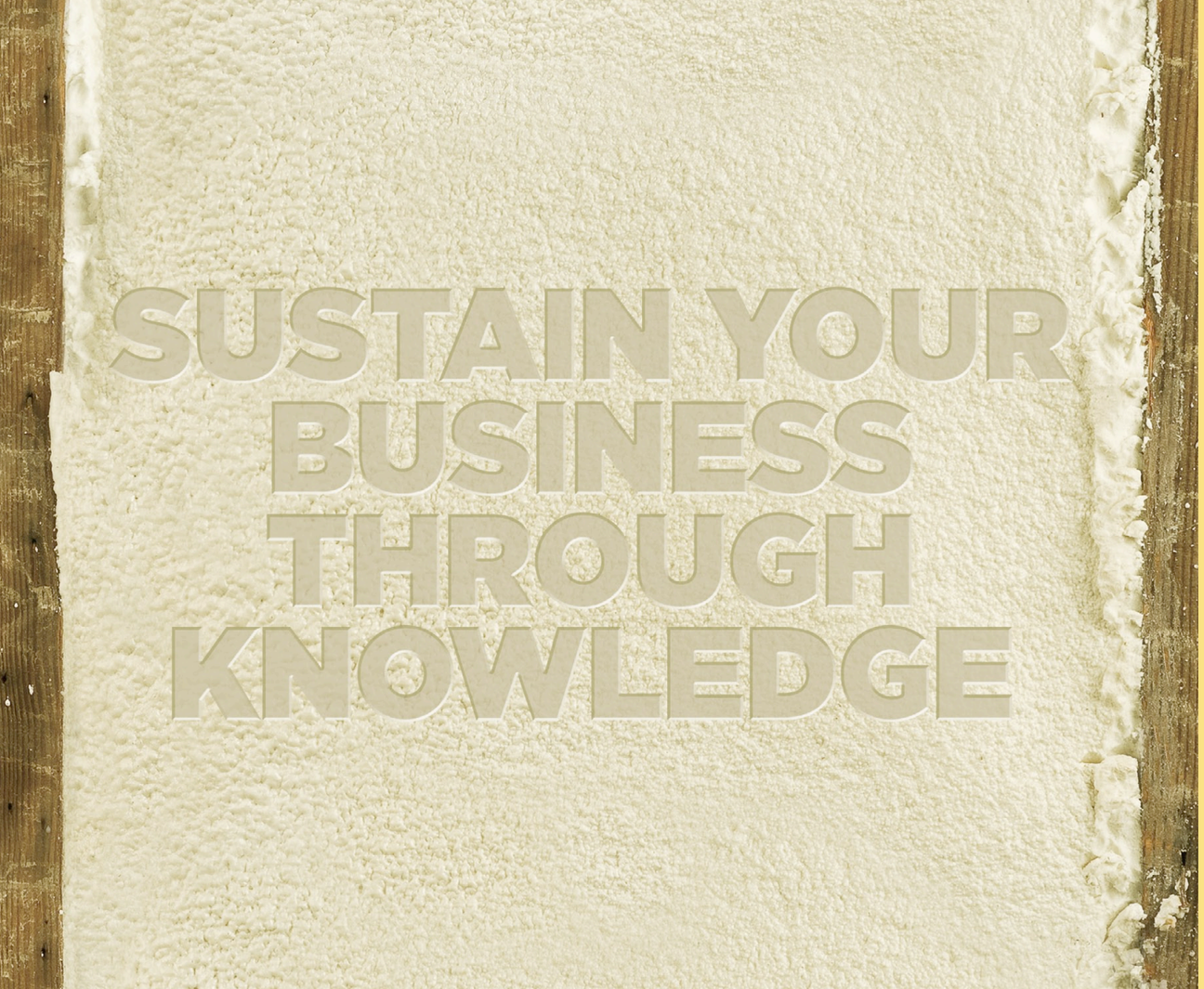
Bayer MaterialScience

FOAM BOOK

EDUCATION ABOUT SPRAY FOAM BOOK 1

BaySystems
customized polyurethanes

INSIDE: WHY SPRAY FOAM? • SPF & HEAT TRANSFER • SPF & MOLD GROWTH



At BaySystems, we're dedicated to helping you build and sustain your business. We've created this series of educational books to help you learn more so you can sell more spray foam. Your success is our business, and we're here to help you every step of the way.

