Maine Department of Environmental Protection

Good Operating Practices for Outdoor Wood Boilers

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Introduction

All wood burning equipment, including outdoor wood boilers, will emit smoke at least some of the time. Wood smoke is made up of many different chemicals and some can cause harm if inhaled. The amount of smoke that is produced depends on the actual design of the wood burner, its installation and its operation. Users can minimize the amount of smoke produced by following all the installation and maintenance practices recommended by the manufacturer. Information about outdoor wood boilers can be found at http://www.maine.gov/dep/air/woodsmoke/woodcombustion.htm; included below are some additional "good operating practice" recommendations.

Installation

Make sure that the outdoor wood boiler is installed correctly, according to all the manufacturer's requirements. All installations must be done by a Master Solid Fuel Boiler Technician with the exception that Maine law allows homeowners to install heating equipment in their own single-family residence. (Note that homeowner installation must still comply with the Maine boiler codes as well as any local codes.) Boilers larger than 350,000 Btu/hr and those used for supplying heat or hot water to commercial establishments must have an engineering assessment to determine criteria such as the appropriate boiler size and design.

Two important installation criteria are adequate stack height and appropriate setback as required by Department of Environmental Protection (DEP) regulations. In addition, any smoke stack extensions must be made of material approved by Underwriters' Laboratories or by a nationally accredited testing laboratory. Removing rain-caps from the stack, if allowed by the manufacturer, will let the smoke rise better, and new installations must be without rain-caps unless required by the manufacturer. If a spark arrestor is required, ask for one that does not include a solid top.

Fuel Quality

The quality of the fuel can have a large effect on the amount of smoke that is produced and on the efficiency of the boiler. Some manufacturers claim that their boilers can burn green wood, but experience shows that this can not be done without creating a lot of smoke. Green wood has a high water content and some of the energy from the wood is used to boil off the water contained in the wood. Most firewood should be "seasoned" for 6 months to a year and have a moisture content of 20-25%. Some species, such as oak, need a longer period of seasoning because of their high water content.

Wood that is too dry can also create a lot of smoke. Kiln-dried wood will burn too fast and can produce a lot of sparks. The best practice is to mix kiln-dried wood with seasoned wood to control the burn rate or save the kiln-dried wood for kindling.

Storing firewood under cover is another important factor that affects the smoke produced. Seasoned firewood will be wasted if it is not protected from the weather. It takes a lot of energy to melt and evaporate snow and ice, so burning wood that is snow- or ice-covered will use up energy that should go to heat your home.

Firewood Size

Size of the firewood can also play an important factor in smoke emissions and efficiency. A full load of small wood will present a large amount of surface area to the fire. This effect is similar to burning kiln-dried wood. The fire will burn fast, spend too short a time in the boiler to transfer heat well and create a lot of smoke. Mix small diameter pieces of firewood with larger pieces of firewood.

Do Not Overload

A load of wood smoldering for a long time in the boiler can create more emissions than when the wood burns in a moderate fire. A load of wood that lasts for over a day may be convenient, but with the fire box at a low temperature, the smoke burns less completely and the cooler smoke does not rise well.

Here the best practice is to fill the boiler to burn for only 6-10 hours. A moderate size fire that burns hot is the most efficient and cleanest way to burn wood in a conventional boiler. However, you will have to learn the correct timing through experience. The colder the weather, the more wood will be needed to get the appropriate burn time.

Each boiler is designed for a maximum load, which may be indicated on the boiler doorway. To burn well, the boiler has to have a certain amount of air in the combustion chamber. Filling the boiler beyond the manufacturer's fill-line or recommendations will reduce the amount of air around the fire. The result will be poor combustion until the load burns down.

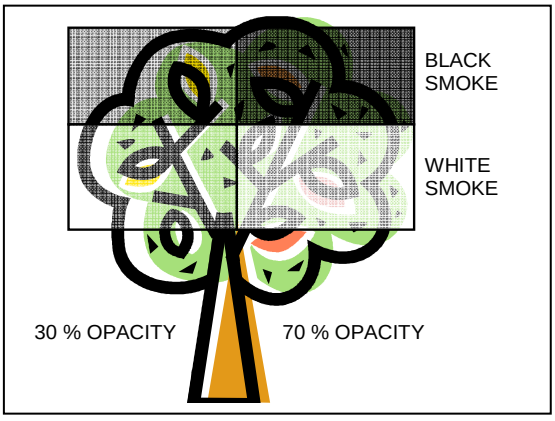
Burn Only Clean Wood

The only thing that should be burned in the boiler is clean wood. Fuel oil and propane are allowed only if it is a multi-fuel boiler and this practice is recommended by the manufacturer. Below is a list of materials that are prohibited as fuels by DEP regulations.

- ✖ NO garbage;
- ✖ NO tires;
- ✖ NO lawn clippings or yard waste;
- ✖ NO materials containing plastic;
- ✖ NO materials containing rubber;
- ✖ NO waste petroleum products;
- ✖ NO paints and paint thinners;
- ✖ NO chemicals;
- ✖ NO glossy or colored papers;
- ✖ NO construction and demolition debris;
- ✖ NO plywood;
- ✖ NO particleboard;
- ✖ NO salt water driftwood and other previously salt-water saturated materials;
- ✖ NO manure;
- ✖ NO animal carcasses;
- ✖ NO asphalt products;
- ✖ NO materials containing asbestos;
- ✖ NO materials containing lead, mercury, or other heavy or toxic metals; and
- ✖ NO coal, unless the outdoor wood boiler is specifically designed to burn coal.

How Much Smoke Is Too Much?

One way to measure smoke is by "percent opacity." 100% opacity means that you cannot see through the smoke; 0% means no smoke is visible. More smoke means that more unhealthy emissions are being produced. Wood boilers are limited to 30% opacity except for 2 six-minute periods in any three hours (the smoke opacity can be more than 30% for only those 2 six-minute periods). A wood fire usually produces white smoke, but the opacity standard applies to both black and white smoke. Judging the amount of smoke opacity takes special training. You can contact the DEP for a list of certified "smoke readers."



Breathing wood smoke is unhealthy and can make life difficult for many people. By law, the smoke produced by the boiler cannot create a "nuisance" on neighboring property. The term nuisance applies to anything that will cause injury or prevent someone from enjoying their property. For outdoor wood boilers, nuisance also includes any visible smoke crossing onto neighboring property or impacting buildings for 12 minutes or more in an hour. It is the responsibility of outdoor wood boiler owners to make sure that the smoke they produce complies with the opacity and nuisance criteria.