Guidance for Health Professionals

State of Wisconsin
Division of Public Health
Bureau of Environmental and Occupational Health

Outdoor Wood Boilers (Water Stoves)

Guidance for local government and public health officials on the use and regulation of outdoor wood boilers (OWBs).

Public health hazards can result from excessive smoke produced when outdoor wood boilers are improperly placed and operated. Local health departments have the authority to address public health hazards and health nuisances under Wisconsin State Statute 254. This fact sheet summarizes current Wisconsin Department of Health Services recommendations for best-management practices of outdoor wood boilers.

What is an Outdoor Wood Boiler?

An outdoor wood boiler (OWB) is any furnace, stove, or boiler designed to burn wood, where the unit is not located within a building intended for habitation by humans or domestic animals. OWBs, or water stoves, typically look like a small utility building with a smoke stack. OWBs provide heating and/or hot water to a single residence.

The basic design of an outdoor wood-fired furnace (OWB) includes a firebox enclosed in a water jacket, surrounded by insulation, and vented through a chimney stack. The combustion of wood heats the water in the reservoir. Heated water is carried through underground pipes to heat a home, farm building, swimming pool, hot tub, or to produce domestic hot water. OWBs are more popular in rural areas than in other areas. Most OWBs cost between $3,000-$10,000 installed.

The basic design of the OWB encourages a slow, cooler fire, to maximize the amount of heat transferred from the fire to the water. Slow, cooler fires, however, burn inefficiently and create more smoke and creosote than higher temperature fires. The most efficient wood-burning furnaces burn at very high temperatures, include a heat store of several hundred gallons of water, and have refractory tunnels where high-temperature secondary combustion can take place. These units are typically installed *inside* the home, have very low emissions, and have a stack height of 20-30 feet. Outdoor models often are missing these important features.

Public Health Hazards Associated with OWBs

Health officials worldwide have only recently begun to understand the health problems seen in people who regularly cook or work around wood fires. Wood smoke contains a mixture of at least 100 different compounds in the form of gases and fine sooty particulate matter (PM). Some of the major components of wood smoke are on EPA's list of six "criteria pollutants" in the National Ambient Air Quality Standard (NAAQS), including ozone, carbon monoxide, nitrous oxides, particulate matter, and sulfur dioxide. The six criteria pollutants were singled out by the United States Environmental Protection Agency (EPA) because of the negative impacts of these pollutants on human health, which include coughing and difficult or painful breathing, increased susceptibility to respiratory illness like pneumonia and bronchitis, eye and nose irritation, hospitalization for heart or lung diseases, and premature death.

Smoke associated with OWBs

At the relatively low temperatures at which OWBs are designed to burn wood, the stoves can produce thick smoke and creosote. This smoke can contain unhealthy levels of toxic air pollutants

and known carcinogens, including significant amounts of particulate matter (PM) of various polycyclic aromatic compounds (PAHs).

Exposure to PM can trigger or aggravate respiratory and cardiovascular problems. PM are so small that they behave much like gases -- they can penetrate homes, even when windows and doors are closed. PM can lodge deep in the lungs of those exposed to wood smoke, and are not easily expelled. Symptoms of people exposed to wood smoke from OWBs include eye and nose irritation, breathing difficulty, wheezing, coughing, and headaches. People with heart disease, asthma, emphysema, or other respiratory diseases are especially sensitive. In particular, wood smoke can be harmful to the elderly, babies, children, and pregnant women.

The chance a person will experience health effects as a result of exposure to smoke depends on the concentration of air pollutants they breathe and the duration of their exposure. Because most OWBs have very short stacks and are located close to homes, there is a greater potential for emissions to create a health hazard for those living near the unit, including neighbors. In areas where homes are not close together, the use of an OWB may not be a health hazard for neighbors.

