INTRODUCTION

Choosing the right insulating material for a structure involves weighing several factors, including climate where the building is to be located, intended use, installation method, R-value of potential materials, flammability and toxicity, safety hazards for installers and occupants, and of course, cost. With so many materials available to consumers, making an informed choice can be difficult. Rising energy costs make selecting the right method for long-term savings even more important.

In the following pages, we will briefly explain some of the different types of insulation in use today and compare the features and benefits of two of the most popular forms.

COMMON INSULATION METHODS

Common building insulation materials include:

- **Cellulose**. Derived mostly from recycled newspapers and treated with flame retardants such as boric acid. Possibly more susceptible to mold than other types of insulation but considered more eco-friendly due to its recycled content.
- **Reflective**. Metal surface, typically made from aluminum. Reflects radiant heat. Requires a sandwich of air between reflective surface and structural surface or will serve as a conductor of both heat and electricity. Not very suitable for cold weather.
- **Structured Insulated Panels**. Made from rigid foam plastic sandwiched between two pieces of wood or similar material. Used mainly as pre-insulated structural components (for walls, etc.) rather than as a pure insulation solution, making it less flexible to use
- **Natural fiber or mineral**. This category includes compressed hay, cotton, rock wool and others. Each type has varying degrees of effectiveness and safety issues depending on the chemicals added for flame retardation.

The two other widely-used insulation methods are **fiberglass** and **spray foam insulation**.

FIBERGLASS INSULATION

Fiberglass insulation has been a mainstay of the building industry since it was first introduced in 1938 by the Owens Corning Company. It is manufactured by forcing pressurized air through molten glass to produce long filaments of varying thicknesses. The fibers are then matted together and generally cut into large blankets or standard-sized “batts,” although loose-fill fiberglass insulation is used in some structures. Dyes are often added to the product, as might resins, oils and other additives to bind the fibers together.

Fiberglass is widely used because it is cheap and relatively easy to install. It is simply unrolled, cut to desired length and width, and put into place. Its rating ranges from around R-3 to R-4.3 per inch when properly installed. In the quest to obtain a higher R-value, medium- and high-density fiberglass have been developed which have a rating up to R-5.

Fiberglass is non-flammable, with the exception of the facing with may be made out of paper in some cases. Fiberglass with metallic facing is generally non-flammable. No special equipment besides gloves and a dust mask are required to install fiberglass, although some contractors will use full body protection to avoid contact with the fibers.

One major problem with fiberglass insulation is that its true R-value rating is often hindered by improper installation. If the batts are cut too short, air will seep through the gaps and reduce efficiency. Likewise, batts that are cut too long tend to get roughly "stuffed" between studs or joist cavities by contractors desiring to complete a job as quickly as possible. This compresses the fiberglass and prevents it from making adequate contact with the drywall, further reducing efficiency. One study by the California Energy Commission found that a full 30 out of the 30 homes it examined had improperly installed batts, demonstrating that the problem is not isolated to a small percentage of structures.

Odd-shaped framing details are also difficult to insulate with fiberglass batts because very few contractors take the time to cut them into the exact correct shape to fit into irregular crevices in the ceiling or around electrical junction boxes, as they are usually paid by the square foot rather than the quality of the finished job. More often than not, leftover pieces of fiberglass are simply jammed into crevices, or batts are bent around protuberances instead of being precisely cut to fit.

To sum up, while fiberglass is inexpensive to buy, it can cause health issues during installation and for occupants later on. Improper installation, which is commonplace, will reduce its effectiveness as an insulator and cost consumers money in the long run.

SPRAY FOAM INSULATION

Spray foams were originally introduced by Dupont in the 1960s, originally made with polyurethane but now incorporating other chemicals such as polysterene and isocyanate. The foam is produced by combining two chemicals at the head of a spray nozzle which is powered by compressed air or gas. A chemical reaction is immediately produced, which causes gas bubbles to form and become trapped as the foam solidifies. The trapped gas has excellent insulating properties, giving spray foam insulation a higher R-value than many other materials, including fiberglass. R-values for some foams reach as high as R-8 per inch, about double what normal fiberglass can offer.

In addition to its natural superiority as an insulator, spray foam is an excellent sealant, guarding against one of the most common complaints in other insulation methods: air leakage. An air-tight seal results from spray foam, especially useful when sealing gaps around pipes and ductwork, hose bibs, etc.

The air-tight seal also creates a moisture and vapor barrier, as well as an effective sound barrier. This is useful for large structures, such as pole barns, which tend to amplify exterior sounds such as rain, wind and hail. Another benefit in industrial and agricultural applications is

that foam insulation adds structural strength. This makes metal warehouses or barns converted into offices or workshops much more wind resistant and leak-proof.

