campaigning season, everybody seems to be talking about energy. The source of our nation's energy supply has been framed as a national security and environmental problem. Traditionally, environmental issues are seen as a Democratic Party concern, but when aligned with energy supply issues all sides of the political spectrum have become engaged. Even Republican candidate John McCain asserted in an April 22, 2007 speech to the Center for Strategic and International Studies that global warming was "a serious and urgent economic, environmental and national security challenge" not a "Hollywood invention."¹

Both the current President and many of the 2008 presidential candidates support large scale biofuel projects as the key to an energy supply not based on imported fossil fuels. The United States' massive corn and soy fields have been touted as a domestic 'Saudi Arabia.' The holy grail of ethanol production is to solve the problems of climate change and foreign oil while fueling the current American lifestyle. Less glamorous biofuels such as woodchips and blended grass pellets have also seen a surge of interest, even from Middlebury College, as a heating and electricity generation alternative to fuel oil and natural gas.

Biofuels are destined to be an important part of the U.S.' renewable energy portfolio, but they are not without their faults and unresolved questions. Foremost is the question of sustainability: do we have enough land to grow our own fuel without adversely affecting our food supply, food prices, biodiversity, and open space? The claim that biofuels are "carbon-neutral" is also subject to debate. Increased pollution is another issue: emerging studies suggest that the widespread use of ethanol may increase health hazards from ozone emissions and increase water pollution due to ethanol's corrosive qualities.² Another important question involves the conflict between large-scale centralized energy sources and locally distributed energy sources.

¹ Talhelm "McCain warns of twin threats of energy dependence, global warming."

² Davidson "Study warns of health risk from ethanol."

While a great deal of progress is being made to alter the scale and sources of our energy supplies, the unintended consequences of these efforts must be considered. Balancing these often overlooked consequences with the need to make technological and social advances to reduce dependence on foreign fuel sources and minimize greenhouse gas emissions is of the utmost importance. These tradeoffs occur at all scales from national to state to local communities.

Wood Fuel in Vermont

In Vermont, the tradeoffs between the social, political, and environmental benefits of renewable energy sources and the unintended consequences of their increased use is perhaps best illustrated by the case of wood fuel. For centuries, wood was the only heating fuel used in Vermont. Today the state is 80% forested, and many households continue to use wood as their primary source of heat. Wood has several advantages as a heating fuel: it is both locally abundant and a “contemporary-carbon” fuel. Proponents of biomass say it is “carbon neutral” because the CO₂ produced by burning sustainably harvested wood is offset by the tree’s absorption of CO₂ during its growing years. Wood is also the cheapest heating fuel per unit energy content.³ The worrisome side of wood heat is that even in the cleanest combustion unit it produces far more locally harmful air pollutants than natural gas or fuel oil. This pollution could increase dramatically as more Vermont homes, communities, and businesses turn to wood for heating in response to concerns about climate change, high oil prices, and national security. The potential for increased demand also raises questions of sustainability: are Vermont’s forest resources sufficient to meet the heating needs of the entire state?

Our Project and Partners

Our Spring 2007 Environmental Studies Senior Seminar class set out to research, assess, and participate in the issues relating to Vermont’s use of wood as a renewable alternative energy source. Our project was based on a community partnership with three organizations: the American Lung Association of Vermont (ALAVT), People for Less Pollution (PLP), and the Air Pollution Control Division (APCD) of the Vermont Department of Environmental Conservation. Each of these organizations has specific strengths. The ALAVT is a state chapter of the larger

³ Vermont Department of Public Service “Vermont Fuel Price Report.”

national association. It is primarily focused on public health and has a wealth of information on the health effects of air pollution in addition to a broad constituency. PLP is an Addison County grassroots organization of concerned citizens that formed in response to—and is fresh off their success against—the proposed International Paper Corporation’s tire-derived fuel program. The APCD has a wealth of information and technical proficiency. A state government agency, it is mandated to monitor air quality and propose legislative rules in response to air quality concerns. Our role was to both facilitate information exchange between groups and add our own research and perspective to the issues. Responding to one of the main active concerns of the APCD, we chose to focus our project on Outdoor Wood Boilers, an increasingly prevalent home heating technology.

Outdoor Wood Boilers: An Introduction

Outdoor Wood Boilers (OWBs) are large wood-fired water heaters housed in a weatherproof outdoor structure. They consist of a large firebox in which wood is burned to heat water, which is then circulated through insulated underground piping (Appendix A). They can be used to heat homes, garages, greenhouses, domestic hot water, swimming pools, and spas.

OWBs are an alternative to indoor woodstoves, over which they have several advantages. Wood is a fairly dirty, dusty fuel and it can contain mites and other insects. OWBs eliminate the mess, indoor air pollution, and fire hazard associated with woodstoves. They can also be placed next to a woodpile thus reducing the labor associated with wood heating. Their large fireboxes accommodate large pieces of unsplit wood, further reducing labor. The large firebox also provides long burn times between refueling. Admittedly, fueling an OWB during a winter blizzard may be quite unpleasant, but most OWBs will run for 8 to 12 hours on a single fuel load at peak demand and can go for several days without refueling in the summer. By contrast indoor woodstoves must be refueled every few hours. OWBs also produce much more heat than a woodstove, so a single unit can heat multiple buildings and also provide domestic hot water. Woodstoves produce radiant heat and so must be carefully located for even heat dispersal, but OWBs can be hooked up to any existing home heating system.

The main disadvantage of OWBs is that most models are primitive and inefficient. The standard design involves a large firebox that is surrounded by a jacket of water, which is in direct contact with the firebox. The fire is controlled by an automatic damper which remains

completely open until the water reaches a set point, usually around 180 °F. Then the damper shuts off all air to the fire and the boiler “idles” until the water temperature drops below another set point. These design features make efficient, clean combustion of wood impossible.⁴ Many of the gasses that volatilize when wood is heated only combust at temperatures around 2000 °F. Since the temperature of the water in contact with the firebox never exceeds 180 °F, the firebox remains quite cool and many of the wood gasses are vented up the smokestack, resulting in low combustion efficiency and high emissions. Whereas EPA-certified woodstoves have efficiencies of 63-72%, most OWBs have efficiencies of only 40-50%. This efficiency is further reduced by heat loss during the transfer of hot water through underground pipes.

Another reason for the high emissions from OWBs is their cyclic and year-round operation. OWBs are sized to meet the peak winter heat demand, but many are operated all year to provide domestic hot water or heat a swimming pool. In the summer the heat demand is much lower so the boiler spends much more time idling with the damper closed. When the damper is closed the fire smolders in cool, oxygen starved conditions and produces creosote deposits on the firebox walls. When the damper opens up again these deposits burn and produce large quantities of smoke containing particulates and other emissions.⁵

Whereas an indoor woodstove vents smoke and exhaust gasses up a chimney, releasing them above the peak of a residence’s roof, most OWBs come with a smokestack that reaches only 6-10 feet above the ground.⁶ This low stack height limits dispersion of smoke and exhaust gasses, which settle at ground level and become a health hazard for people living in the vicinity of the OWB. This problem is particularly exacerbated in the summer when low heat demand results in long idling times and lots of smoke, warm air makes smoke rise even more slowly, and people are likely to be outside or have their windows open.

Health Effects of Wood Smoke

All forms of wood smoke contain significant quantities of health-damaging pollutants including particulate matter and known carcinogens such as carbon monoxide, benzene, aldehydes, polycyclic aromatic hydrocarbons, and other free radicals.⁷ Throughout most of the

⁴ Maine Air Toxics Advisory Committee “Position Paper on Outdoor Wood Boilers.”

⁵ Maine Air Toxics Advisory Committee “Position Paper on Outdoor Wood Boilers.”

⁶ Schreiber et al. “Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State.”

⁷ Naeher et al. “Woodsmoke Health Effects: A Review”

U.S., wood burning heating devices are the largest residential source of particulate matter air pollution.⁸ In developing countries, the World Health Organization estimates that exposure to smoke from biomass sources is responsible for 1-2 million premature deaths per year.⁹ Wood smoke exposure has been linked to dozens of illnesses including cancer, asthma, and pneumonia.¹⁰ Fine particulate matter emissions in wood smoke have received particular attention, both for their health effects and because their levels are easily measurable. Particulates smaller than 2.5 microns in diameter (PM_{2.5}) are especially harmful as these particles can lodge deep in the lungs, carrying with them any poisonous or carcinogenic chemicals adhering to their surface as well as causing structural damage.^{11,12} In response to increasing evidence of the harmful effects of PM_{2.5} air pollution, in September 2006 the U.S. EPA tightened the National Ambient Air Quality Standards on 24-hour PM_{2.5} levels from 65 micrograms per cubic meter to 35 micrograms per cubic meter.¹³

OWBs are of particular concern because of their high levels of PM_{2.5} emissions. There is also some evidence that certain dangerous compounds are found in higher concentrations in OWB wood smoke than in wood smoke from conventional wood stoves.¹⁴ Studies by the Northeast States for Coordinated Air Use Management (NESCAUM) found that PM_{2.5} emissions from an OWB may be anywhere between 2,000 and 8,000 times higher than a natural gas furnace.¹⁵ Whereas EPA-certified indoor wood stoves must meet PM_{2.5} emissions standards of 7.5 grams per hour for non-catalytic models and 4.1 grams per hour for models that use a catalytic converter, OWB tests have found average PM_{2.5} emissions rates of 72 or even 161 grams per hour.^{16,17} See Appendix B for a visual comparison of the particulate emissions of various heating devices.

⁸ The American Lung Association “Woodburning.”

⁹ Naehler et al. “Woodsmoke Health Effects: A Review.”

¹⁰ Maine Air Toxics Advisory Committee “Position Paper on Outdoor Wood Boilers.”

¹¹ The American Lung Association “What is Particulate Matter.”

¹² Washington State Department of Ecology “Health Effects of Wood Smoke.”

¹³ US EPA “PM Standards Revision – 2006.”

¹⁴ Northeast States for Coordinated Air Use Management “Assessment of Outdoor Wood-Fired Boilers.”

¹⁵ Maine Air Toxics Advisory Committee “Position Paper on Outdoor Wood Boilers.”

¹⁶ Schreiber et al. “Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State.”

¹⁷ Northeast States for Coordinated Air Use Management “Assessment of Outdoor Wood-Fired Boilers.”

The Problem of Salisbury: A Lack of Regulation

The Town of Salisbury, Vermont recently experienced a particularly divisive conflict between owners of boilers and neighbors who had to deal with the effects of these excessively smoky units. The original idea for our project was in fact born out of the Salisbury conflict. Although Vermont already had regulations governing smokestack height and setback from property lines and residences, when we began our project there was no emission standard for OWBs. It has been our great privilege to watch and participate in the recent Vermont regulatory decision to set emission limits on new OWBs sold or installed in the state.