Hazards associated with burning garbage or inappropriate materials
Burning particleboard, treated, stained, painted, wet or freshly cut wood can release very toxic chemicals. These materials should never be burned in OWBs. Trash burning is especially harmful because it releases chemicals that are persistent in the environment, polluting our air, food, lakes and streams. Burning plastic and treated wood also releases heavy metals and toxic chemicals such as dioxins. Exposure to dioxins can cause skin problems, reproductive or developmental problems, and may even increase the risk of cancer.

Existing Public Health Laws and Ordinances
Human health hazards can result from the use of outdoor wood boilers. Local health departments, which have the authority to address health hazards, may be asked to respond to complaints from the public regarding problems with water stove use. In addition, several communities in Wisconsin have taken the step of creating ordinances that ban or regulate the use of OWBs. The adoption of local ordinances regulating outdoor wood stoves is currently the best way to address the issue proactively. Although the US EPA has regulations for reducing pollution from residential stoves and fireplace inserts, there are currently no Federal or State standards regulating the use of outdoor wood boilers. The US EPA does maintain a website (http://www.epa.gov/burnwise/whereyoulive.html) with links to state and local agencies working to reduce emissions from OWBs, as well as current regulations governing OWB use.

The Wisconsin Department of Natural Resources (DNR) has developed a guidance document and model ordinance for local communities interested in regulating outdoor burning, burning of refuse, and the installation and use of OWBs. This document can be found on the internet at: http://dnr.wi.gov/environmentprotect/ob/modelOrdinance.htm.

What Can Local Governments Do About Water Stove Complaints?
In some communities, the best approach to managing nuisance complaints and public health hazards is a local ordinance that restricts or bans the use of OWBs. While water stoves are typically used in

rural settings, an increasing number are being installed in subdivisions and small towns. If your municipality is receiving complaints about OWBs, you should consider the following best-management practices for their placement and use:

1. Ensure that OWBs are installed where they do not create an air pollution health hazard. Local officials should give careful consideration to the influence that changes in land use can have on where OWBs are installed. This is especially important when agriculturally zoned land is changed to residential. This frequently results in homes being built too close to OWBs.
2. Restrict what can be burned in an OWB to clean dry firewood.
3. Place OWBs at least 300-500 feet from the nearest building which is not on the same property as the unit.
4. Require that OWB chimneys be 15 feet high, or at least as high as the roofs of nearby buildings.
5. Require annual permitting of OWBs by the local fire chief.

For more guidance on establishing control over the installation and use of OWBs please refer to the DNR "Model Ordinance for Outdoor Burning, Open Burning and Burning of Refuse – A Guide for Wisconsin Counties, Cities, Villages and Towns." You can retrieve this document at: http://dnr.wi.gov/environmentprotect/ob/modelOrdinance.htm

For More Information

Contact the Wisconsin Division of Public Health, Bureau of Environmental and Occupational Health, PO Box 2659, Madison, WI 53701-2659, (608) 266-1120, or visit the department's website, http://dhs.wi.gov/eh.

More Internet Sites:

- US EPA, Emissions from Outdoor Wood-Burning Residential Hot Water Furnaces: http://www.epa.gov/ttn/atw/burn/woodburn1.pdf
- US EPA, National Ambient Air Quality Standards (NAAQS): http://www.epa.gov/air/criteria.html
- WI DNR Open Burning Website: http://dnr.wi.gov/environmentprotect/ob/
- WI DHS Fact Sheet on Trash and Wood Burning: http://dhs.wisconsin.gov/eh/HlthHaz/fs/WoodBrn.htm
- Washington State Department of Ecology, Health Effects of Wood Smoke Fact Sheet: http://www.ecy.wa.gov/pubs/92046.pdf
- Puget Sound Clean Air Agency, Facts About Outdoor Fires Website: http://www.pscleanair.org/burning/outdoor/index.shtml

Prepared by the Wisconsin Division of Public Health, with funds from the Agency for Toxic Substances and Disease Registry, Public Health Service, USDHHS.
PPH 45075 (Rev 1/10)