Arctic Energy Alliance

COMBUSTION SPILLAGE

CAUSES AND CONCERNS IN NORTHERN HOMES

Whenever any type of fuel burns, it creates *combustion gases* such as carbon monoxide (CO) and carbon dioxide (CO_2). Examples of items in homes that produce combustion gases include furnaces, boilers, wood stoves and propane stoves. These are known as *combustion appliances*.

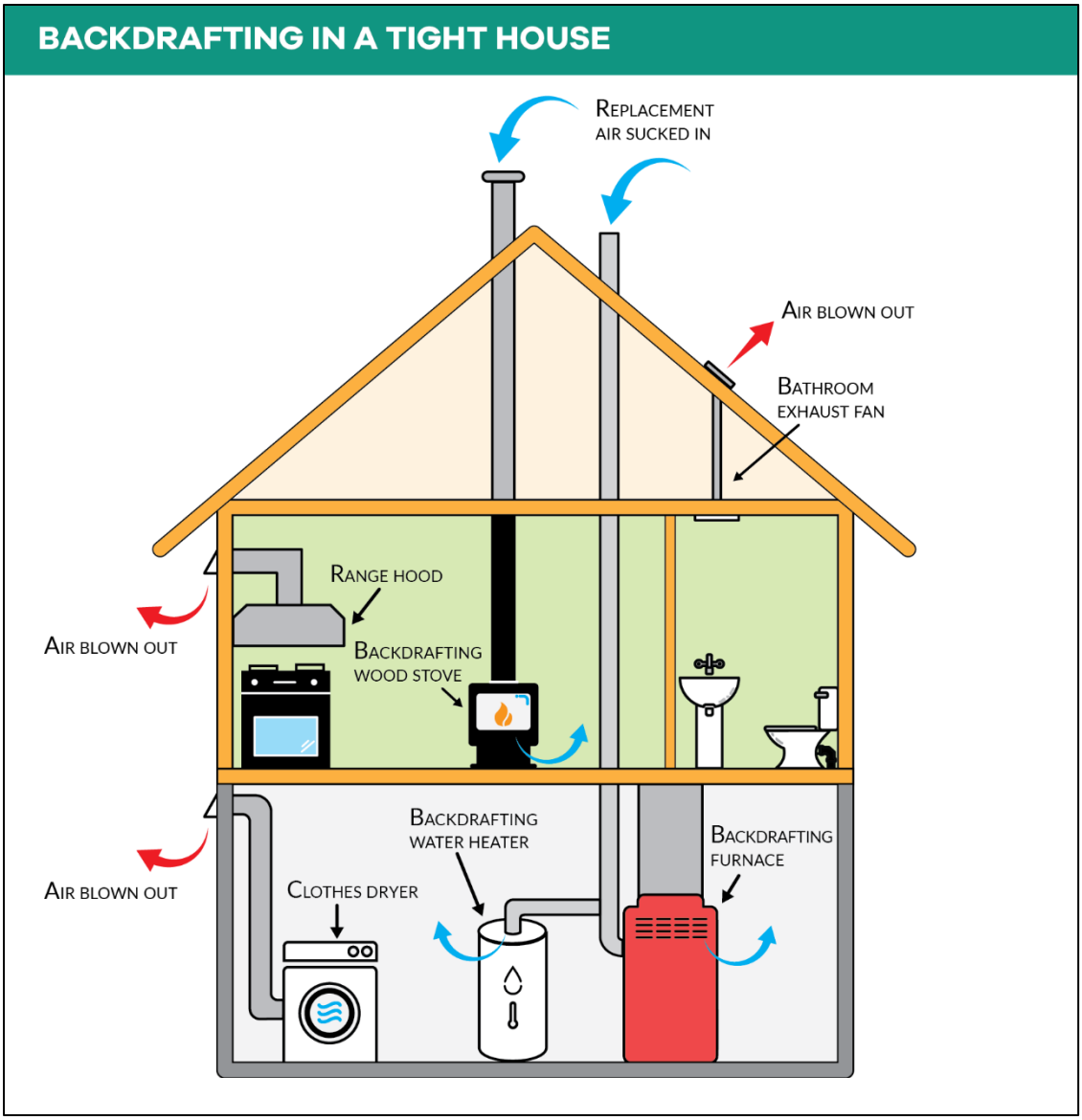
Usually, combustion gases will exit your home through a chimney or dedicated vent. But sometimes they can flow back into your home, for various reasons. This is called *combustion spillage.*