BaySystems manufactures spray foam wall insulation, roofing spray foam insulation, and a full line of specialty coatings that are used for thermal and moisture protection, roofing, waterproofing, abrasion resistance, and other applications. BaySystems products enhance the total building envelope to provide sustainability, durability, energy efficiency, and improved occupant comfort.

For more information go to www.BaySystemsSpray.com

When Customers Ask:

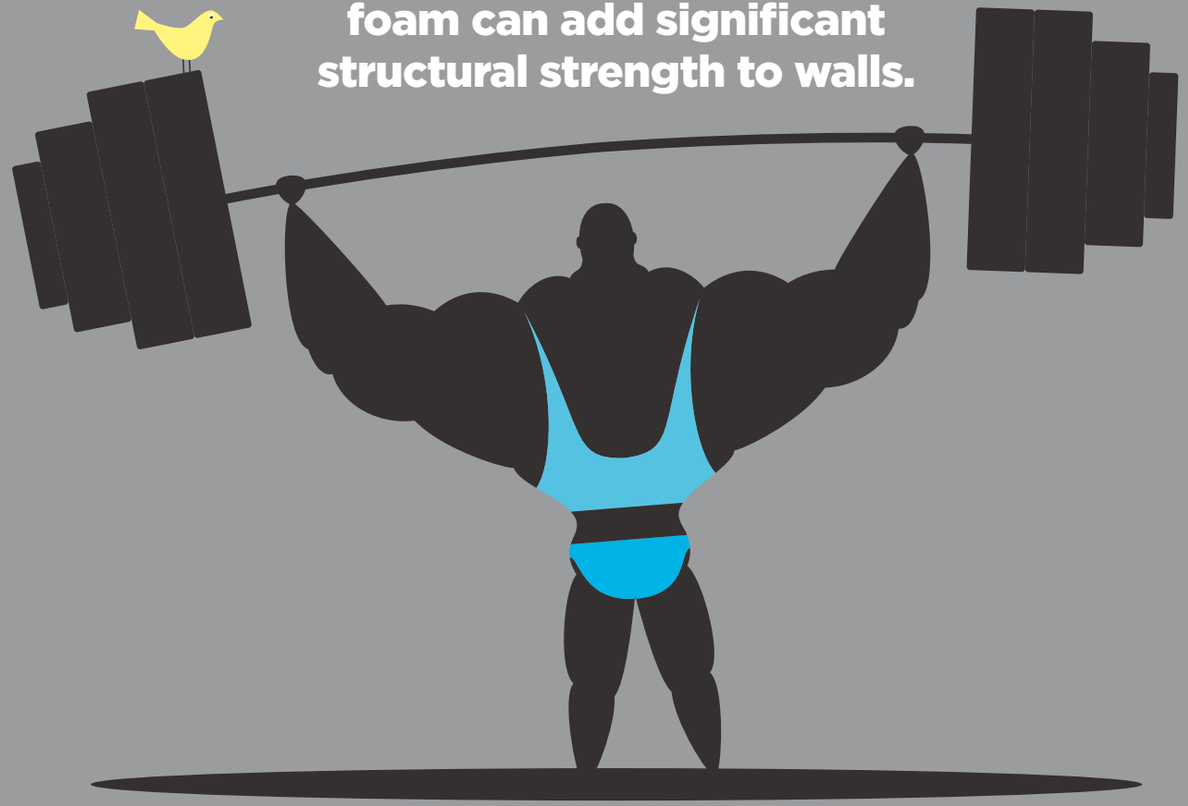
WHY SPRAY FOAM?

Answer: Spray polyurethane foam (SPF) is the ideal method for insulating commercial and residential buildings. Spray foam stops air and moisture intrusion, cuts energy bills, strengthens the structure, and protects the internal air from mold, airborne pollutants, and allergens, thereby creating healthy buildings.

Bayseal™ Spray foam provides a continuous, protective air barrier that practically eliminates air leakage, the leading cause of building energy waste.

