INSULATION FACTS #30

NAIMA
North American Insulation Manufacturers Association

Insulation and Fire Safety

Information from NAIMA

In this issue we compare the fire safety of fiber glass and cellulose insulations.

Introduction

When people think about insulation, they think of energy efficiency and comfort in the home. Fire safety seldom comes to mind. But this should be a concern because the two most common insulations – fiber glass and cellulose – perform very differently in terms of fire safety.

Fire Characteristics

Fiber Glass Insulation

Fiber glass itself is inorganic and, as such, is noncombustible. In fact, unfaced fiber glass insulation is accepted as a fire block in wood frame walls. *The Uniform Building Code* says:

"Fire blocks may also be of gypsum board, cement asbestos board, mineral fiber, glass fiber, or other approved materials, securely fastened in place."

However, most vapor retarders used on fiber glass insulation are flammable. For this reason, faced insulation should be covered with gypsum board or other building code approved finish material soon after installation. To reinforce this recommendation, member companies of the North American Insulation Manufacturers Association (NAIMA) print the following warning on the kraft paper and foil vapor retarders on batt and roll insulation:

"This vapor retarder is flammable and should not be left exposed."

This warning is also printed on most packaging and product literature.

For those applications where the vapor retarder facing is left exposed, such as garage walls or ceilings of warehouses and other storage areas, flame spread-resistant (FS-25) faced fiber glass insulation is available.

Cellulose Insulation

Cellulose insulation is made of paper products, principally old newspapers, which are naturally flammable. Cellulose insulation must be chemically treated in order to reduce its flammability. However, the chemical treatment does not make the insulation 'non-combustible' or smolder resistant. Writing in an issue of *Fire Journal*, published by the National Fire Protection Association, John G. Degenkolb, a fire protection engineer, states:

"Even the best of these flame-retardant cellulosics will begin to smolder when heated to approximately

450°F. When smoldering once begins, it is most difficult to extinguish. It reacts like a smoldering cotton mattress. The ordinary application of water or other extinguishing agent is ineffective. The material must be carefully pulled apart in its entirety, and each parcel extinguished separately."

In addition, questions remain about the long-term fire retardancy of treated cellulose. Several independent tests (described on the following pages) showed that, over time, cellulose insulation not only failed to meet ASTM's smoldering combustion resistance requirements but also indicated a trend of decreasing fire retardant chemical content.

How Insulation Products are Tested for Flammability

General performance properties are covered by the following specifications: ASTM C 665 for mineral fiber batts and rolls; ASTM C 764 for loose-fill mineral insulation; and ASTM C 739 for cellulose.

Fiber Glass Insulation

The fire test procedure currently specified for fiber glass insulation is ASTM E 84, known as the Steiner tunnel test. The test specimen is placed in a 25-foot-long tunnel and ignited at one end. The flame spread along the specimen is measured, then compared with the flame spreads of asbestos-cement board and red oak flooring, which have been arbitrarily established at 0 and 100, respectively. The maximum flame spread allowable for mineral fiber is 25. All fiber glass insulations manufactured by NAIMA member companies are within this limit.

Cellulose Insulation

Two test procedures, both developed by the National Bureau of Standards (NBS), are referenced in the specification ASTM C 739 for cellulose insulation. One is a test for flame spread and the other is a test for smoldering combustion.

The flame spread test is known as the critical radiant flux (attic floor radiant panel) test. Critical radiant flux, the radiant energy level which enables a flame to spread across an insulation surface, indicates flame propagation. ASTM specifications require that insulations (cellulose and fiber glass) used in attics meet a critical radiant flux of at least 0.12 watts/sq. cm. This figure is based on an expected "real world" attic heat flux of 0.08 watts/sq. cm., plus a 50 percent safety factor.

While fiber glass insulation has no problem meeting the 0.12 watts/sq. cm. requirement because it is a non-combustible material, cellulose must be chemically treated in order to meet the ASTM specification requirements.

The test for smoldering combustion is known as the "cigarette test." After a stainless-steel box is filled with cellulose, a lighted cigarette, burning end up, is inserted in the insulation, and the insulation is allowed to smolder for two hours. The insulation fails the test if it flames up or if its loss of weight exceeds 15 percent.