Historical Context of Outdoor Wood Boiler Regulation

EPA Woodstove Regulations

In 1988 the Environmental Protection Agency enacted the New Source Performance Standard for Residential Wood Heaters as part of a regulatory negotiation process with the hearth industry and non-governmental organizations. This process was initiated in response to concerns that wood heater particulate emissions had become a significant contributor to particulate air pollution. The New Source Performance Standard for Residential Wood Heaters requires manufacturers of woodstoves to undergo emissions testing to certify that each model line complies with the particulate emissions limit of 7.5 grams per hour for non-catalytic woodstoves and 4.1 grams per hour for catalytic stoves. Each model line must be tested by an EPA-accredited laboratory, of which four exist in the United States and one in Canada.¹⁸ Manufacturers must also conduct a quality assurance program for production-line wood heaters and use both a permanent label (Appendix C) which certifies that each wood heater meets the emission standard and a temporary label (Appendix D) which specifies the emission rate, the heating range of the wood heater and overall efficiency.

The Wood Heater Program is a federal program managed by the Compliance Assessment and Media Programs Division at EPA Headquarters in Washington, D.C. The program's purpose is to promote compliance with the requirements of the wood heater regulation. The Wood Heater Program undertakes a range of activities which include certification of new residential wood heaters, approval of design change requests, interpretation of rule language, conducting facility inspections, provision of public access to compliance information, direct

¹⁸ US EPA "Wood Stoves Accredited Laboratories."

monitoring of compliance by accredited laboratories, manufacturers, retailers and homeowners, and response to complaints regarding violations of the rule.¹⁹

Outdoor wood boilers (OWBs) were not highly used in the late 1980s when the EPA first instituted regulations on woodstoves and indoor wood burners and so were not included in these regulations. Since that time the popularity of OWBs has increased tremendously, with sales growing by 25 to 350% annually.²⁰ The Northeast States for Coordinated Air Use Management (NESCAUM) estimates that 155,000 OWBs have been sold nationwide since 1990 and predicts that 500,000 units will have been sold by 2010.²¹ This growth has made the problem of wood smoke from these furnaces more prevalent in local communities.

In response to growing concerns over the health effects of OWBs, on January 29, 2007 the EPA instituted an Outdoor Wood-fired Hydronic Heaters Program.²² This voluntary program “encourages manufacturers to improve air quality through developing and distributing cleaner, more efficient Outdoor Wood-fired Hydronic Heaters (OWHH).”²³ It establishes a Phase I emissions level of 0.6 pounds per million BTU input, which the EPA estimates represents about a 70% reduction in emissions compared to current boilers.²⁴

Currently 11 manufacturers (Appendix E) representing more than 80% of all OWB sales in the U.S. have signed on to the EPA’s voluntary program. To join, manufacturers must sign a non-binding partnership agreement stating that they will commit their best efforts to develop one or more cleaner OWBs that meet the EPA Phase I emissions level with the goal of distributing these units starting in April 2007. These new OWBs must be tested by an EPA-accredited laboratory and identified by an orange EPA tag (Appendix F). Qualifying boilers will be listed on the EPA website at www.epa.gov/woodheaters. Participating manufacturers must also submit sales and test data on these improved models to the EPA, display voluntary program information in areas where their boilers are sold, and provide boiler owners with text on the proper operation and maintenance of OWBs including how and what to burn.

¹⁹ US EPA “Wood Heater Compliance Monitoring Program.”

²⁰ Northeast States for Coordinated Air Use Management “Assessment of Outdoor Wood-Fired Boilers.”

²¹ Northeast States for Coordinated Air Use Management “Assessment of Outdoor Wood-Fired Boilers.”

²² “Outdoor Wood-fired Hydronic Heaters” is an alternate term for Outdoor Wood Boilers.

²³ US EPA “EPA’s OWHH Program.”

²⁴ US EPA “Program to Reduce Pollution from Outdoor Wood-fired Hydronic Heaters FAQs.”

NESCAUM Model Rule

The EPA also worked with the Northeast States for Coordinated Air Use Management (NESCAUM) to develop a model rule to serve as a reference for states, tribes and local authorities wishing to establish their own OWB regulations. The model rule contains the following components: 1) emission limits for OWBs, 2) setback requirements from property lines, structures and people, 3) smokestack height requirements, 4) instructions for proper operation and maintenance of OWBs, 5) labels for OWBs, and 6) notice to buyers.²⁵ It was created in January 2007 to make up for the lack of national legislation and encourage states to move ahead of the federal government in OWB regulation.

In the absence of binding EPA regulations, a few states have already crafted their own responses to the environmental and health risks of increased OWB popularity. The examples of Maine, Washington, and Vermont illustrate the range of these responses. Maine has not yet passed any regulations on OWBs but three are currently in the State Legislature. Washington has regulated OWBs for years under its woodstove regulations, which are stricter than those of the EPA. Vermont has had setback and stack height regulations for OWBs since October 1, 1997 and recently passed OWB emissions regulations that will take effect March 31, 2008. Vermont's regulations closely resemble the NESCAUM model rule.

State Regulations: Maine

While Maine does not yet have state regulations on OWBs, they have begun public education and outreach and there has been increasing concern about the use of OWBs in Maine. The American Lung Association of Maine has been particularly active in this process and has made the passage of legislation on OWB emissions one of their top priorities. In a position paper on OWBs they state that the increasing use of OWBs has caused them to become a public health problem. They do not support the use of OWBs in the state of Maine and “advocate for the development of risk assessment methods to better characterize the health risks associated with these devices and the degree of hazard posed by these units relative to other kinds of wood combustion.”²⁶

²⁵ Northeast States for Coordinated Air Use Management “Outdoor Hydronic Heater Model Regulation.”

²⁶ The American Lung Association of Maine “Position Statement: Outdoor Wood Boilers.”

Maine currently has three proposed bills in the legislature regarding the regulation of OWBs: LD 128, LD 1824, and LD 1551. LD 128 proposes the adoption of rules to decrease emissions and improve efficiency of OWBs, LD 1824 suspends the installation of high emission OWBs, and LD 1551 establishes a ban on the use of OWBs in the spring, summer and fall.²⁷ The last action on LD 128 was on 01/09/2007; on LD 1824 on 04/04/2007; and on LD 1551 on 03/20/2007. The action taken by both the house and the senate was the same. In the house, they were “referred to the Committee on Natural Resources”; “sent for concurrence.” In the senate, all three of them are “Under suspension of the rules on motion by Senator Martin of Aroostook, Referred to the Committee on Natural Resources and ordered printed, in concurrence.”²⁸

State Regulations: Washington

Washington has had regulations on emissions including OWBs for longer than most other states. Their regulations have become standards by which to create other state regulations. The recently passed Vermont OWB emissions limit is similar to Washington’s limit on non-catalytic wood stoves (4.5 grams of PM_{2.5} emissions per hour). The Washington State regulations can be found at the Washington State Department of Ecology website under the Air Quality subheading.

In Washington, all solid fuel burning devices with a heat output of less than 1 million BTU per hour are included in the same category. Thus OWBs are subject to the same restrictions and emissions limits as indoor installed boilers and wood stoves. However, since OWBs are not manufactured in a manner that would allow them to be tested to determine if they meet these emissions limits, they are prohibited in the state of Washington.²⁹

State Regulations: Vermont

Since October 1, 1997 all OWBs installed in Vermont have had to meet setback and stack height requirements. On April 27, 2007 Vermont’s new OWB emissions regulations went into effect. These apply to all OWBs sold or installed in Vermont after March 31, 2008. The full text of these rules may be found on the Vermont Air Pollution Control Division website.³⁰ They are summarized as follows:

²⁷ The American Lung Association of Maine “ALAME’s Outdoor Wood Boiler Testimony.”

²⁸ State of Maine Legislature Bill Status Search

²⁹ Washington State Department of Ecology “Outdoor Wood-Fired Boilers Law and Policy.”

³⁰ Vermont Air Pollution Control Division “Vermont APCD files final Adopted Outdoor Wood-Fired Boiler rule.”

- No OWB may be installed within 200 ft of a neighbor's residence
- Any OWB located within 500 ft of a neighbor's residence must have a permanent stack higher than the peak of the structures served by the OWB. However, new boilers that meet the OWB particulate matter emissions limits are not subject to this requirement.
- Before selling or leasing an OWB, dealers must provide customers with a notice stating that the customer must use untreated natural wood, comply with any municipal laws including public nuisance regulations, and that the use of OWBs in certain areas is not appropriate due to terrain concerns or public health hazards. The customer must sign a copy of this notice, which the dealer must mail to the APCD.
- Any OWB sold or installed in Vermont after March 31, 2008 must have particulate matter emissions that do not exceed 0.44 pounds per million BTUs of heat input.
- By March 31, 2008 at the latest, the APCD will file a new proposed rule establishing an OWB particulate matter emissions limit of 0.32 pounds per million BTUs of heat output, or whatever other limit is deemed necessary.

Community Partners and Outdoor Wood Boilers in Vermont

Our Involvement: A Proactive Approach

Our project framing started the first day of class during a conference call with John Cronin from the American Lung Association of Vermont (ALAVT). We initially thought our role would be one of information sharing between the groups along with some analysis of social and economic issues. Since not all of the community partners were up to speed on the technical aspects of Outdoor Wood Boiler (OWB) operation and proposed legislation, we prepared an information packet as part of our March project progress report (Appendix G). We also prepared a summary of OWB issues for posting on the ALAVT website (Appendix H).

When we started our project, the Air Pollution Control Division (APCD) was already in the process of submitting an emissions regulation on OWBs to the Vermont legislature for the second time. Though the initial emissions regulation (Rule 5-205) was submitted to the Vermont Legislative Committee on Administrative Rules (LCAR) in 2005, the rule stalled because of public and industry protest. In our conversations with the APCD they expressed a need for vocal public support of the rule to counteract the opposition from dealers, manufacturers, and OWB

users that had been so detrimental in the past. As in 2005, many members of the public who are against boiler regulation continue to be misinformed by false claims from manufacturers.

During the fast-paced month that led to the emissions rule debate in the LCAR, our class had a proactive approach to the time constraints associated with the hearing. In hopes of gaining more public support for the rule we prepared action alerts to be distributed to the email lists of the ALAVT and People for Less Pollution (PLP) (Appendices I & J). These community partners forwarded the messages to encourage members of their organizations to write or call in support of Rule 5-205 and possibly show up at the hearings. This idea originated during a conference call on March 20 with John Cronin from the ALAVT and Harold Garabedian from the APCD.

We also wrote two letters to the *Burlington Free Press*. The first (Appendix K) was a response to an outrageous newspaper advertisement (Appendix L) taken out by an OWB manufacturer on April 2, just days before the regulation was to be debated. This advertisement perpetuated the common yet erroneous attack that emissions regulations were just the first step in an effort to outlaw Vermonters' "right to burn wood." Our second letter (Appendix M) was in response to an April 7 letter to the editor citing similar concerns (Appendix N) and was published on April 20, 2007.