Spray Foam Insulation:

- Offers a High Insulation R-value
- Provides a Seamless Air Barrier
- Restricts Moisture Transmission
- Adds Structural Strength
- Minimizes Sound Transmission
- Does Not Shrink or Settle
- Promotes Better Indoor Air Quality

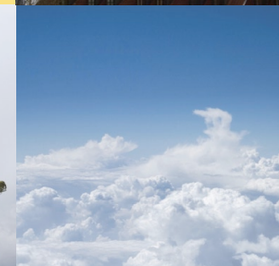


THE STRUCTURAL ADVANTAGES OF SPRAY FOAM

When it comes to protection against natural disasters, spray foam roof and wall systems have shown remarkable resistance to high wind uplift and blow-off; a characteristic attributed to spray foam's strong adhesion, lack of fasteners, and absence of joints or edges.

Closed-cell SPF in wall cavity applications has increased racking strength to 330 - 400% in NAHB tests.

Bayseal™ SPF roofing foams have a compressive strength of 40-50 lbs/in. compared to other insulations at 20-25 lbs/in.



According to a 2005 National Institute of Science and Technology (NIST) study, energy savings of up to 62% can be realized by undertaking specific air-leakage prevention measures in homes and buildings.

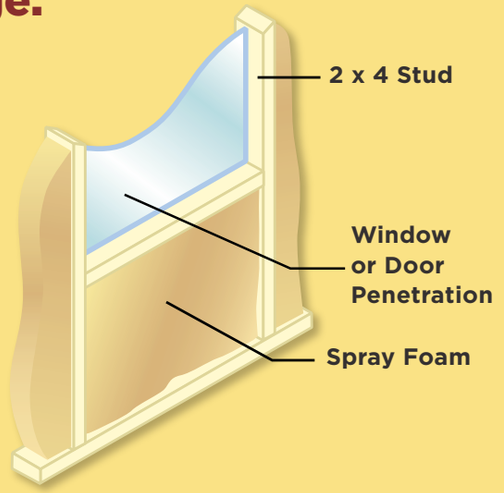
SPRAY FOAM ELIMINATES AIR LEAKS

Air leakage can contribute to problems with moisture, noise, dust, pollutants, insects, and rodents.

Small voids of 1-2% at the end of fiberglass batt insulation can result in a 25-40% reduction of R-value due to air leakage.

Air leakage can account for 30% of a home's annual heating and cooling costs.

Spray polyurethane foam seals the building envelope to create an optimal energy-efficient environment.



SPRAY FOAM & MOISTURE

Moisture management is a critical concern in energy-efficient building design and construction. According to Building Science Corporation, the unique characteristics of closed-cell spray polyurethane foam (ccSPF) set it apart from all other insulation and waterproofing materials, delivering high R-value per inch, airtightness, low permeability, good material strength, and good "liquid water holdout;" or rain control. These unique characteristics create a significant competitive advantage when specifying ccSPF.

Only closed-cell spray foam is classified as an "acceptable flood resistant material" by FEMA.

"Flood-resistant Material" is defined as any building material capable of withstanding direct and prolonged contact with floodwater without sustaining significant damage.

Closed-cell foam is the only wall and ceiling insulation material classified as "acceptable."

Fiberglass batt and blanket insulation are classified "UNACCEPTABLE."

Unvented attic with closed-cell spray foam resists roof uplift during high wind events.

"During high wind events, vented soffit collapse leads to building pressurization and window blowout and roof loss due to increased uplift. Unvented roofs - principally due to the robustness of their soffit construction - outperform vented roofs during hurricanes - they are safer."

Lstiburek, "Understanding Attic Ventilation," Building Science Corporation, 2003

Spray polyurethane foam is self-flashing and offers 100% adhesion without fasteners. Fasteners are a common point of failure in other systems. And spray polyurethane foam grips the building walls, thereby holding tight in the face of high winds.

When properly installed, spray applied foam forms an air seal that prevents air leaks and greatly reduces noise transmissions through walls.

REDUCES SOUND TRANSMISSIONS

Closed-cell foam blocks transmission of low frequency sound

Open-cell spray foam absorbs mid to high frequency sound

In combination, the two can create an effective sound barrier

Air-tight, void-free walls minimize sound pathways

HEALTHY BUILDINGS

The Building Science Corporation believes that insulation products capable of achieving green building standards need to control moisture, air movement and temperature in one material. SPF is the ONLY product in the industry that can control all three.

