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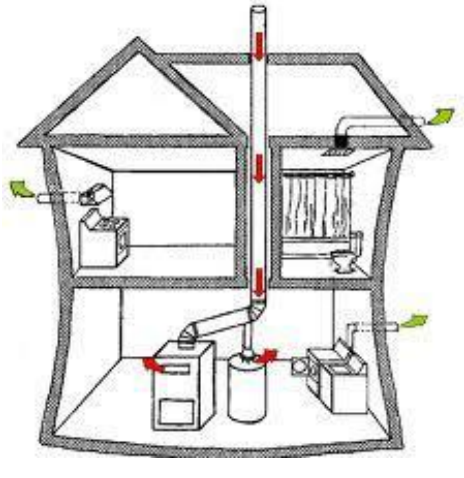
Unintended Consequences of Re-Insulating a Home

by Steve Schirber.

Re-insulating an existing home *properly* is a complicated task. A house is a system; a bunch of smaller parts that make up systems, that make up larger systems. The tighter the house, the more a house tends to behave like a system. This means that when you change something in the house, such as adding more insulation, that change can affect the homes performance. In most cases, this is the intended outcome.
If insulation and air sealing is performed in an attic, it might make the rooms below feel warmer, reduce heating costs during the winter, and help to prevent snow from melting on the roof, in turn eliminating ice dams. That's great, but *what else changed that wasn't supposed to?* Here's a list of possible unintended consequences.

Back Drafting

When air is pulled out of a house, the house will draw outside air back into the house. The amount of air coming in equals the amount of air being pulled out. Simple. This exchange of air happens when you run your bath fans, range hood, or clothes dryer. Depressurization occurs when there is more air leaving the house than coming in. Depressurization can cause a handful of problems, but I will focus on back drafting.



Back drafting occurs when a combustion appliance, such as a water heater, can't generate enough draft to vent the combustion gases up the flue. When back drafting happens, these gases spill into the house, causing a potential buildup of carbon monoxide.
Unintentional carbon monoxide exposure accounts for an estimated 15,000 emergency department visits and 500 unintentional deaths in the United States each year. (Source:http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5650a1.htm).
While the Minnesota Fuel Gas Code has specific installation requirements for gas water heaters, just following all of these rules doesn't mean a water heater will draft properly. Even with a proper installation, there are three common home improvements that can cause problems with existing water heaters.

- **Tightening the enclosure**. This is done by air sealing gaps or cracks in the exterior of the house, adding insulation or weather stripping, and replacing windows or siding.
- **Adding ventilation appliances** such as bath fans, larger cooktop vent hoods or whole house ventilation fans.
- **Replacing the furnace**. When older furnaces are replaced with newer sealed combustion units, the water heater vent often becomes "orphaned". It used to share a large flue with the old furnace, but now it's left to fend for itself to produce a draft. The relatively small burner on a water heater doesn't always product enough draft to work properly by itself, so it back drafts.

Back drafting can be prevented by not having open combustion appliances - this often means replacing the old natural draft water heater with a powervent water heater. Performing a worst case depressurization test can determine if back drafting is occurring already, and can help predict if it will occur when the home is made tighter.

Condensation Problems

I often hear people say "...they build houses too tight. You gotta let them breathe." A leaky house may be uncomfortable and may have high utility bills, but is always well ventilated. This is why most 100 year old homes don't have mold or moisture problems. They "breathe". When houses are made tighter, they need to breathe through an intentional hole at a controlled rate. We have to pay close attention to this as we go into a house to perform air sealing measures or add insulation. These changes can tighten the house, effectively eliminating a source of ventilation. These changes in ventilation rates can have undesirable consequences such as elevated moisture levels in the house, condensation on windows, or mold growth.

Any of the changes made to a house that can cause depressurization can also change the ventilation rate. Another common ventilation change that isn't so obvious happens when when old furnaces are replaced with new high efficiency furnaces. The older units produced a draft that pulled air from the house up the flue, providing a source of ventilation. Replace the old furnace... take away the source of ventilation.

Every house has its own prescribed ventilation requirement. This can be calculated along with a blower door test to determine if the house is "breathing" properly. The fix most commonly consists of adding new ventilation equipment that can be programmed to ventilate the correct amount of air.

Increased Radon Levels

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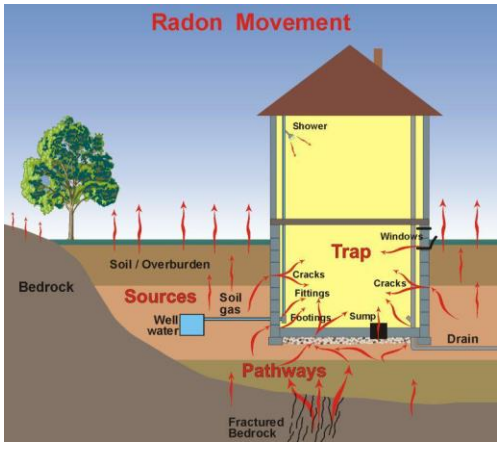
Radon is a naturally occurring radioactive gas that is present in soil. It is odorless, colorless, and tasteless. Radon is the second leading cause of lung cancer and is responsible for an estimated 21,000 deaths per year.



Radon is literally drawn up into the house by a form of depressurization called stack effect.
Houses that are leaky and have low levels of radon will often see an increase in radon levels after the building enclosure is tightened. This is due to a change in the natural air change rate, which dilutes radon levels. Once this source of ventilation is removed, radon levels increase. Any change to the natural ventilation rate in a house can cause a change in the radon levels.

What To Do

To minimize the potential for unintended consequences when adding insulation to a home and making it tighter, the first step should be to have a home diagnostic test performed. I'm not talking about the energy audits where you get a low-flow aerator for your sink, a tube of caulk, and a few CFL light bulbs. I'm talking about a comprehensive set of tests that includes the use of a blower door, an infrared scan, testing of the exhaust fans, and possibly even a radon test.
The benefit of having a diagnostic test is:

1. Thoroughly understanding the opportunities to improve the performance of you house
2. An accurate scope of work designed to have intended results
3. Testing after the work is done can measure if the work was done correctly
4. Unintended consequences can be identified before they become problems

For the best possible results on your next insulation project, be sure to work with a company that takes a holistic approach to your home envelope, and guarantees the results, not just the work.

Steve Schirber is the Principal and G.M. of Cocoon. As a diagnostic testing, envelope modification, and Insulation contractor, Cocoon provides solutions to home owners with tangible results in the area of health, safety, comfort, and energy efficiency. His unique knowledge comes from 20 years of service in the construction industry, specializing in residential building assemblies, delivery systems and building performance. Steve has a BCE in Structural Engineering from the University of MN. Steve is an NRPP Radon measurement specialist/mitigation provider and is a BPI Building Analyst and Envelope Professional.