On April 4, the Legislative Committee on Administrative Rules voted to adopt Rule 5-205. But just when it seemed like everything was settled, another roadblock came into the path of regulation. This time it was in the form of a proposed amendment to an Appropriations Bill that would change the emission limit of Rule 5-205 from 0.44 lbs/MM BTU input to 0.6 lbs/MM BTU input and delay the implementation date for another year. The gravity of this amendment was contextualized by our community partners as well as a local State Senator. The real issue was less in the technical aspects of the emission standard and more in the amendment's requirement that the APCD be taken out of the regulatory process entirely—further OWB regulation would be tied to the US Environmental Protection Agency's voluntary program rather than the best judgment of Vermont's own experts. This amendment was being pushed by Senator Snelling, who was sympathetic to the OWB manufacturers who waged a tireless and biased lobbying effort.

Upon receiving this news, we immediately prepared and sent out email alerts to be used by the ALAVT and PLP to request action from their constituents. We also called Senator Flanagan, a member of the Rules Committee and supporter of the APCD's rule, to voice our

personal support for Rule 5-205. Senator Flanagan was particularly concerned with the amendment and the industry's backroom meddling during the entire legislative process. After a week of uncertainty, we received the good news that no senator had moved to attach the amendment and the emission rule would stand as passed. This was ultimately due to the fact that a leaked U.S. Environmental Protection Agency test reported that Central Boiler, a manufacturer from Minnesota and the primary voice of industry opposition, in fact already has a prototype OWB model that would meet Vermont's new standards. Thus Central Boiler's argument that the regulation would cause the company undue economic harm through lost sales in Vermont was rendered moot.

As a group, we were fortunate to see the process of regulation take place right before our eyes. From a public health perspective the new rule was an obvious solution. At the same time, it was amazing to see that even such common sense initiatives can encounter stiff opposition from both citizens and manufacturers. There is no way to say whether our activism influenced the rulemaking process or not, but it was both exciting and insightful to be a participant.

Outreach and Education

Although the new Vermont rule was passed, almost all OWBs that are currently available are old, dirty models. With the passage of the new rule, however, manufacturers and dealers unfortunately have a strong incentive to dump their old stock before the rule takes effect next March. A large challenge faced by the APCD is how to encourage consumers to wait to purchase an OWB until cleaner, regulated models are available. In addition, the APCD would like to educate existing OWB owners about good wood burning practices and encourage them to replace their boiler with a clean model. As one element of an outreach strategy to this effect, our class developed an informational fact sheet (Appendix O) that includes the following content: suggestions for wood seasoning and clean burning practices, encouragement of consumers of woodstoves to opt for EPA certified units, information on health impacts, and a request that potential buyers of OWBs hold off on their investment until the new, cleaner units are available. It is our hope that the state, ALAVT, and PLP will distribute fact sheets such as these at furnace retailers, centers of local government, or local areas of high traffic such as a supermarket.

We also conducted an economic analysis of OWBs to highlight the advantages of cleaner units. Probably the strongest selling point of OWBs is the low cost of wood fuel. Table 1 shows

the relative costs of various fuels in Vermont as of April 2007. The values for cost per million BTU are adjusted to include differences in the efficiency of heating technology for each fuel. Even though wood is only $\frac{3}{4}$ as efficient as gas and oil, it is still by far the cheapest energy source. Furthermore, many OWB owners have their own woodlot or burn scrap wood and so consider the fuel free. Thus although most OWBs cost between \$5,000 and \$15,000 plus installation this cost is quickly recouped by savings on fuel.

Fuel	Unit	BTU/unit	\$/Unit	Efficiency	\$/million BTU
Propane	Gallon	91,600	\$2.42	80%	\$33.07
Kerosene	Gallon	136,600	\$2.87	80%	\$26.24
Fuel Oil	Gallon	138,200	\$2.55	80%	\$23.10
Coal	Ton	24,000,000	\$285.00	60%	\$19.79
Pellets	Ton	16,400,000	\$257.00	80%	\$19.59
Natural Gas	Therm	100,000	\$1.54	80%	\$19.25
Wood	Cord	22,000,000	\$180.00	60%	\$13.64

Table 1. Vermont heating fuel costs for April 2007, from Vermont Fuel Price Report: <http://publicservice.vermont.gov/pub/fuel-price-report/07april.pdf>

The only disadvantage of the clean OWB models that meet the new emissions regulations is that they are more expensive than equivalent dirty models. But since the clean models are also far more efficient, the extra cost can quickly be recouped through savings on fuel consumption. Originally our class intended to develop a consumer fact sheet listing all the models of various OWB manufacturers along with their price, heat output, and emissions information. This fact sheet would allow consumers to easily compare different models and calculate the eventual savings from buying a clean, efficient model. However, of the 22 OWB manufacturers we contacted (Appendix P) only three provided us with efficiency and emissions data: Clean Wood Heat LLC, GARN, and TARM USA. Most manufacturers had never even conducted emissions tests on any of their models. We also found emissions information on the EPA website for a Central Boiler prototype, but this model is not yet in production and Central Boiler would not provide us with emissions data for any of its other models. Pricing information was also difficult to find and varied somewhat between dealers. Thus we were forced to abandon our plan of creating a comprehensive comparison of all OWB models. Instead, we estimated the savings for the average Vermont household from the purchase of a clean OWB model.

We used the values from the April 2007 Vermont Fuel Price Report of \$180 per cord for the price of wood and 22,000,000 BTU per cord for the heat content of wood. Between 1998 and 2000 the average Vermont home used 110 million BTU for heating.³¹ This value represents the energy content of the heating fuel consumed, so assuming that heating was performed by an oil furnace at 80% efficiency the average Vermont home requires 88 million BTU of heat output each year. We assumed that current OWB models are 45% efficient and clean models will be 85% efficient. Tests show that most current OWB models are 40-50% efficient and current clean models are about 85% efficient.^{32,33,34,35,36}

Due to the limited number of clean OWB models, it was difficult to estimate the price differential between equivalently sized clean and dirty models. None of the manufacturers that provided us with emissions data even produce dirty OWBs, and Central Boiler could not give us a price estimate for their clean prototype model, so we had to make estimates and compare boiler models produced by different manufacturers. Comparing the models we found that prices for clean units were anywhere from 30% to 100% more expensive than a dirty model with the same rated maximum heat output. By contrast, the EPA estimates that cleaner OWB models will cost about 15% more.³⁷ For our comparison we used a range of price differentials.

Table 2 shows the result of our analysis. If new clean OWB models cost only 15% more than the current dirty models then the average Vermont user will recoup the initial additional investment within the first year of use. Even if clean models are twice as expensive, the average Vermont user will see their additional investment returned from savings on fuel in under 7 years. Assuming a 5% annual discount rate, the 20-year net present value of a clean model ranges from almost \$9000 to almost \$5000 depending on the initial cost. In other words, over the course of 20 years you could save \$5000 to \$9000 more by buying a clean OWB than by investing an amount equal to the initial additional cost of the clean model in a bank account earning 5% annual interest. Thus there is a significant financial advantage to purchasing a clean, efficient OWB! Although the recoup will not be as evident for those who get their wood for free, these

³¹ Dalhoff "An Evaluation of the Impacts of Vermont's Weatherization Assistance Program"

³² Schreiber et al. "Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State."

³³ Northeast States for Coordinated Air Use Management "Assessment of Outdoor Wood-Fired Boilers."

³⁴ <http://www.woodboilers.com/efficiency.asp>

³⁵ <http://www.dectra.net/garn/Efficiency.htm>

³⁶ <http://www.greenwoodfurnace.com/Manufacturers.htm>

³⁷ US EPA "Program to Reduce Pollution from Outdoor Wood-fired Hydronic Heaters FAQs."

users will benefit from more efficient heating and may see savings in time and labor. Also, since “free” wood could be sold at market price instead of burnt it is not truly a free fuel.

Annual Output	Efficiency	Cords per Year	Boiler Cost	Annual Wood Cost	Initial Additional Cost	Annual Savings	Simple Payback Time	20-Year NPV
88,000,000	45%	8.9	\$5,000	\$1,600				
88,000,000	85%	4.7	\$5,750	\$847	\$750	\$753	1.0	\$8,939
88,000,000	85%	4.7	\$7,500	\$847	\$2,500	\$753	3.3	\$7,273
88,000,000	85%	4.7	\$10,000	\$847	\$5,000	\$753	6.6	\$4,892

Table 2. Savings from purchase of cleaner, efficient OWB models.

Sustainability

Is Wood a Healthy and Sustainable Alternative Energy Source for Vermont?

Oil prices are soaring. On Monday May 14, 2007 the U.S. Energy Information Administration announced that gasoline reached a new record of \$3.10—beating out the record set in September 2005 after the Hurricane Katrina disaster.³⁸ Further, global climate change, directly linked to human use of fossil fuels, is no longer being debated. The only remaining question about global climate change is how bad it will be. In addition, turmoil in the Middle East creates uncertainty around our supply of oil and the possibility of a supply interruption is crucial to consider as well. As Americans, we have some tough decisions to make in the coming years about where we get our fuel. To minimize fossil fuel combustion impacts on climate change, the environmental movement has undergone a dramatic shift in the past couple of years and currently many top environmental leaders are advocating a shift away from fossil fuels by relying more heavily on locally sustainable energy sources.

This trend is echoed in the progressive state of Vermont. One source of renewable energy that has gained momentum in the past five years is biomass. Biomass is biological material that can be used to produce heat, electricity, and an array of fuels. Types of biomass range from firewood to woodchips and wood pellets to low-grade wood waste to grass pellets. In fact in the state, “20 percent of Vermont public school students attend a school heated with wood.”³⁹ In addition many people use wood stoves, Outdoor Wood Boilers, or pellet heating systems for their homes. In the town of Middlebury, the Biomass Commodities Corporation has proposed building an \$8 million pelletizing plant to refine biomass fuel locally. Biomass

³⁸ US News “U.S. retail gasoline price hits record \$3.10.”

³⁹ Biomass Energy Resource Center “Vermont Fuel For Schools”

production can lead to increased economic development by keeping energy dollars within local communities. Money spent on oil and gas is a significant loss for local economies. Further, using locally grown biomass products creates jobs in the forestry and agriculture industries.

Using biomass is good for the environment and is considered a carbon neutral way of generating power or heat. Some forests are healthier when wood is selectively harvested to prevent the understory from becoming choked. In addition, biomass creates power and energy in a closed loop carbon neutral cycle: as the biomass source grows the crop sequesters climate altering greenhouse gases.