Bayseal™ spray polyurethane foam contributes to healthy buildings by reducing air leakage thereby preventing condensation within the envelope.

Mold and mildew growth cannot occur in the absence of water. Spray foam prevents water vapor transported by air leakage from entering the building envelope thereby helping prevent mold growth.

Thermal bridging is a significant cause of energy loss. With no fasteners, joints or gaps, spray foam eliminates thermal bridging.

Spray polyurethane foam improves indoor air quality by reducing the transport of dust and pollen from outside.

Spray polyurethane foam reduces drafts and air movement.

HEAT TRANSFER & SPRAY FOAM

Outside heat or cold can transfer from an exterior wall to an interior wall through six different methods of transference. Spray foam insulation blocks all six transfer methods and thereby helps to maintain a comfortable indoor temperature.

R-value alone is NOT the answer!

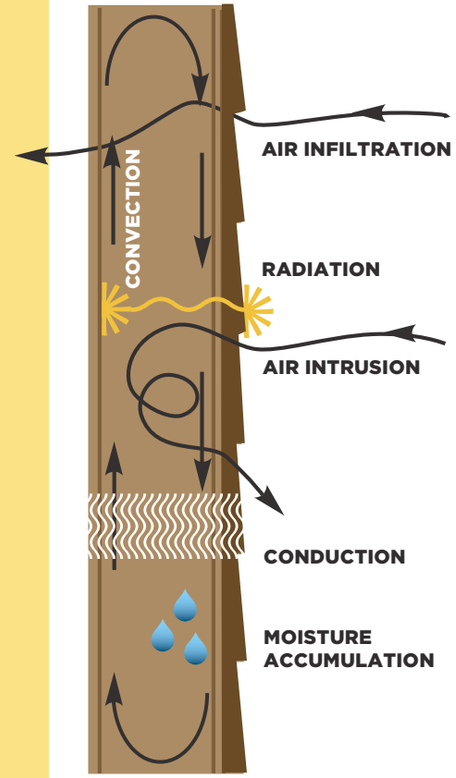
Heat loss or gain can occur through any element of the building envelope (wall, floor, or roof/ceiling) by three primary mechanisms:

1. CONDUCTION
2. CONVECTION
3. RADIATION

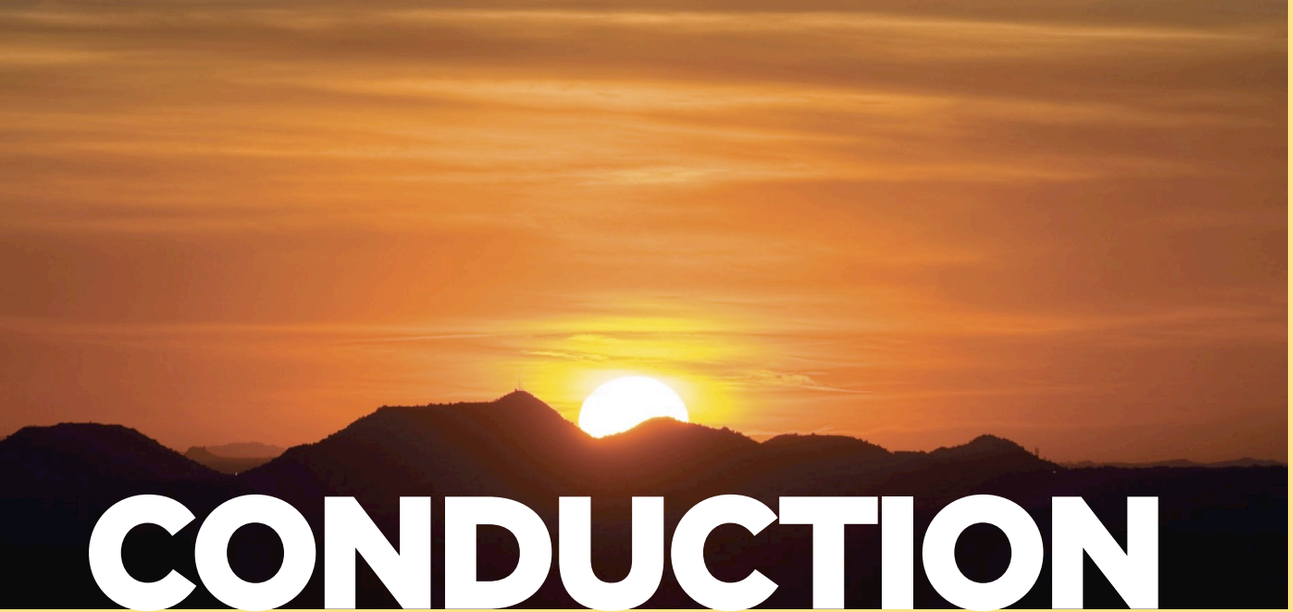
In addition, three secondary mechanisms can influence the heat loss/gain by affecting insulation effectiveness:

