

## **BUILDING SCIENCE BASICS**

We can break the shell of a house into three basic components called boundaries.

The outermost envelope is the **water boundary**. The roof, siding, foundation, and slab floor form a complete circle around the house and are designed to keep water out. It's can be fairly easy to see if it fails as you'll have a roof leak, water in the basement, etc.

Next is the **thermal boundary or envelope**. It defines the areas of the house that you are going to condition (heat in winter, cool in summer). It is usually not the same line around the house as the water boundary as it will not include the garage, crawlspaces, attics, and unfinished basements. If the area is not heated it is outside the thermal envelope (just like your back yard). Defining this line around your house and making sure it is continuous is extremely important to keeping your conditioned air in the house. Unless your house is new and built to "Energy Star" specifications, you have many breaks in your thermal barrier. WHY! Because nobody really cared about it or understood how a lot of small holes can equal one very large hole. Thirty to fifty percent of your heat can be going into areas that you don't live in. That's a lot of money to keep the mice comfortable!

The last barrier is the one that has changed the way we look at houses in the last few years. It is the **air barrier** (also called the **pressure boundary**). It's the innermost surface of the house. It includes all of the walls, ceilings, and floors that are within the thermal boundary. It should be in total contact with the thermal boundary (insulation) and free of any holes to the outside. This is the hardest concept to visualize, but once you see it (I'll show you), you'll be on your way to making your house a lot more efficient and healthy.

The obvious holes to the outside are doors and windows. You probably like to keep them closed during the heating and cooling seasons. But the amount of small holes underneath your attic insulation can add up to an open window! The insulation does not stop airflow (even if it was installed correctly) so heat is constantly leaving your house via the attic. HOW? Your attic hatch or pull down stairs are usually made of thin plywood that allows a tremendous amount of heat to leave the house. In the summer when

your attic is too hot to go into, that heat follows the same paths into the living space and now you have to cool it. Remember - the attic in most houses is outside the thermal boundary - just like your back yard.

All of your interior partition walls allow heat to enter inside them (they are not insulated) and into the attic either through holes cut for wires or the top of the wallboard itself.

If you remove the insulation you will see holes everywhere. Around pipes, chimneys, heat ducts - the list is long. That's just the way houses are generally built.

Now to add insult to injury, with all of this air leaving the house, fresh air has to be brought in to replace it. From where? You guessed it - Outside!

Through openings in your thermal and air barriers in the lower portions of the house. Not only are you losing heat through the attic but you're bringing outside air in that you now have to condition. Some ventilation is absolutely necessary and we don't want our houses to be too tight, but a happy medium can be reached between comfort, economy, and health. That's what Building Science is about!

#### WHAT DO I DO ABOUT IT?

Generally if you air seal the attic then insulate, you will significantly slow down the air movement and save on heating costs. With some well placed insulation and air sealing in the lower areas of the house you can keep more of the heat that you're paying for. But have your house evaluated first.

**Remember - any changes made to the airflow of the house can cause combustion appliances to back draft and allow exhaust fumes into the house. An energy audit by a certified energy star contractor is a must.**

It will cover how much leakage you have, where the leakage is, how much will it cost to fix, and what the payback on the investment will be. It will also measure appliance exhaust leakage and other safety issues. There are also government programs in place to help pay for the repairs or lower the interest rate for any loans used to do the repairs.