The Arctic Energy Alliance, through our EnerGuide home energy evaluations, has found that in newer, more airtight homes, combustion spillage can happen when things like exhaust fans, dryers or even other combustion appliances are running. This is because the fan or other appliance reduces the air pressure inside your house—by about 50 to 80 pascals (Pa)—and the combustion gases leak into the area of lower pressure.

This spillage can be dangerous because it can cause a buildup of deadly carbon monoxide. The risk is especially high if a combustion appliance is not designed to be fully sealed to prevent spillage.

One of the most common ways combustion spillage occurs in homes is through *backdrafting*. This is a potentially hazardous condition that can occur when combustion gases are pulled down the chimney and into the house rather than being vented to the outside.

If you have a chimney-vented appliance that draws its *combustion air* (see p. 4) from indoors rather than from outside, you're more at risk of backdrafting if the pressure inside your home drops by more than 5 Pa.



In some cases, you can see backdrafting happening. For example: If you have a wood stove or a wood-burning fireplace, you could see smoke escaping into the living space.

In other cases, spillage may not be so obvious, in part because combustion gases, especially from natural gas and propane, are hard to detect.

Combustion gases are invisible and odorless.

What Causes Combustion Spillage and Backdrafting?

There are three typical causes of combustion spillage and backdrafting:

- Issues related to the design and maintenance of your chimney
- Damage to your combustion appliance
- Depressurization of your home

Chimney Issues

A chimney's job is to direct combustion gases outside of your home. However, if the chimney has not been designed correctly or is poorly maintained, these gases may not be properly removed.

If a chimney is too small for the appliance it's connected to, it won't have enough space to vent the combustion gases. If it's too big, there won't be enough of a draft, meaning gases won't flow up the chimney fast enough.

Obstructions within the chimney can also lead to inadequate draft. Some common obstructions are birds' nests and ice build-up.