4. AIR INFILTRATION
5. AIR INTRUSION
6. MOISTURE ACCUMULATION

R-value, the traditional measure of an insulation's effectiveness, measures only ONE of these six mechanisms. Spray polyurethane foam effectively prevents or blocks all six heat transfer methods.



MECHANISMS OF HEAT TRANSFER



CONDUCTION

Conduction is the transfer of heat within an object or between two objects in contact.

THE SPRAY FOAM ADVANTAGE: The predominant heat transfer mechanism is conduction. Because the polymer matrix and the gas contained within the cells are both poor conductors of heat, closed-cell spray polyurethane foam has a very high R-value and effectively blocks heat transfer by conduction.

CONVECTION

Convective heat transfer occurs when air moves within the walls. Natural convection currents occur when temperature differences in different locations (for example, walls) create air movement which transfers heat.

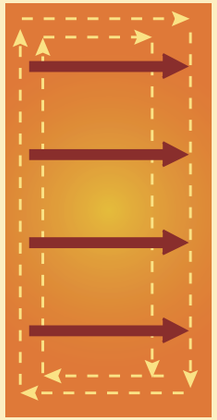
THE SPRAY FOAM ADVANTAGE: Closed-cell spray foam eliminates air movement within the walls thereby eliminating convection as a heat transfer mechanism within the insulation mass.

RADIATION

Radiation is the transfer of heat from one object to another by means of electromagnetic waves.

THE SPRAY FOAM ADVANTAGE: Heat transfer by radiation is reduced by spray foam because of the cell structure. Minimizing radiant heat loss/gain leads to greater comfort.

CONVECTION LOOP IN THE WALL



AIR INFILTRATION

Air infiltration, in essence, bypasses insulation. It transfers heat by the gross flow of air between the exterior and interior.

THE SPRAY FOAM ADVANTAGE: Air will not penetrate spray foam under pressure differences buildings normally experience. Stopping air infiltration is one of spray polyurethane foam's greatest advantages.

MOISTURE ACCUMULATION

Moisture accumulation within insulation materials will reduce that insulation's R-value, contributing to heat loss/gain.

THE SPRAY FOAM ADVANTAGE: Closed-cell spray foam stops moisture accumulation due to air infiltration and air intrusion.

AIR INTRUSION

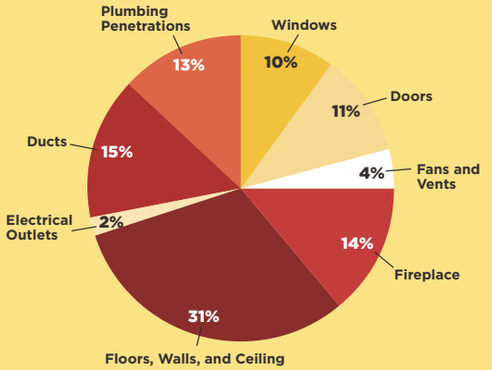
Air intrusion occurs when air enters the insulation from the exterior and exits back to the exterior.

THE SPRAY FOAM ADVANTAGE: For the same reasons spray foam stops air infiltration, it will stop air intrusion.

Bayseal™ closed-cell spray polyurethane foam effectively blocks the three primary and three secondary mechanisms of heat transfer.