Biomass can be used to cut fuel costs. According to the Vermont Fuel for Schools brochure, “In the last 20 years, wood prices have increased at about the rate of general inflation while oil prices have increased twice as fast.” They go on to say that “heat from oil, propane, and natural gas costs roughly two to-three-times as much as heat from woodchips.”⁴⁰

Biomass is a resource that deserves the attention it has been receiving in recent years. But, is biomass, on a large scale, sustainable? To understand this question the definition of sustainability must be clear. According to a Vermont Family Forests brochure, the definition of sustainability is as follows: sustainable management of forests is based on a multi-use vision of the landscape that preserves healthy and sustainable ecosystems, prosperous forest products, ample recreational opportunities, and supports ownership patterns that promote a working forest while protecting unbroken forest tracts.⁴¹ In addition, biomass sources need to be local to be sustainable; otherwise the materials will need to be transported long distances using fossil fuel energy which negates the carbon neutral cycle of biomass.

It is prudent to stop and consider this question fully before putting all our eggs in the biomass basket. In Addison County, Vermont, this is exactly the guided approach that is happening. Netaka White, the executive director of the Vermont Biofuels Association is attempting to take on this task. Along with his partner, Harvey Smith, the two are looking to find funding to assess cropland and the overall land base in Addison County that could support the production of biomass pellets. If they are granted the necessary money they will undertake a full assessment of the Addison County fiber shed in an attempt to see how much biomass the county can grow sustainably.

⁴⁰ Biomass Energy Resource Center “Vermont Fuel For Schools”

⁴¹ Jacobi et al. “Community Support Forestry Firewood Program: Gauging Local Interest for a Healthier Tomorrow”

Two other people working on the question of biomass sustainability in Addison County are Jock Gill, President of the Biomass Commodities Corporation and Jason Oleet, a partner at Worth Mountain Capital. The two are confident the fiber shed has ample supply to bring the pelletizing plant to the Town of Middlebury.

Both men believe that Lyme Timber Company will be a major player if the pelletizing plant gets built. According to the locally-based Lyme Timber Company, if a pelletizing plant in Middlebury was built, the plant could have access to a quarter million acres of land they own locally. On top of that, both Jason and Jock believe farmers are hesitant to switch farmlands to grass crops suitable for biomass because of the lack of constant demand and high subsidies on alternative crops. If the commitment to biomass taking shape across Vermont catches on, and a constant market demand appears, more farmers would be willing to make a transition towards grass for biomass. In addition if there were a subsidy from local governments for grass to be used for biomass—an incentive well worth the subsidy due to the multiplier effect as money stays in the local economy—farmers would have a much stronger incentive to make a transition. Further, Jock suggests that there may be well over 1 million tons of low quality forest fibers available every year in Addison County alone. A 2003 Biomass Energy Resource Center study suggested that almost 300,000 green tons of potentially sustainably harvestable wood is already grown each year in Addison and Rutland counties.⁴² And a Fall 2006 Environmental Studies Senior Seminar found that the private owners of approximately 10,000 acres of forest supported Vermont Family Forests' Community-Supported ForestryTM firewood program which aims to promote the sustainable harvesting of firewood at a local level.⁴³

In the end, as with many environmental questions these days, we return to the idea of uncertainty. Is biomass sustainable in Vermont? Probably, but until a full scale analysis is undertaken it is crucial to proceed with caution. Biomass shows tremendous potential to create a paradigm shift in the way we heat and fuel our local communities, but the question of sustainability continues to create drag on this positive momentum. Vermonters have made a commitment towards taking a lead on positive environmentally-based and economically attractive energy alternatives to dirty energy. But Vermonters must be careful to not be too overzealous, supporting an initiative that may not, in the end, be as successful as we all hope.

⁴² Vermont Family Forests "Biomass Fuel Assessment for Middlebury College"

⁴³ Jacobi et al. "Community Support Forestry Firewood Program: Gauging Local Interest for a Healthier Tomorrow"

Conclusion

Our Spring 2007 Environmental Studies Senior Seminar focused on healthy communities and renewable resource use, specifically addressing the growing issue of wood fuel and Outdoor Wood Boilers (OWBs) in Vermont. The popularity of OWBs has resulted in a dramatic increase in sales, especially in New England and the Midwest. As 80% of Vermont is forested and wood is growing as an important source of heat for many households, understanding responsible ways to burn and manage wood resources is an important and valuable asset to the state's communities. Wood's growing popularity is based on a handful of factors: people see choosing wood as a way to address national security issues related to oil, wood is the cheapest heating fuel despite the low efficiency of most wood stoves and boilers, and wood is a local resource in abundant supply that is renewable to boot!

Despite these positive characteristics, OWBs and irresponsible wood burning have unintended consequences. Most OWBs create localized pollution, which has been proven to lead to an array of serious and minor health problems. It was these new local problems and the effect they have on communities that most intrigued us and shaped the direction we took in addressing the issue. Ultimately, however, our goal evolved to support and aid in the passage of state legislation that eventually implemented regulations on OWB emissions, and mandated the production of cleaner units using more efficient technologies.

Because of the nature of the issue, the first and most important question was how to engage, work with, and positively affect the community. The solution to these first two issues was achieved by establishing a network of community partners, which included the Vermont branch of the American Lung Association (ALAVT), People for Less Pollution (PLP), and the Vermont Air Pollution Control Division (APCD). The answer to the question of how to positively affect the community was less static, and constantly evolved as our project developed. That said, the foundation of our efforts was built on the idea that by increasing general awareness of the issue within the community through educating and informing, our actions would yield positive and constructive results in the legislative and industrial fields.

By working with these local groups, and through our efforts to educate the people most affected by the issue of outdoor wood boilers, our seminar group learned a great deal about the proceedings of local politics and advocacy. Interactions with, dedication to, and assistance from our three community partners varied widely. These dynamics demonstrated the caveats that can

arise when working with multiple parties who are interested in tackling an issue, but simultaneously have other concerns on their agendas. Our role among the community partners can best be described as a middleman, with the job of facilitating the sharing of information and resources between each group. We effectively mobilized the Vermont public by engaging with our community partners and their constituents—activism that certainly helped the OWB regulation pass.

Furthermore, our efforts to educate people and bring about public awareness introduced us to the crooked politics that can be involved when industry has interests (especially economic) in the issues. Informing and mobilizing members of our community partner groups proved to be an important factor in moving the legislative process along. Additionally, in response to advertisements and letters written by OWB manufacturers slandering the proposed legislation, we wrote two letters to the editor of a local newspaper hoping to educate the wider community about the issue. Through its prominent use of the media, the efforts of industry to kill the regulations demonstrated that people with no true connection to an area can have a significant influence there without considering the value of maintaining a healthy community.

Our involvement in the legislative process' outcome yielded a better understanding of the complexities and dynamics that are involved in government, even to address and pass such seemingly obvious regulations. The importance of providing community awareness, as well as persistently pushing an issue and staying involved in the process, has become clear in our role as a network connector and proactive class. Through our established network collaboration, ALAVT, PLP, APCD, and students in our class effectively pressured the legislature to support the new rule. We applaud the strong legislation that was passed and attribute part of the successful outcome to our efforts.

Although the new Vermont rule was passed, almost all outdoor wood boilers that are currently available are old, dirty models. In addition, the passage of the new rule leaves OWB manufacturers and dealers with a strong incentive to dump their old stock before the rule takes effect next March, which would unfortunately add a significant number of dirty, inefficient, and unregulated units to the Vermont community. A large challenge faced by the APCD is to educate the public about good wood burning practices and encourage consumers to postpone their purchase of an OWB until cleaner, regulated models are available. We hope that we have

encouraged public organizations such as PLP to take on such endeavors by reaching out to the public concerning the issue.

Moreover, we see these regulations as having the potential to act as a tipping point for a larger paradigm shift towards local, responsible energy production and sustainable resource use. Between rising gas prices and strong local support of biomass heating in conjunction with new, more efficient wood heating methods, we believe that Vermont has the potential to be a national example of sustainable and efficient heating. By looking at projects such as Vermont Fuel For Schools, we are optimistic about Vermont's ability to support a shift to a more renewable future. It is extremely encouraging to see successful examples of sustainable efforts, especially when they are presented in the local community with projects such as the Mt. Abe High School in Bristol, Vermont. As biomass has become more widespread and researched, we are optimistic that students of all ages, including ourselves, will take leadership positions, while instilling our passion for and knowledge of the issues to drive this shift towards a cleaner energy economy.

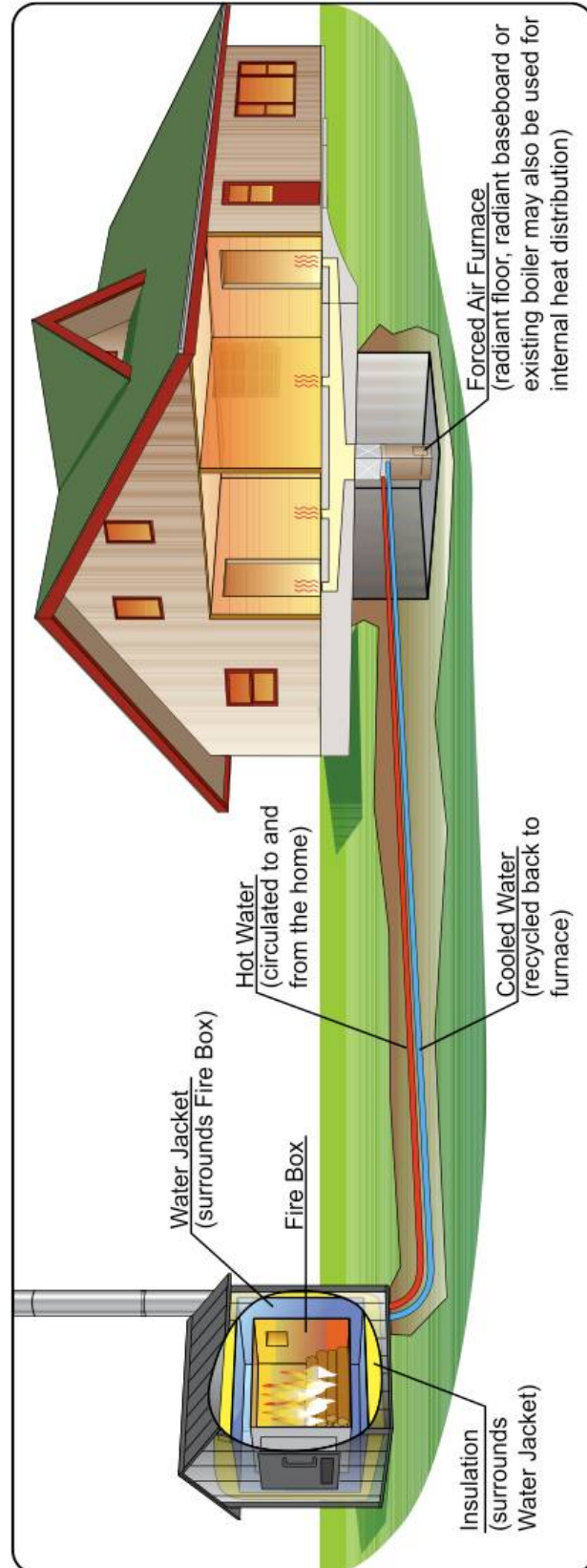
Ultimately, our seminar's efforts have successfully helped to foster healthier local Vermont communities, both in terms of clean, efficient combustion of a local renewable fuel and in terms of community knowledge and engagement. In the process, we have discovered the complexities and dynamics of legislative processes, as well as the importance of community networking on all levels—ranging from the public to the governmental sphere—in order to encourage and successfully enforce responsible and sustainable wood burning practices.