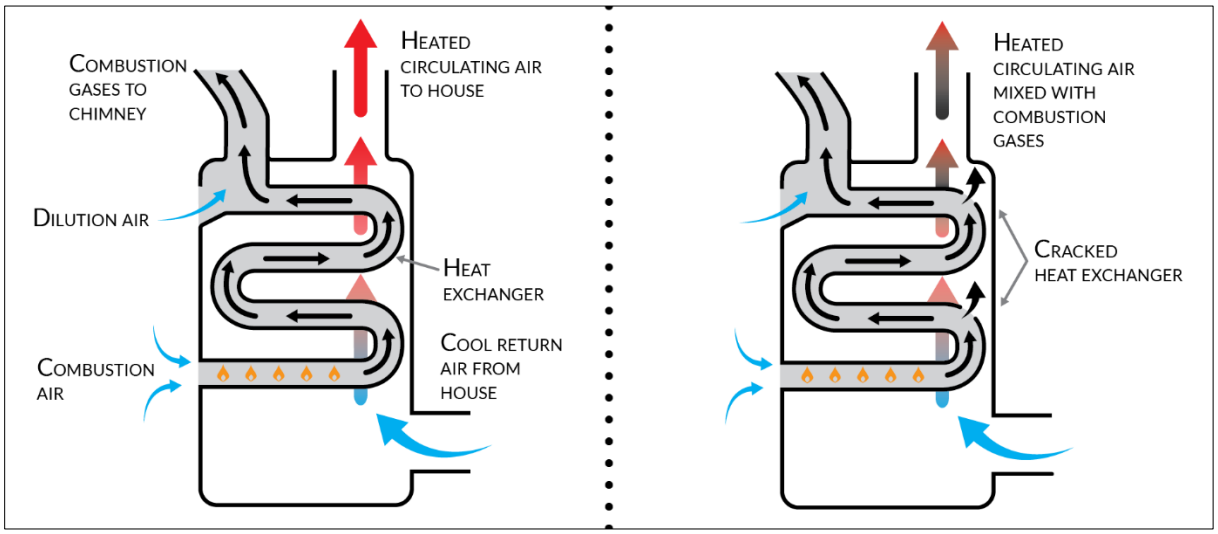
Damage to a Combustion Appliance

A forced-air furnace is an example of an appliance that uses air for both combustion and circulation.

Combustion air provides oxygen to burn the fuel. Depending on the furnace, this air could be drawn from either inside or outside your home.

Circulating air is the warmed air that is blown through the ducts to heat your home. A *heat exchanger* warms the circulating air inside the furnace.

When a furnace is operating correctly, the combustion air and circulating air do not mix. However, if the heat exchanger is cracked, the combustion air and gases could leak into the circulating air.



Furnace operating correctly *Furnace operating with crack in heat exchanger*

Depressurization

In recent years, new technologies and changes to construction techniques have allowed homes to become more energy efficient. This applies not only to new homes but also to older ones that have been renovated.

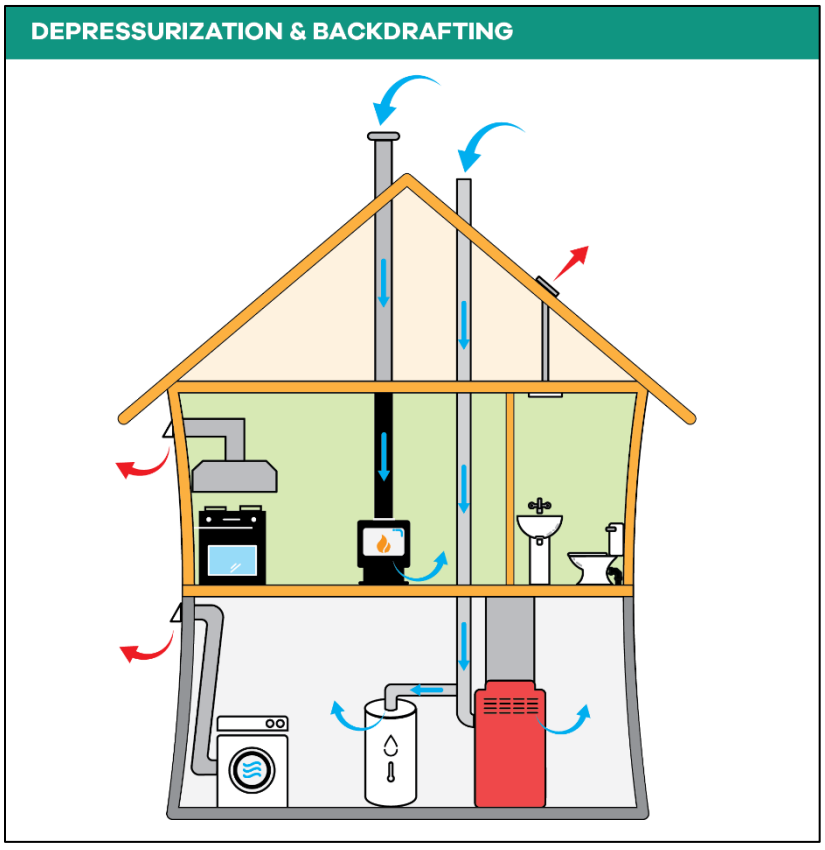
One way to improve the efficiency of a home is to reduce air leakage—or increase *airtightness*. However, the more airtight a home becomes, the easier it is to depressurize the house when things like exhaust fans or clothes dryers are running. This depressurization increases the risk of combustion spillage.

