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Wood Burning and Creosote Buildup

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For many years, wood was the prime source of heating the house and continues to be so in some parts of the world. In this country, we are beginning to see many individuals returning to wood burning—using it as an alternate heat source and even occasionally as a primary heat source. Heating with wood, however, is not for everyone. It is not as simple as heating with gas, oil or electricity. It is not as convenient to use because it requires a considerable amount of labor, a large storage area for the wood, more cleaning of the home, many more safety precautions, and acceptance of fluctuating room temperatures.

With the development of efficient wood stoves and furnaces, creosote buildup in the chimney became more of a problem because the flue gas temperatures were lower due to more of the heat being put in the room rather than going up the chimney. Creosote clings firmly to the pipe and chimney walls, causing buildup of a very flammable material. When creosote deposits catch fire, the heat is very intense and can result in roof and house fires. Even if the burning creosote does not cause a fire from flying sparks or cracks in the chimney, it tends to weaken the chimney masonry or warp metal chimneys.

Why Creosote Forms

In the burning process, wood starts to chemically break down at 500°F, producing volatile gases including creosote. These gases burn at about 1100°F; if that temperature is not reached, the gases will escape up the chimney, resulting in the loss of much of the wood's energy. In addition to losing energy, the creosote in the gases remains unburned.

Creosote can be seen as a dark brown or black material and has an unpleasant odor. Combined with droplets of water vapor, it comes out the chimney as smoke. The creosote will condense at any point in the pipe or chimney where the temperature drops below 250°F. Between 150° and 250°F, this condensed creosote deposit is quite fluid. It can often be seen as dark streaks that have flowed down outside of the chimney.

Controlling the amount of inlet combustion air will hold the volatile gases in the combustion chamber until the chamber temperature is around 1100°F. This will cause the creosote to burn, more energy will be realized, and stove efficiencies can go as high as 65 percent. This compares to about 10 percent efficiency with a standard fireplace. Such types of stoves are often referred to as airtight and have a manual or temperature-sensing damper control.

Controlling Creosote Problems

Management of a wood burner is very important for safe and successful operation. This includes inspecting the chimney and/or pipes at the start of the heating season for leaks or creosote buildup. You can do this by gradually lowering a flashlight or battery lantern down the chimney. Correct any problems before using the wood burner again. To remove creosote, you'll need a wire brush which is available in various sizes and configurations to fit different pipes and chimneys. Make sure to repeat these inspections every two months during heavy use.

Many families using airtight stoves have controlled creosote by daily stocking the stove with dry kindling and allowing it to burn intensely for 10 to 15 minutes before burning the wood in the regular manner. This tends to burn off any thin coat of creosote that might have formed from the previous day. One word of caution is that you should not begin this technique until after the chimney has been thoroughly cleaned. Even with daily kindling burning, you still need to inspect your chimney for creosote formation.

When starting a fire with the regular wood, leave the primary air inlet at least halfway open

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until the fire is well-established. This gives the firebox time to reach the desired temperature of 1100°F needed to ignite the volatile gases. If the wood is dry and of good quality, you can then set the inlet at the desired heat demand position.

It is often difficult to judge how well wood is burning. You can fasten an oven thermometer about 20 inches above the stove connection on the flue pipe to estimate the firebox temperature. As long as the oven thermometer reads between 200°F to 400°F, the firebox temperature should be around 1100°F.

Overloading the firebox with wood increases creosote buildup by reducing complete combustion and causing more of the unburned gases to escape up the chimney. A good daytime management practice is to feed the firebox more often, each time never exceeding one-third of a full load. Freshly fed wood needs to be well-exposed to the live coals of the previous loading.

Using too many large logs also will contribute to creosote formation. These large pieces of wood will produce more wasted combustible gases than smaller pieces in direct contact with the live firebox coals. Smaller pieces of wood also tend to make it easier to control the temperature fluctuations.

Hardwood with a 20 percent or less moisture content is the best wood to burn. For many years, high moisture wood was associated with creosote formation but this has been proven untrue. Increasing the amount of primary air as green wood is added and then reducing it to the normal level after a good burn is established contributes no more to creosote formation than does dry wood. The green wood contributes less to total heat output since heat is being used to remove the excess water.

There is considerable controversy as to how effective chemicals are in preventing creosote formation. A variety of chemical chimney cleaners have been tested and found to be substantially ineffective in reducing the accumulation of creosote or in eliminating existing deposits.[1] Many of the chemical cleaners also contained sodium chloride (table salt) as a major ingredient which can be corrosive to both metal and masonry materials.

Chimney Fires

When faced with a chimney fire, follow these steps:

1) Call the fire department immediately.

2) If you have an airtight stove, cut off the oxygen supply by closing all openings. With stoves that are not airtight, close the flue damper.

3) Alert everyone in the house.

4) If the stove fire is still burning, use an approved fire extinguisher or throw baking soda onto the burning fire. Commercial chimney fire extinguishing flares are also available for this purpose.

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[1] *Shelton, J.W., and C. Barczys. 1981. Testing Chemical Chimney Cleaners. Mother Earth News, No. 71, Sept./Oct. p. 118-120.*

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