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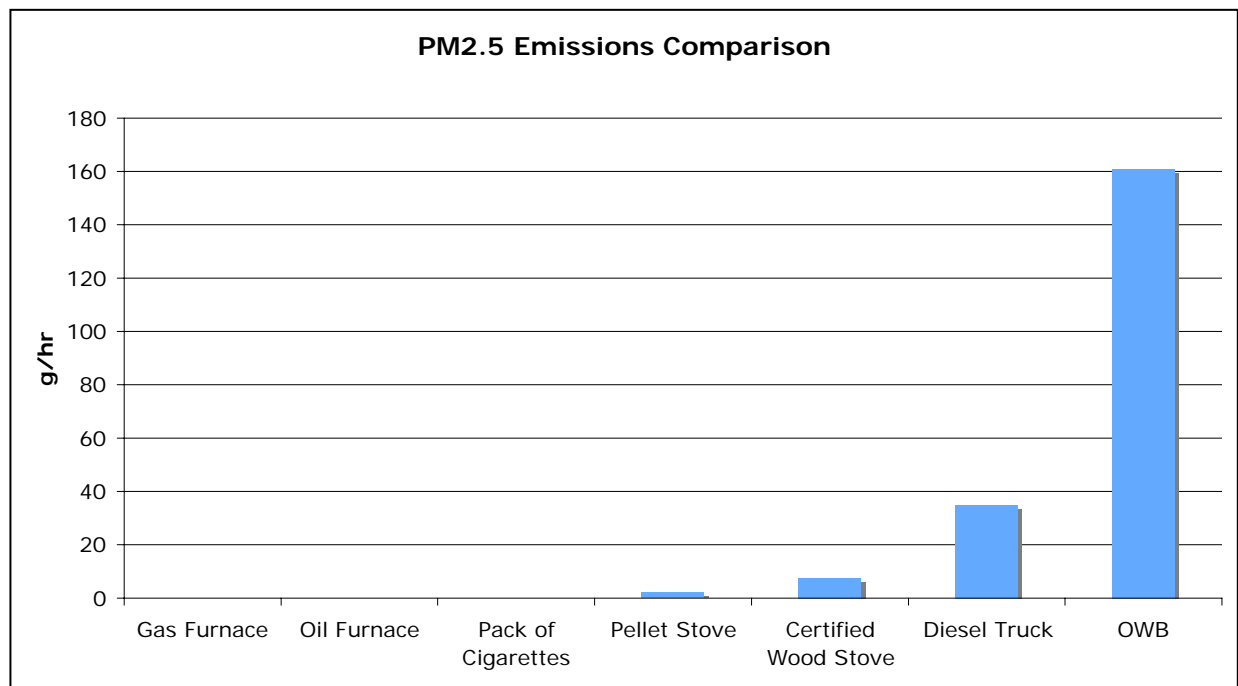
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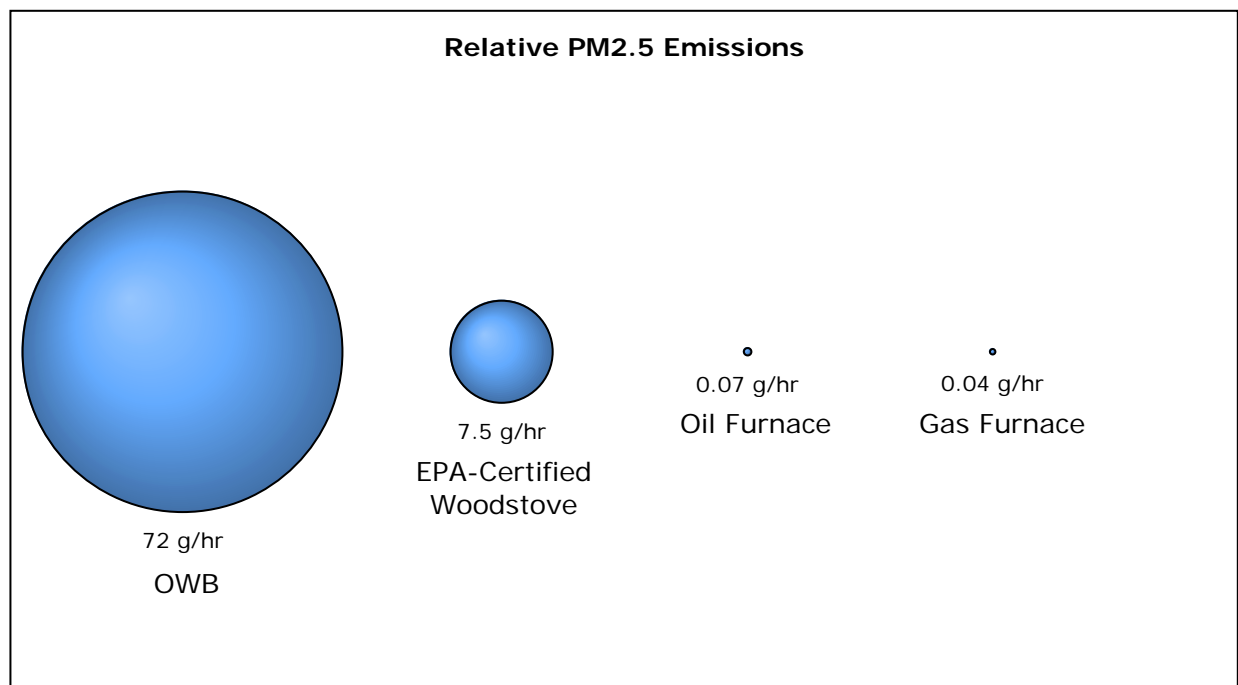
Appendix A: Diagram of a typical Outdoor Wood Boiler setup



Appendix B: Comparison of PM_{2.5} emissions from various heating devices



Source: NESCAUM Assessment of Wood-fired Boilers



Source: Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State

Appendix C: Permanent label for EPA-certified woodstoves



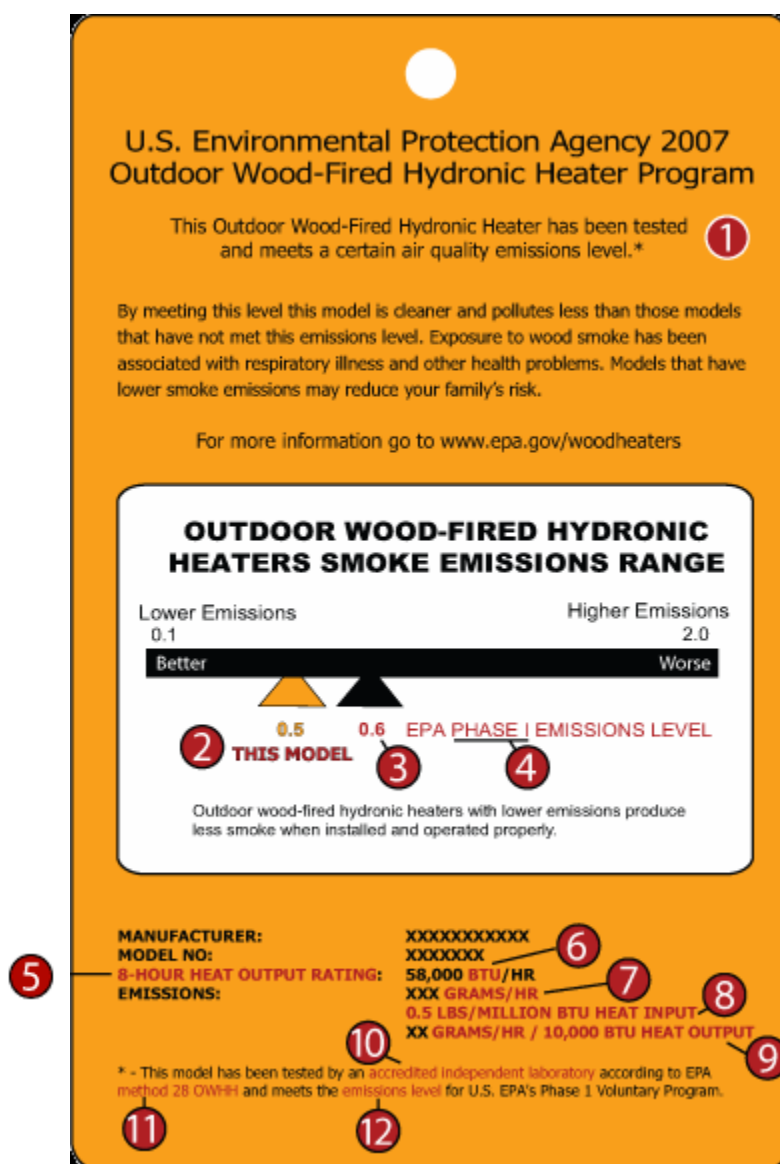
Appendix D: Temporary label for EPA-certified woodstoves

Manufactured by COMPANY NAME HERE	Design No. XXXXXXXX
<div style="border: 1px solid black; border-radius: 15px; padding: 5px; display: inline-block;">US ENVIRONMENTAL PROTECTION AGENCY</div>	
Meets EPA particulate matter (Smoke) control requirements for NON-CATALYTIC wood heaters.	
<div style="margin-bottom: 10px;">SMOKE</div> <div style="text-align: center;"><div style="border: 1px solid black; padding: 2px; display: inline-block; margin-bottom: 5px;">This Model</div><div style="width: 100px; height: 20px; background: black; margin: 0 auto;"></div></div> <div style="text-align: center; margin-top: 10px;">0 (grams per hour) 8.5</div>	
<div style="margin-bottom: 10px;">EFFICIENCY</div> <div style="text-align: center;"><div style="width: 80px; height: 40px; background: black; margin: 0 auto; transform: rotate(180deg);"></div></div> <div style="text-align: center; margin-top: 10px;">50% 60% 70% 80% 90% 100%</div>	
<small>* Not tested for efficiency. Value indicated is for similar non-catalytic wood heaters. Wood heaters with higher efficiencies cost less to operate.</small>	
<div style="margin-bottom: 10px;">HEAT OUTPUT</div> <div style="margin-bottom: 10px;">10,600 to 26,100 Btu/Hr</div> <div style="margin-bottom: 10px;"><i>Use this to choose the right size appliances for your needs.</i></div> <div style="margin-bottom: 10px;">ASK DEALER FOR HELP.</div> <div style="margin-bottom: 10px;"><small>This wood heater will achieve low smoke output and high efficiency only if properly operated and maintained. See owner's manual.</small></div>	
<small>S 19581 Rev.0</small>	

**Appendix E: List of Outdoor Wood Boiler manufacturer participants in voluntary EPA
Outdoor Wood-fired Hydronic Heaters Program**

Aqua-Therm, LLC
Black Bear/ Clean Wood Heat, LLC
Burns Best
Central Boiler
Freedom Outdoor Furnace, LLC
Hardy Manufacturing Co., Inc.
Heatmor, Inc.
HeatSource1
Mahoning Outdoor Furnace, Inc
Northland Distributing and Manufacturing, Inc
Pro-Fab Industries, Inc.
Sequoyah Paradise
Taylor Manufacturing, Inc
Timber Ridge, Inc.
Woodmaster/Northwest Manufacturing, Inc.