Depressurization occurs in a home when exhaust devices are turned on. When these devices are on, the air pressure inside the home drops below the air pressure outside the home. As the pressure within the home attempts to balance itself, air is drawn in from small gaps and cracks, and other openings, such as a chimney. If the depressurization is significant enough, it can pull air down the chimney, potentially reversing the flow of combustion gases. This is known as backdrafting.

Three main factors determine the potential for depressurization-related problems:

- house size
- airtightness level
- the size and number of exhaust devices running simultaneously

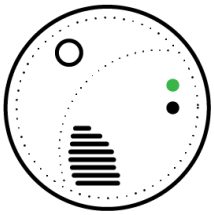
In general, a home is easier to depressurize the smaller it is, the more airtight it is, the more exhaust devices there are running at the same time, and the larger those devices are.



Why is This a Concern?

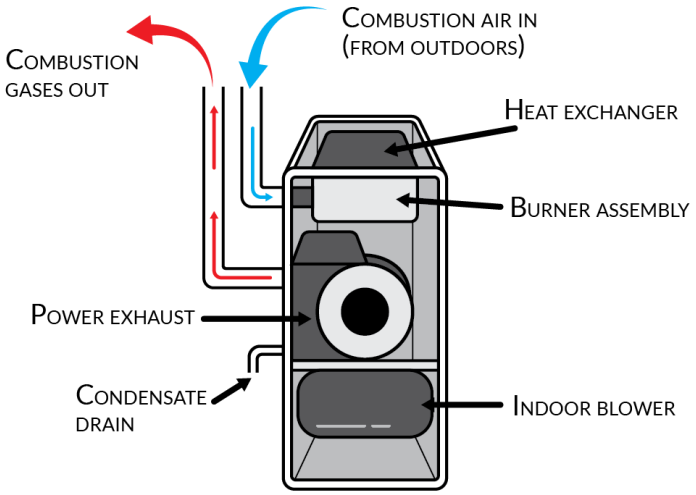
Combustion gases are highly toxic and when these gases are mixed with air inside the house, they can lead to problems ranging from headaches, serious illness, carbon monoxide (CO) poisoning and even death.

What Should I Do?



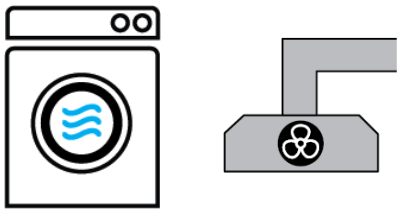
- Install a carbon monoxide (CO) detector regardless of how you heat your home.
- Replace it before its "replace by" date.
- Make sure it's certified to UL2034 or CAN/CGA6.19 standards.

If you are planning to replace a combustion appliance, install a sealed-combustion and direct-vent model, if possible. These models will bring combustion air directly into the burner through sealed inlets connected to the outside and usually have a fan-assisted exhaust.

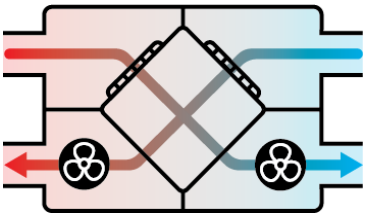


Ensure your equipment is safe and in good condition by having a professional inspect and maintain your combustion appliances every 6 to 12 months.

Don't use all your exhaust devices at the same time (dryer, rangehood, bath fans and central vacuum). This can depressurize your home and lead to backdrafting.



Install a heat recovery ventilator. (HRV), especially in a new home. An HRV can also be a good option for an existing home with a furnace, especially if it's been renovated to be airtight. HRVs bring in fresh air from outside while retaining the heat from the indoor air, helping to maintain a comfortable, energy-efficient, and healthier indoor environment.



References

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3. Carbon Monoxide: Backdrafting and Spillage – HVAC Insider
4. ASHRAE Position Document on Unvented Combustion Devices and Indoor Air Quality - untitled (ashrae.org)
5. Combustion Equipment Safety (energy.gov)