Contrary to popular belief, windows and doors are not the major sources of air leakage, contributing only 25%. Rather, joints between the main walls and floor system, electrical outlets on exterior walls, and ceiling penetrations for light fixtures, attic hatches, partition walls and plumbing fixtures constitute the major infiltration / exfiltration paths.

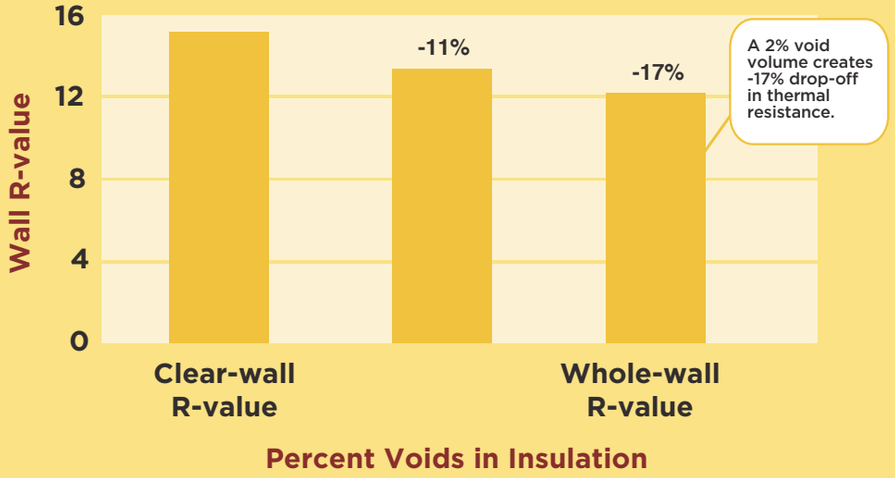
Geistbrecht and Proskiw, ASTM STP 904 *"An Evaluation of the Effectiveness of Air Leakage Sealing,"* Philadelphia, 1987, pp 312-322



SPRAY FOAM VS. FIBERGLASS

Gaps and voids are common during fiberglass installation

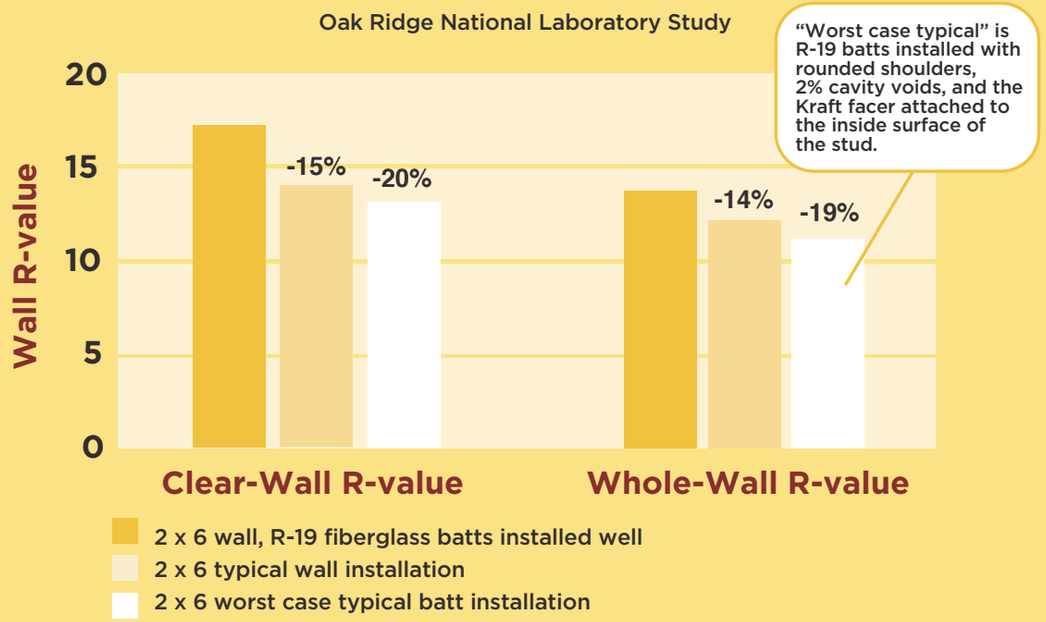
AIR VOIDS SIGNIFICANTLY DETRACT FROM INSULATION PERFORMANCE



Infante et al., *Thermal Insulation, Materials and Systems for Energy Conservation, in the '80s*, p 341