Appendix F: Explanation of orange EPA tag



1 **Seasonal vs. Year-round burning** - an OWHH is rated for either seasonal or year-round burning. A "year-round" unit has been tested and meets the criteria for potential usage 12 months of the year. A "seasonal" rating designation is for units that are specified for use *only* during winter months (approximately October through April).

2 **"This Model" Designation** - shows the pollution emission level (measured in lbs/million BTU heat input) for this particular OWHH model. This number resulted from the emissions test ([EPA Method 28 OWHH](#)) used to compare the OWHH device with the EPA qualifying emissions level.

3 **0.6 EPA Phase I Emissions Level** - the OWHH must meet this level to qualify for the EPA Phase 1 voluntary program. This level is calculated in lbs/million BTU input (i.e., wood fuel burned).

- 4 Phase I** - is the initial step of EPA's phased program to provide better choices to consumers of OWHH models that are cleaner and more efficient than current models.
- 5 8-Hour Heat Output Rating** - describes how much heat this model can provide in eight hours (measured in BTU/hour).
- 6 BTU** - is short for British Thermal Unit. A BTU is a measure of an amount of heat. Specifically, a BTU is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.
- 7 Grams/hour** - shows the amount of pollution (measured in grams) per unit of time (measured in hours). This number is essential for estimating air quality and health impacts. For comparison, most current OWHH are estimated to emit 100-300 g/hr whereas most current EPA-certified woodstoves emit less than 4 g/hr and some emit less than 2 g/hr.
- 8 XX lbs/ Million BTU Heat Input** - shows the amount of particle pollution per amount of wood burned. For comparison, most current OWHH are estimated to emit 1.5-5.0 lbs/million BTU heat input whereas most current EPA-certified woodstoves emit 0.8-1.5 lbs/million BTU heat input.
- 9 Grams/Hour/10,000 BTU Heat Output** - shows the particle pollution per hour per every 10,000 BTU of heat output. This calculation takes into consideration varying sizes of OWHH units. In general, larger models typically emit more pollution but they also provide more heat output if the efficiency is the same. Although EPA's primary interest is reducing emissions to protect public health, EPA is also encouraging manufacturers to increase the efficiency of their OWHH which typically reduce emissions for a given heat output. For comparison, many current OWHH are estimated to have combustion efficiencies of only 30-40 percent whereas most current EPA-certified woodstoves and wood pellet stoves have efficiencies of 67-80 percent.
- 10 Accredited Independent Laboratory** - EPA has provided official authorization for certain OWHH testing labs in the United States. An important criterion is that these labs are independent of the manufacturers. Also, this accreditation is determined by reviewing a lab's performance, their capabilities for completing specific types of testing, and accurately and fully compiling results data.
- 11 [EPA Method 28 OWHH](#)** - is the EPA test method for measuring emissions and heat output for OWHH. This is a standard test method which all manufacturers must follow to participate in this voluntary rating initiative.
- 12 Emissions Level** - designated by EPA as a maximum of 0.60 lbs of particle pollution per million BTU heat input. EPA established this number with input from various stakeholder groups such as industry manufacturers, EPA-accredited woodstove testing laboratories, state air quality agencies, and the Northeast States for Coordinated Air Use Management (NESCAUM).

Appendix G: Preliminary information packet for community partners

Outdoor Wood Boiler Regulation: An Overview of the work of the Vermont Air Pollution Control Division and others

Preliminary information for the American Lung Association of Vermont and People for Less Pollution

*Compiled by Brett Foreman and Ian Hough of ENVS 401B,
Middlebury College, Spring 2007*

Introduction:

There is a compendium of good information that has been made publicly available by the VT APCD, US EPA, New York State, and Washington State. This piece is meant to be more of an interactive summary of some of the good materials along with links to primary source information.

The problems associated with Outdoor Wood Boilers (OWB):

- Most OWB are poorly designed and inefficient:
 - OWB burn more wood than woodstoves
 - Leads to public health hazard due to thick, ground-level smoke

Resources:

www.vtwoodsmoke.org

- Specific Outdoor Wood Boiler website of the Vermont Department of Environmental Conservation, Air Pollution Control Division.
- Opening Summary:
 - Welcome to the Vermont Department of Environmental Conservation website on Outdoor Wood Boilers (OWB) or Outdoor Wood Hydronic Heaters (OWHH). With the rising cost of heating oil, more Vermonters are looking to wood as a source of heat and hot water. Not all wood heat is the same. While indoor woodstoves have been tested and certified by EPA for emissions since 1990, outdoor wood boilers are not. OWB cause dense smoke and are equipped with very short smoke stacks so the smoke does not disperse well. This smoke endangers the health of you, your family and neighbors as well as the environment.
 - The claims of some OWB manufacturers are not proving to be accurate with time and testing. We want you to have the facts before making an investment. OWB are regulated in VT and may also be regulated or banned by your town. This site is designed to help you get the facts. If you have any questions about OWB, please [contact us](#).
- Useful links:
 - <http://www.vtwoodsmoke.org/about.html>
 - <http://www.vtwoodsmoke.org/health.html>

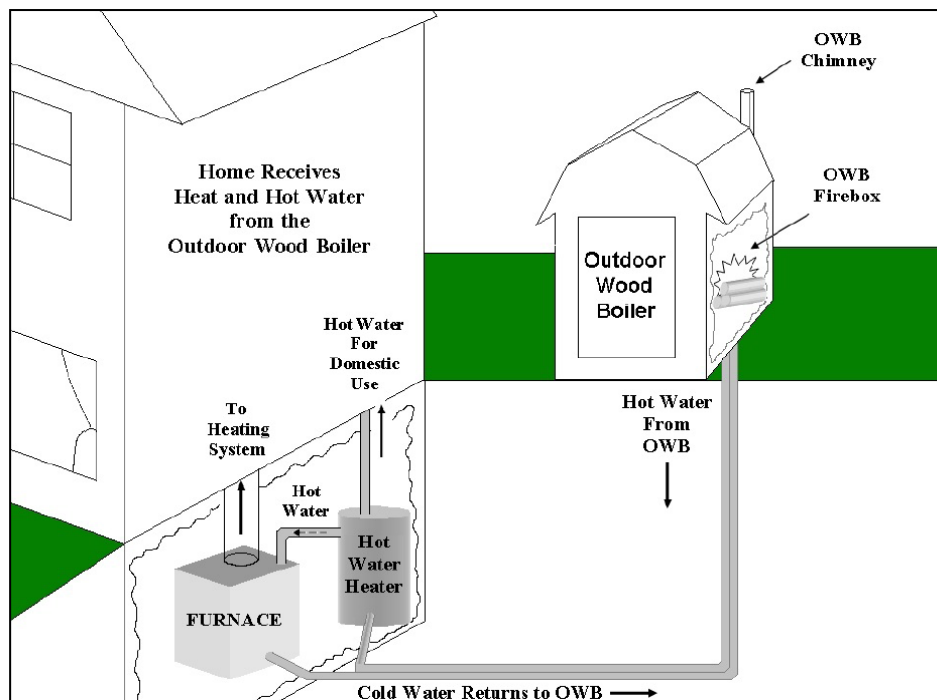
www.woodheat.org

- Wood Heat Organization Inc. is a nonprofit, nongovernmental agency dedicated to the responsible use of wood as a home heating fuel.
- Environmental impacts:
 - <http://www.woodheat.org/environment/environment.htm>
- Proper Burning Techniques:
 - <http://www.woodheat.org/firewood/fuelproc.htm>
- Outdoor Boilers; today's most controversial wood heating technology

- <http://www.woodheat.org/technology/outboiler.htm>

Schreiber, Judith, et al., *Smoke Gets in Your Lungs: Outdoor Wood Boilers in New York State*. Office of the Attorney General; Albany, New York, 2005. Available Online: <http://www.oag.state.ny.us/press/2005/aug/August%202005.pdf>.

- Executive Summary:
 - Homeowners, especially in rural communities, are increasingly turning to wood burning units installed outside the home, known as outdoor wood boilers (OWB), to heat their homes. OWB sales have tripled in New York since 1999, with over 7,000 OWB sold from 1999 to 2004.
 - The New York State Office of the Attorney General (OAG) Environmental Protection Bureau reviewed information on OWB and analyzed the manufacture, distribution, testing, and sales of OWB in New York State. We found that while OWB are advertised as a clean and economical way to heat one's house and water, OWB may be among the dirtiest and least economical modes of heating, especially when improperly used. Even when used properly, OWB emit, on an average per hour basis, about four times as much fine particulate matter pollution as conventional woodstoves, about 12 times as much fine particle pollution as EPA-certified woodstoves, 1000 times more than oil furnaces, and 1800 times more than gas furnaces. Such emissions are significant because fine particulate matter pollution has both short-term and long-term health effects.
 - Currently, neither federal nor New York State regulations address the proper use of, or limit the pollution from, OWB. Unlike indoor woodstoves and other heating devices, OWB do not have to meet safety or performance standards. In the absence of such regulations, some local governments have imposed sensible limits on OWB, which are described in this report.
 - We recommend that comprehensive testing protocols and emission limitations be enacted. We also suggest practical steps that owners and neighbors can take to mitigate environmental and health problems associated with OWB.



