

Spray Foam: The Not So Perfect Insulation

By Stephen MacDougall, P.Eng. Brown & Beattie Ltd.

In the quest for increased thermal performance of building envelopes as required by modern Building Codes, the use of spray foam insulation has become more popular in recent years, particularly in residential buildings.



The use of spray foam insulation within flat roof assemblies without ventilation has one significant drawback however; moisture which enters the roof assembly is trapped between the insulation and roofing membrane, both of which act as vapour retarders.

Polyurethane spray foam insulation has been suggested by some in the construction industry as a silver bullet to provide a high insulation value per inch in addition to also forming a continuous air barrier and vapour retarder. The idea that the spray foam provides a built-in air and vapour 'barrier' has also led to the use of spray foam without a traditional polyethylene vapour retarder or a vented air space above when used in roofing or ceiling applications, typically accepted as being required with conventional fibreglass batt insulated assemblies.

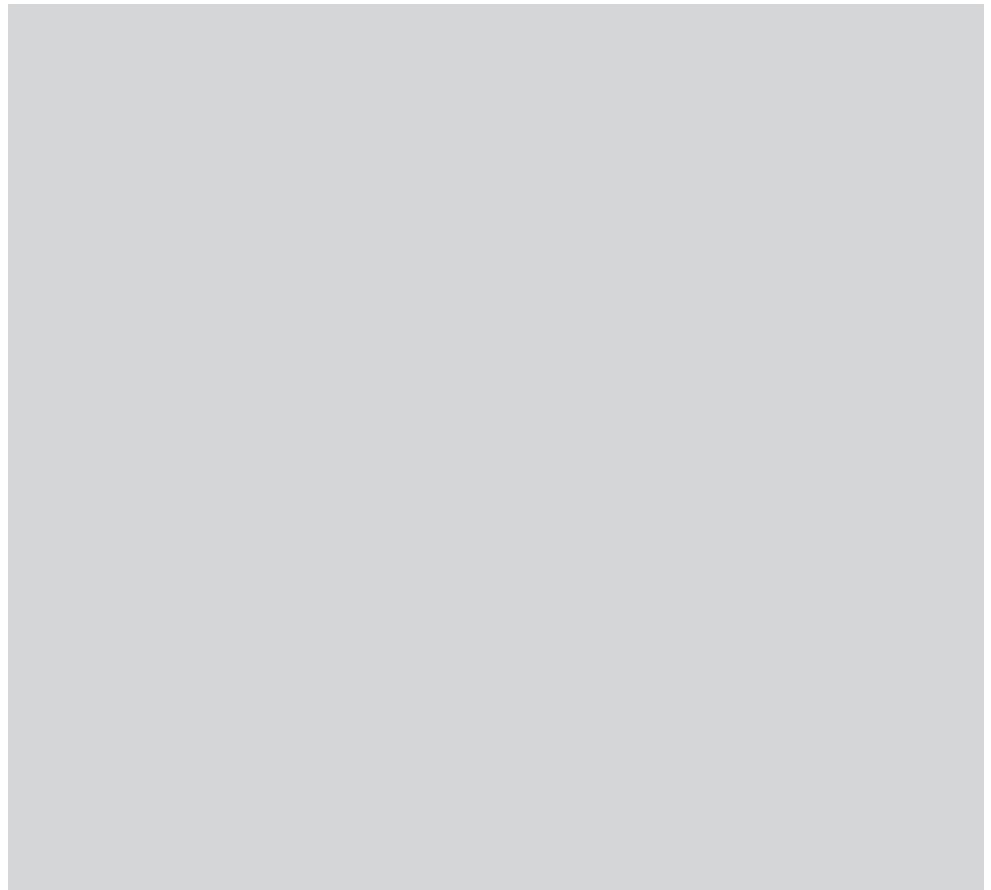
The use of spray foam insulation without the requirement for a vented air space has made it particularly appealing for flat roof applications which conventionally require an vented air space above insulation placed between the roof framing (usually with limited functionality in flat roofs) or the placement of rigid insulation above the roof sheathing (typically used in large commercial buildings), both increasing the overall thickness of the roof assembly.

The use of spray foam insulation within flat roof assemblies without ventilation has one significant drawback however; moisture which enters the roof assembly is trapped between the insulation and roofing membrane, both of which act as vapour retarders. Further, unlike a conventional roof where significant moisture within the roof assembly would typically result in visible damage to the ceiling finishes, moisture entering and collecting within a



spray-foamed roof assembly may go unnoticed for years, allowing for significant deterioration of the structural framing.

We have inspected a number of buildings in recent years which include unvented flat roof assemblies with spray foam insulation (both open and closed cell) between the roof joists where the collection and build-up of moisture within the roof assembly has gone unnoticed until a point where the wood roof framing was significantly rotted. The source of moisture within the roof assembly included direct leakage through the roofing membrane in some cases as well as the formation and collection of condensation where the spray



foam insulation did not provide “perfect” air and vapour ‘barrier’, allowing air and vapour flow through the assembly where it condenses on relatively colder outside components.

In the cases with condensation, air leakage from within the building was able to collect in the roof space at areas where the foam insulation was counted on to do too much in the assembly or may not have been installed to its full potential and allow relatively warm humid air or vapour from within the building to contact and condense on the sheathing on the ‘cold’ side of the insulation during the winter months. In this type of assembly, the entrapment of moisture between the insulation and roofing membrane can allow moisture from relatively small air leakage sources to build-up over

time, in concentrated manners, leading to rotting of wood framing unbeknownst to the building owner.

The low moisture permanence of spray foam insulation, praised for its vapour ‘barrier’ properties can hide leakage or condensation related moisture collecting within a roof assembly, significantly increasing the costs of related repairs when finally discovered. The potential for spray foam insulation to contribute to the long-term deterioration of wood framing may also contribute to structural failures in otherwise sound buildings.

Undoubtedly spray foam insulation will continue to be used in the construction industry for the foreseeable future, functioning as intended in most cases; however as the long-term issues associated with the use of spray foam in modern building applications become clearer, hope-

fully designers and installers will become more aware of the limitations of this product to enable its proper application and performance potentials.



Stephen MacDougall is an Engineer with Brown & Beattie Ltd. and is registered with Professional Engineers Ontario (PEO). He and his colleagues have been working closely with insurance companies on many insurance related investigations such as fires, explosions, collapses, structural damage, floods, hail, wind, vehicle impacts, personal injury claims and more. Practical Approaches – Sensible Results

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Brown & Beattie

BUILDING SCIENCE ENGINEERING

556 Edward Avenue, Unit 71
 Richmond Hill, ON L4C 9Y5
 P 905-737-0111 F 905-737-4046
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