FIBERGLASS BATTS, AS TYPICALLY INSTALLED, LOSE 15-20% OF R-VALUE RELATIVE TO A PERFECT INSTALLATION

Oak Ridge National Laboratory Study



Christian, Jefferey, et al. *The Whole Wall Thermal Performance Calculator - On the Net. Proceedings, Thermal Performance of the Exterior Envelopes of Buildings VII*, Atlanta, GA, ASHRAE, Dec., 1998

WATER VAPOR & MOLD GROWTH

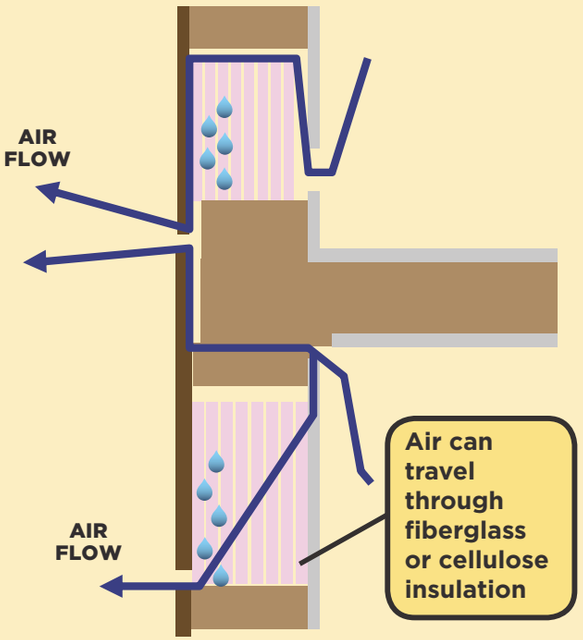
Water vapor is a hitchhiker carried into the building envelope by air leakage

Condensation

within the building envelope occurs when air reaches its dew point temperature.

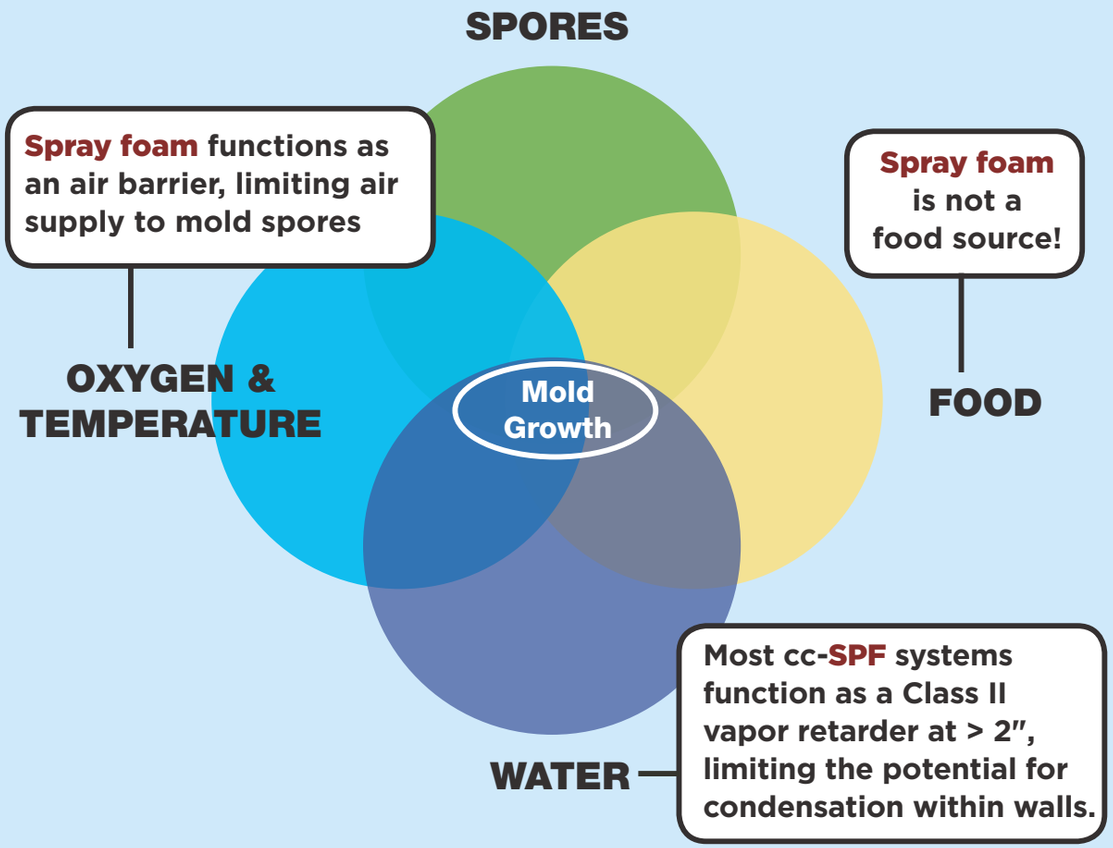
Water in the building envelope...