Washington State Department of Ecology website:

- (http://www.ecy.wa.gov/programs/air/AOP_Permits/Boiler/Outdoor_Boilers_home.html)
- *What are Outdoor Wood-fired Boilers (OWB)?*
 - OWB are wood-fired water heaters that are located outdoors or are separated from the space being heated. The fires in the large fire boxes heat water that is circulated into the home through underground pipes. The energy may be used to heat houses, shops, domestic hot water, greenhouses, swimming pools and spas. Indoor installed boilers are a variation of an OWB. They are in the same legal category as OWB, and subject to the same regulations.
- *Why Is There Controversy?*
 - OWB tend to cause dense smoke that impacts neighbors by creating a nuisance and health problems. Most OWB come equipped with very short stacks. The smoke from these low stacks disperses poorly. These units are intended to be operated year around, so smoke is emitted constantly. In addition, because of the way they are manufactured, OWB are prohibited in the state of Washington.
- *What Causes OWB To Smoke?*
 - Most OWB employ very primitive combustion technology. When the water circulating through the furnace reaches an upper set point (usually around 180°F) the air supply to the fire is cut-off, cooling the fire so the water will not overheat. The furnace operates in this "idle" mode until the water temperature hits a lower set point and the air supply is re-established. Under some conditions, the OWB may be in idle mode far longer than in operating mode. This type of operating causes very poor combustion and heavy foul smoke. Most of the smoke emitted is fine condensed organic material that does not burn under cool, oxygen starved conditions. In addition, many owners burn green wood full of moisture which also causes poor combustion. Wood from the outdoor winter wood pile may be very cold when loaded into the OWB causing an even colder fire.
- *Are OWB Worse Than Indoor Woodstoves?*
 - Yes. Newly manufactured indoor woodstoves are required to meet strict Washington State particle emissions standards, 2.5 grams per hour for catalytic stoves and 4.5 g/hr for noncatalytic stoves. Certification tests are conducted in EPA approved laboratories. In contrast, tests done by the Northeast States for Coordinated Air Use Management (NESAUM) found that the average fine particle emissions (a particularly harmful pollutant) from one OWB are equivalent to the emissions from 22 EPA certified woodstoves, 205 oil furnaces, or as many as 8,000 natural gas furnaces. One OWB can emit as much fine particle matter as four heavy duty diesel trucks on a grams per hour basis. The smallest OWB has the potential to emit almost one and one-half tons of particulate matter every year. Although older style indoor woodstoves emit more than new certified stoves, they are still several times less polluting than OWB. Due to the poor combustion conditions, it is also probable that OWB emit proportionately more benzene, polycyclic aromatic hydrocarbons, formaldehyde and other toxic partial combustion products which have been linked to asthma, heart attacks and cancer.
- *Is Natural Wood Smoke Harmful?*
 - Yes, all wood smoke is harmful. Fine particles from smoke emissions can be carried deep into the lungs and can be responsible for significant health problems, including asthma, lung diseases, heart diseases and death. These particles can also increase the risks of certain types of cancer. Breathing smoke is especially harmful for sensitive populations, including children, the elderly, and people with heart and lung ailments. It is estimated that fine particle air pollution costs citizens of Washington State hundreds of millions of dollars each year in health care costs and lost productivity due to illness.

- While all smoke is harmful, outdoor wood boilers generate more particle pollution ("soot") than indoor woodstoves. The units are designed to burn wood at lower combustion temperatures and generally have shorter stacks which emit smoke at house level. Wood smoke releases fine particles, carbon monoxide, and other toxic pollutants.
- Breathing air containing wood smoke can:
 - reduce lung function, especially in children;
 - increase severity of existing lung diseases such as asthma, emphysema, pneumonia and bronchitis;
 - aggravate heart disease;
 - increase susceptibility to lower respiratory diseases;
 - irritate eyes, lungs, throat and sinuses;
 - trigger headaches and allergies.
- Long term exposure to wood smoke may lead to
 - chronic obstructive lung disease;
 - chronic bronchitis;
 - increased risk of cancer and genetic mutations (based on animal studies);
 - cardiovascular disease.

A Variety of State and Federal programs are attempting to address this problem:

Current Vermont Regulations:

- ("Standards for Outdoor Waterstoves," Section 5-204, Environmental Protection Regulations, Vermont Agency of Natural Resources, Available Online: <http://www.vtwoodsmoke.org/pdf/OWBrule04.pdf>)
- The current regulations in Vermont are applicable to units installed after October 1997. These regulations include requiring the OWB unit to be at least 200 feet from a neighbor's house and have a stack height higher than the roofline of the residence. Additionally, must comply with all applicable laws and not create a public nuisance. The dealer must have buyer or lessee sign a written notice saying that they can only burn untreated natural wood, are aware of location requirements, and recognize that even an OWB meeting these requirements may be inappropriate in some terrain as it could be a nuisance or public health hazard. The dealer will then mail a copy of signed notice to APCD along with name, address, phone of buyer or lessee and location, make, model of OWB.

New Vermont Regulations Filed with VT Secretary of State and Legislative Committee on Administrative Rules as of March 12, 2007:

- ("Final Proposed Rule: Control of Particulate Matter From New Outdoor Wood-Fired Boilers," Section 5-205, Environmental Protection Regulations, Vermont Agency of Natural Resources, Available Online: <http://www.anr.state.vt.us/air/docs/OWB%20Final%20Prop%20Reg%20022807.pdf>).
- This new rule that is currently under review with LCAR sets a particulate emission standard of .44 pounds per million BTU input for new boilers sold in Vermont after March 31, 2008. This emission standard is comparable to the current EPA limits on indoor woodstove particulate emissions. Setback and stack-height requirements will not apply to new stoves that meet this emission standard.
- This emission standard was advocated during proceedings in 2005, but was blocked by a problem of public outcry. There was a public misperception, perhaps influenced by OWB industry special interests, that the scientists at the APCD were trying to restrict the use of wood as a residential fuel. The regulation ultimately failed in part due to angry citizens protesting at the state capital. This segment of public was tragically misinformed about the APCD's intentions. The APCD

would simply like to have OWB emissions regulated to safe levels for both the owners of the units and their neighbors. The APCD clearly recognizes that the sustainable use of biomass is an economical and contemporary carbon fuel source to be included in Vermont's renewable energy portfolio.

- LCAR will decide on the rule in the month following the rule-filing date (03/12/2007). As the public comment period finished in the fall of 2006, it is unclear whether public support from ALA VT and PLP will be able to affect the approval of this regulation.

US Environmental Protection Agency Outdoor Wood-fired Hydronic Heaters Program:

- This is a voluntary program that is meant to encourage manufacturers of OWB to produce cleaner models. These cleaner models, with emission standards of .5 pounds per million BTU input or less, are eligible to carry an EPA certified orange tag. In the EPA's opinion, this voluntary program will achieve pollution reductions and protect public health in a more timely manner than a federal rule. http://www.epa.gov/woodheaters/what_epa_doing.htm
- Here is what the orange tag looks like: Available Online: <http://www.epa.gov/woodheaters/pdfs/hangtag1.pdf>

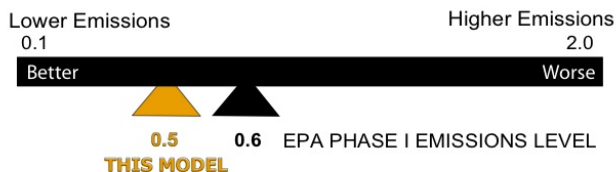
U.S. Environmental Protection Agency 2007 Outdoor Wood-Fired Hydronic Heater Program

This Outdoor Wood-Fired Hydronic Heater has been tested
and meets a certain air quality emissions level.*

By meeting this level this model is cleaner and pollutes less than those models
that have not met this emissions level. Exposure to wood smoke has been
associated with respiratory illness and other health problems. Models that have
lower smoke emissions may reduce your family's risk.

For more information go to www.epa.gov/woodheaters

OUTDOOR WOOD-FIRED HYDRONIC HEATERS SMOKE EMISSIONS RANGE



Outdoor wood-fired hydronic heaters with lower emissions produce
less smoke when installed and operated properly.

MANUFACTURER:	XXXXXXXXXXXX
MODEL NO:	XXXXXXX
8-HOUR HEAT OUTPUT RATING:	58,000 BTU/HR
EMISSIONS:	XXX GRAMS/HR
	0.5 LBS/MILLION BTU HEAT INPUT
	XX GRAMS/HR / 10,000 BTU HEAT OUTPUT

* - This model has been tested by an accredited independent laboratory according to EPA
method 28 OWHH and meets the emissions level for U.S. EPA's Phase 1 Voluntary Program.

Appendix H: Information on Outdoor Wood Boilers for ALAVT website

Burning wood to heat your home doesn't have to be a threat to your health or to the health of your neighbors. The technology to build woodstoves that produce limited soot and smoke has improved dramatically over the past ten years. The most efficient woodstove on the market is seven times cleaner than the current EPA standard for woodstoves. Inexplicably, there is one type of woodstove on the market that has escaped EPA regulation altogether. These stoves emit 100 times more pollution than the most efficient model and 15 times more than the EPA standard. These unregulated stoves are commonly called Outdoor Wood Boilers (OWBs).

OWBs are becoming more and more common in Vermont, which in turn puts more and more Vermonters at risk for serious health problems. While there are currently OWBs on the market that do meet the EPA standard for woodstoves, legislation has recently passed regulating the emission standards on OWBs purchased after May 31, 2008. The American Lung Association of Vermont supports the latest regulations that help to protect the health of Vermonters, while promoting cleaner air.

For more information refer to the resources provided at the bottom of this page.

Links:

<http://www.vtwoodsmoke.org>

<http://www.nescaum.org>

Appendix I: Text of email for distribution by the American Lung Association of Vermont requesting public support for proposed OWB rule

- Smoke and emissions from wood burning can be harmful to your health, significantly contributing to health problems such as **ASTHMA, EMPHYSEMA, CHRONIC BRONCHITIS, and CANCER**
- Indoor woodstove emissions were regulated in the 1980s by the EPA. Outdoor Wood Boilers are not subject to these regulations even though most models produce 22 times more harmful particulates than EPA-certified woodstoves.
- The Vermont state government has proposed a rule that would require all new Outdoor Wood Boilers to meet emissions standards similar to those for EPA-certified woodstoves.
- **What can you do to help?** Contact your local representative and encourage them to urge the members of the Legislative Committee of Administrative Rules to maintain a healthy Vermont by regulating Outdoor Wood Boilers!!! Attend the public hearing in Montpelier at 8 am on March 28.
- **ADMINISTRATIVE RULES Committee:**
 - Sen. Ann Cummings
 - Sen. Ed Flanagan
 - Rep. Jim Hutchinson
 - Sen. Mark MacDonald
 - Rep. Richard Marek
 - Rep. Virginia Milkey
 - Rep. Linda Myers
 - Sen. Diane Snelling

Legislative Calendar can be found at: <http://www.leg.state.vt.us/schedule/schedule2.cfm>

Appendix J: Text of email for distribution by People for Less Pollution requesting public support for proposed OWB rule

Proposed Rulemaking to Protect Our Health Needs Your Support

- Smoke and emissions from wood burning can be harmful to your health, significantly contributing to health problems such as **ASTHMA, EMPHYSEMA, CHRONIC BRONCHITIS, and CANCER**
- Indoor woodstove emissions were regulated in the 1980s by the EPA. Outdoor Wood Boilers are not subject to these regulations even though most models produce 22 times more harmful particulates than EPA-certified woodstoves.
- The Vermont state government has proposed a rule that would require all new Outdoor Wood Boilers to meet emissions standards similar to those for EPA-certified woodstoves.
- Under this ruling an efficiency standard will be established similar to that of woodstoves, helping to improve overall air quality in towns across Vermont.

- **What can you do to help?** Contact your local representative and encourage them to urge the members of the Legislative Committee of Administrative Rules to maintain a healthy Vermont by regulating Outdoor Wood Boilers!!! Attend the public hearing in Montpelier at 8 am on March 28.