Spray foam is classified into two main categories: open cell and closed cell.

- **Open cell**, also known as "½ lb foam," is not as rigid as closed cell. It resembles the soft, spongy foam used in packing material. The bubbles are larger, and it has a lower R-value than closed cell foam. Compared with closed cell foam, open cell allows for much greater water and vapor penetration as well as trimming and waste disposal issues from foam over-expansion. Nonetheless, its lower cost makes it very useful for soundproofing or for insulating areas where water and vapor penetration is not a concern.
- **Closed cell**, also known as "2 lb foam," has much smaller bubbles and is a much more rigid, dense and insulative material than open cell. It is an excellent water and vapor barrier, and its higher R-value allows a thinner application, useful in tight spaces. It also does not expand much after application, eliminating the need for trimming and waste disposal.

Raising the roof line of a structure from the ceiling to the actual roof can be accomplished easier with spray foam insulation than with traditional fiberglass, especially when the roof slope is shallow and getting to the top plates at the eaves is nearly impossible. Raising the roof line is beneficial when your HVAC ductwork is located in an enclosed attic which can get extremely hot in the summer or is meant to be finished at some point in the future.

As you can see, spray foam has other benefits beyond its superior insulation properties, including soundproofing, air leak prevention, ability to be applied in tight spaces, and allowing roof lines to be easily raised for better attic insulation.

THE COST QUESTION

Fiberglass insulation jobs are often quoted at rates of ½ to 1/4th the price of spray foam insulation, but the monthly energy savings of up to 60% can recoup the larger initial investment within a short period of time. Also, foam can save on other labor and material costs related to weatherizing a structure, such as caulking, housewraps, joint taping, etc.

Another advantage some foams have is the ability to be injected through holes drilled into finished walls, allowing sealing of problem areas with minimal destruction to drywall or exterior sheathing, saving hundreds or even thousands of dollars in material and labor costs for a retrofit.

Other advantages to spray foam that help compensate for the higher initial investment:

- Reduces dust and pollen infiltration, improving air quality for those with allergies or other upper-respiratory sensitivities.
- Reduces noise levels in homes and businesses.

- Helps stop the spread of flam in a fire.
- Retards the growth of mold.
- Will not pack down, split or sag over time.
- Can withstand flooding.
- Expands to seal off leaks and gaps.
- Increases structural stability.

Taking the above facts into account, fiberglass does not seem to be much of a bargain in the long run due to hidden or unexpected costs. These expenses come in the form of health problems related to mold and other allergens, replacement cost if any fiberglass gets wet, and higher monthly energy costs.

SAFETY ISSUES OF FIBERGLASS AND SPRAY FOAM

The jury is still out in regards to the health issues surrounding fiberglass. The American Lung Association states that fiberglass insulation is safe as long as it is properly installed. On the other hand, it acknowledges that physical contact with the material or its airborne fibers might cause itching and irritation in the skin, eyes, nasal passages and the rest of the respiratory system. In addition to the problems presented by fibers themselves, the resins and dyes used in fiberglass can outgas irritating or toxic chemicals, such as formaldehyde, for years. This can cause indoor air pollution problems including allergies and asthma attacks in sensitive persons.

Fiberglass batts usually come with warning labels cautioning against the risk of cancer from exposure to the material, but the scientific data is inconclusive with different agencies from the World Health Organization to the International Agency for Research on Cancer having varying opinions throughout the years.

Spray foam often uses hazardous chemicals in the application stage. Therefore, installation should be performed by certified specialists using protective safety measures including masks, goggles, protective suits, and proper ventilation of the area being sprayed.

Once set, however, the product becomes chemically inert, causing no indoor air pollution issues. Also, new formulations of spray foam have been developed which use less toxic chemicals derived from renewable plant sources, reducing the concern of toxic exposure during the application stage and the use of petrochemicals.

Comparing the safety issues of both fiberglass and spray foam insulation demonstrates that spray foam has less long-term health risks. It avoids the indoor air pollution problems that occur when fiberglass releases tiny glass particles or formaldehyde gas into the air.

SUMMARY

Spray foam insulation can prevent many problems that would be produced by doing the same job with inferior insulating materials, especially fiberglass. In rising-energy-cost environments,

such as the one we are in now, the initial higher installation cost of spray foam insulation will be offset by the large potential savings in cooling and heating bills as well as leak prevention, soundproofing, mold inhibition, and improved indoor air quality compared with fiberglass.

If you are considering spray foam insulation, contact a reputable, certified installer who takes the time to perform a cost-benefit analysis and discusses your options with you.