- **Reduces insulation effectiveness**
- **Creates a site for potential mold growth**



"Of all the environmental conditions, moisture poses the biggest threat to structural integrity and durability, accounting for up to 89% of damage in building envelopes."

Bomberg, M. and W. Brown, Construction Canada 35(1) 1993, pp 15-18,
"Building Envelope and Environmental Control: Part 1 – Heat, Air and Moisture Interactions"

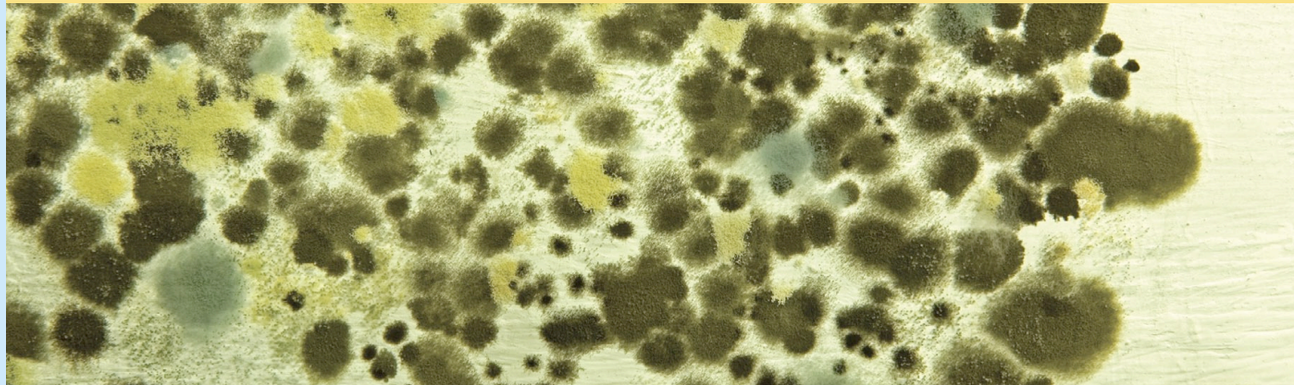


CONDITIONS FOR MOLD GROWTH

Mold spores are always in the air

Mold spores require three conditions to proliferate:
Food • Oxygen/Temperature • Liquid Water

Mold growth is prevented by removing one of the conditions



Condensation *within* the Building Envelope

Both air leakage and diffusion allow water vapor to enter the building envelope.

Air leakage, by far, has the potential to move more water vapor. It is controlled by building an airtight building envelope.

Diffusive transport of water vapor is controlled by vapor retarders.

Vapor retarders should never be installed on both surfaces of the building envelope. This creates potential to trap water inside.

Spray foam helps create an airtight envelope. Both open-cell and closed-cell **spray foam** are air barriers.

Closed-cell foam typically qualifies as a vapor retarder at thickness of two inches or more.

SPRAY FOAM IS THE ANSWER

Bayseal™ spray polyurethane foam is the ideal method for insulating commercial and residential buildings. Spray foam stops air and moisture intrusion, cuts energy bills, strengthens the structure, and protects the internal air from mold, airborne pollutants and allergens, thereby creating healthy buildings.

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Go to www.BaySystemsSpray.com
to learn more about the competitive advantages
of spray polyurethane foam.

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