- **ADMINISTRATIVE RULES Committee:**
 - Sen. Ann Cummings
 - Sen. Ed Flanagan
 - Sen. Mark MacDonald
 - Sen. Diane Snelling
 - Rep. Jim Hutchinson
 - Rep. Richard Marek
 - Rep. Virginia Milkey
 - Rep. Linda Myers
- Legislative Calendar can be found at: <http://www.leg.state.vt.us/schedule/schedule2.cfm>

- **Additional Proposed Regulation Information:**
 1. Final Proposed Rule: Control of Particulate Matter From Outdoor Wood-Fired Boilers, Section 5-205, Environmental Protection Regulations, Vermont Agency of Natural Resources, Available online at: <http://www.anr.state.vt.us/air/docs/OWB%20Final%20Prop%20Reg%20022807.pdf>
 2. Particulate emission standards are proposed to be set at .44 pounds per million BTU input for new boilers sold in Vermont after March 18, 2008, which is comparable to current EPA limits on indoor woodstove particulate emissions.
 3. In 2005 this emission standard was advocated but blocked because of the public's misconception on what the regulation sought to make happen. OWB emissions will be regulated to safe levels for the owner and their neighbors and the regulation only affects new purchases, not already existing units. The proposal does not seek to dismantle the use of biomass as an alternative fuel source for the state.
 4. Again, the public hearing for this regulation is on March 28, 2007 at 8am in Montpelier with the VT Secretary of State and Legislative Committee on Administrative Rules

- Further information on Outdoor Wood Boilers can be found at: www.vtwoodsmoke.org

Appendix K: Letter to the Burlington Free Press in response to April 2, 2007 advertisement by Northwest Manufacturing, Inc. (Unpublished)

Dear Editor,

This letter is in response to an advertisement run on Monday April 2nd, regarding Vermonter's rights to burn wood. Paid for by the Northwest Manufacturing, Inc. of Red Lake Falls, Minnesota, the ad appealed to Vermonters to contact their representatives to stop Rule 5-205: a proposition to regulate the emissions of Outdoor Wood heating systems.

Yes, Rule 5-205 is set to impose an emissions limit on "Outdoor Stoves" at 0.44 lbs/MMBtu. These regulations are not being proposed as a means to infringe upon the rights of Vermonters to burn wood, but to protect the health of our local communities by lowering particulate emissions from "Outdoor Stoves." The advertisement also provides the community with false information regarding the EPA regulations on indoor woodstoves. These standards, available on the EPA website, state that emissions for non-catalytic indoor woodstoves should not exceed 0.73 lbs/MMBtu; the standard for catalytic indoor woodstoves should not exceed 0.4 lbs/MMBtu, making this regulation more stringent than the 0.44 lbs/MMBtu proposed by Rule 5-205 with regard to "Outdoor Stoves."

In addition, the advertisement states that Vermont Air Pollution Control is attempting to pass Rule 5-205 without a public hearing. However, there has been an official comment period, which ended in 2006. There have been public debates within the Rules Committee, taking place on March 28, 2007 and April 4, 2007. Ultimately, the public has had ample opportunity to provide their opinion on this issue.

What the advertisement does not recognize is the reasoning behind regulating "Outdoor Stoves". Yes, wood fuel is a good alternative resource. However, as an increasing amount of these stoves are being used, it has become necessary to take into account the issues that result from increased smoke as well as to further regulate those emissions. Rule 5-205 is not suggesting an elimination of the use of wood for fuel, rather it is being proposed to protect air quality and maintain a healthy Vermont.

So, "is this the first step to eliminating all wood burning in Vermont?"
No way! It is just putting us one step closer to a sustainable future, ensuring a clean living environment by mitigating pollution.

Sincerely,
Middlebury College Environmental Studies Senior Seminar

Appendix L: Advertisement by Northwest Manufacturing, Inc. published in the Burlington Free Press on April 2, 2007

graduate with the course
work to apply to a two-year press.com

— Paid Advertisement —

YOUR RIGHT TO BURN WOOD MAY END THIS WEDNESDAY!

- ✓ Rule 5-205 Is Set To Impose An Emissions Limit On Outdoor Stoves At .44 lbs/MMBtu.
- ✓ EPA Certified Indoor Wood Stoves Are Allowed Emission Limits Equivalent To 0.8 lbs/MMBtu To 1.5 lbs/MMBtu And A Volunteer Standard For Outdoor Wood Stoves At 0.6 lbs/MMBtu, Which Is Also Higher Than The Proposed Rule.
- ✓ Vermont Air Pollution Control Is Trying To Pass This Rule Without A Public Hearing.

IS THIS THE FIRST STEP TO ELIMINATING ALL WOOD BURNING IN VERMONT?

***Contact Your State Representatives
To Put A Stop To Rule 5-205
Before WEDNESDAY APRIL 4.***

**Paid for by Northwest Manufacturing, Inc.
600 Polk Avenue SW
Red Lake Falls, MN 56750**

Appendix M: Letter to the Burlington Free Press in response to April 7 Letter “Wood heating must be encouraged” (Published April 20, 2007)

Rules won't affect right to burn wood

The regulations addressed in the letter to the editor, "Wood heating must be encouraged" (April 7), were not proposed and passed to infringe upon the rights of Vermonters to burn wood. These regulations are designed to protect the health of neighbors and users of outdoor wood boilers through cleaner technologies to lower harmful particulate pollution that leads to respiratory and heart ailments.

Wood fuel is an available alternative heating resource, and it does decrease dependency on fossil fuels. However, burning wood without the best available technologies creates wood smoke that can make our children and elderly populations sick. According to the Vermont Department of Environmental Conservation Air Pollution Control Division, studies have shown strong relationships between high fine particulate levels and chronic lung diseases, as well as cardiovascular disease. Additionally, the American Lung Association states that fine particulates found in wood smoke can be linked to higher school absenteeism, cardiopulmonary conditions, respiratory infections, and asthma.

The writer is concerned about Vermont's affordability, yet the regulations will not make the cost of heating a home with wood more expensive. These regulations will have a minimal impact on those who choose to heat with wood. Ultimately, the argument fails to address the fact that this new ruling places restrictions on new boilers in an effort to make them burn more efficiently and protect the health of Vermonters, rather than take away the right to burn wood.

JENNY HAMILTON
Middlebury

Appendix N: April 7 letter in Burlington Free Press “Wood heating must be encouraged”

Wood heating must be encouraged

Our enlightened Vermont Legislature is proposing action that would, in one fell swoop, increase atmospheric carbon dioxide and make Vermont less affordable by placing unrealistic restrictions on the sale of outdoor wood-fired boilers.

The complaint is that they typically produce more smoke and particulates than conventional airtight woodstoves, but if the greatest immediate threat to the environment is greenhouse gas buildup, any combustion-based home heating method that uses locally harvested renewable biomass as opposed to a fossil fuel has a distinct advantage. Trees cut for firewood have removed carbon from the atmosphere within the last few decades, whereas any time a fossil fuel is burned, it liberates carbon that has been locked up in the earth for thousands of years.

Being very economical, outdoor boilers are typically used by people of limited means and to restrict their use would be just another affront to affordability in Vermont. It's a crying shame to use something as valuable as fossil fuel simply to heat living space so when someone is willing to put in the effort to heat with wood, they should be encouraged instead of hassled. There are a lot worse things we could be putting into the atmosphere than wood smoke.

RICH LACHAPELLE

Huntington

Appendix O: “Good Wood Burning Practices” informational brochure

Good Wood Burning Practices

The proper use of wood as an alternative to fossil fuels can be an economic and sustainable way to meet your household heating needs. It is important to make sure, however, to observe some long held good burning practices. Proper storage and burning techniques are key to reducing harmful air pollutants and enabling you to most efficiently use our forest's natural resources.

Season all firewood. Wood that has been neatly chopped, stacked, and air dried for at least six months burns hotter, cuts fuel consumption, and greatly reduces dangerous fine particulate pollution.

Choose the right fuel. Dried hardwoods are the best. Never burn treated wood, painted wood, laminated wood, glossy papers, or any type of household garbage. Smoke from these sources contains many harmful organic and inorganic chemicals.

Burn small, hot fires. Smoldering fires, with their low temperature and low oxygen environments, produce much more smoke, pollutants, and creosote buildup. Don't overload the firebox—small, hot fires provide the maximum heat while using the least amount of valuable wood.

Keep it clean. Clean ashes out of the firebox regularly to keep it operating at maximum efficiency. Having your chimney cleaned and checked yearly will ensure a good draft within the stove and reduce the risk of a chimney fire.

Buy an EPA-certified woodstove. EPA-certified woodstoves are more efficient and less polluting. Available since 1990, certified woodstoves emit 70% less particulate pollution and use 30% less wood than older models.

Wait to buy an outdoor wood boiler. All OWBs sold or installed in Vermont after March 31, 2008 will meet new fine particulate emission standards of .44 lb/MMBTU. Though some current models meet this standard, most OWBs are very inefficient due to cold, oxygen deprived combustion chambers. These units produce roughly twenty times more fine particulate emissions than EPA-certified indoor woodstoves. An OWB is a big investment—choose wisely by installing a unit that will burn less wood and produce less pollution to keep family members and neighbors safe. Contact the Vermont Air Pollution Control Division for more information on this exciting new advancement for public health.

For more information visit these websites:

www.vtwoodsmoke.org

www.woodheat.org

www.burnitsmart.org

Brought to you by:

 AMERICAN LUNG ASSOCIATION



People for
Less Pollution



Appendix P: OWB manufacturers contacted with requests for emissions data.

Manufacturer	Website
Alternate Heating Systems	http://www.alternateheatingsystems.com/index.htm
Aqua-Therm	http://www.aqua-therm.com
Central Boiler	http://www.centralboiler.com
Charmaster	http://www.charmaster.com/
Clean Wood Heat, LLC	http://blackbearboilers.com
Free Heat Machine	http://www.freeheatmachine.com/index.html
Freedom Outdoor Furnace	http://www.freedomoutdoorfurnace.com
Garn	http://www.dectra.net/garn
Greenwood Technologies LLC	http://www.greenwoodfurnace.com
Hardy	http://www.hardyheater.com
Heatmor	http://www.heatmor.com
HeatSource1	http://www.heatsource1.com
Hud-Son Forest Eqpt	http://www.hud-son.com/woodfurnaces.htm
Mahoning Outdoor Furnace	http://www.shol.com/mahoning
Northland Distributing and Manufacturing, Inc.	http://www.northlanddistrib.com
Northwest Manufacturing	http://www.woodmaster.com
Pro-Fab	http://www.profab.org/
Royall Manufacturing	http://www.royallfurnace.com/index.htm
Sequoyah Paradise	http://www.wdheat.com
TARM USA	http://www.woodboilers.com
Taylor Manufacturing	http://www.taylormfg.com
Wood Doctor Furnace	http://wooddoctorfurnace.com/index.html