Several Sources Cast Doubts on the Fire Safety of Cellulose Insulation

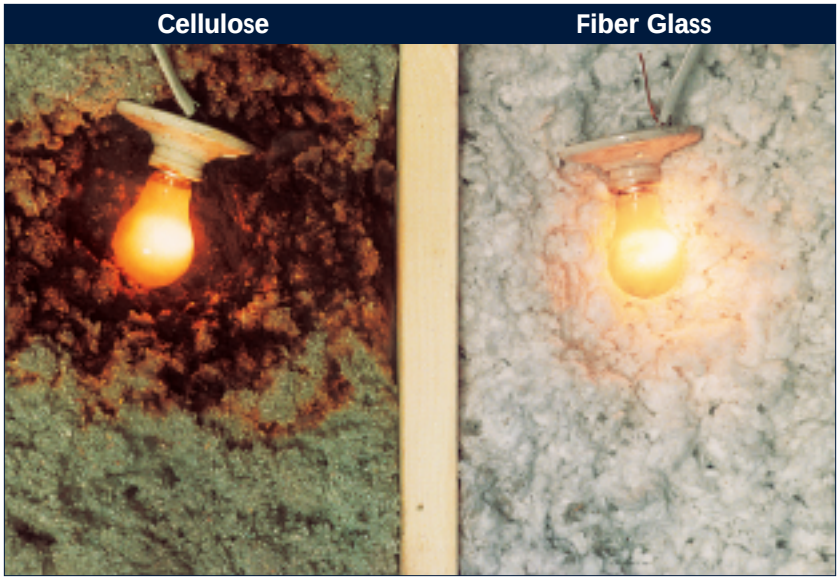
CPSC Regulations

The Consumer Product Safety Commission (CPSC) enacted specific fire safety regulations to govern cellulose insulation in 1979. These regulations mandate that cellulose insulation pass certain fire test procedures. In addition, the CPSC requires labeling on cellulose insulation to inform individuals that a fire hazard exists where cellulose insulation is improperly installed. By way of explanation and background, the CPSC regulations state:

"Based on available fire incident information, engineering analysis of the probable fire scenarios, and laboratory tests, the Consumer Product Safety Commission has determined that fires can occur where cellulose insulation is improperly installed too close to the sides or over the top of recessed electrical light fixtures, or installed too close to the exhaust flues from heat producing devices or apparatus such as furnaces, water heaters, and space heaters. THE FIRES MAY RESULT IN SERIOUS INJURIES OR DEATHS. (Emphasis added.) Presently available information indicates that fires may occur where cellulose insulation is improperly installed even though the cellulose insulation complies with the Commission's amended interim standard for cellulose insulation (16 CFR Part 1209)... The Commission has determined that it is necessary to require labeling to inform persons installing cellulose insulation and consumers."

NBS Study

A 1984 U.S. Department of Commerce, National Bureau of Standards (NBS) study designed to test the effect of building environment conditions on fire retardant chemicals confirmed that "long term fire protection pro-



Standard 75 watt light bulb will cause cellulose insulation to smolder.

Fiber glass insulation is unaffected.
Note: a 75 watt light bulb is the equivalent of 450°F.

vided by fire retardant compounds may be limited."

The cellulose industry's claim that the NBS study was not "a cause for alarm" drew a sharp response from NBS (now the National Institute of Standards and Technology or "NIST") in an August 14, 1992 letter to the cellulose industry. NIST's Chief of Fire Measurement and Research wrote:

"Data from the study shows that there should be great concern about the long term fire performance of fire retardant cellulosic insulation." (Emphasis added.)

Survey of Cellulosic Insulation Materials

In its publication, *"Survey of Cellulosic Insulation Materials,"* the Energy Research and Development Administration (now a part of the Department of Energy) cast doubt upon the permanency of fire retardant treatments because of the methods by which the chemicals are applied. The report said:

"Of the 19 samples received for analysis, 13 showed visible evidence that some of the fire-retardant chemical had separated from the cellulosic matrix; quantities of the additives were found at the bottom of the containers."

NAIMA Tests

Tests to determine the effectiveness and permanency of the fire-retardant chemical additives used in cellulose were conducted in a NAIMA member company laboratory. Samples of cellulose loose-fill were removed from 24 attics in six states. Each of the cellulose samples had been installed for at least two years. Of the 19 samples tested for critical radiant flux, 10 failed to meet the ASTM C 739 criterion.

State of California Tests

The critical radiant flux of several cellulose insulation samples significantly dropped and failed the ASTM C 739 test requirement after just one year of aging under simulated attic conditions during testing by the California Bureau of Home Furnishings and Thermal Insulation in the early 1990's. The tests were designed to track critical radiant flux and smoldering combustion resistance and the effects of aging on the fire retardant chemical content. In addition to the ASTM C 739 test failures, tested cellulose samples demonstrated a trend of decreasing fire retardant chemical content over a three year period.

Fire Reporting Systems

With the significant amount of data bringing the fire safety of cellulose insulation into question, one may wonder why the public is not aware of fires exacerbated, expanded or spread by cellulose insulation. The answer lies in the fire reporting system. Most fires are reported by how they are 'started' vs. what is 'ignited'. However, state and city jurisdictions around the country are re-evaluating their fire reporting systems and looking closely at components that can ignite, smolder or rekindle.

Fire Marshal's Survey

A December, 1993 survey by the Indiana State Fire Marshal's Office of 900 fire departments found that 72% of Indiana fire departments fight cellulose insulation fires in an average year. Nearly one in three departments reported that they had been called back to at least one rekindled fire that began in cellulose insulation. And, when asked what was the most frequent cause of cellulose insulation fires, respondents cited contact between the cellulose and recessed light fixtures, electric fixtures and chimney flues. Similar surveys conducted in California (1996) and Wisconsin (1996) also found a high incidence of cellulose fires.

Survey of State and City Jurisdictions

Another survey of one hundred jurisdictions (states and cities) within the U.S. was performed by Omega Point Laboratories in 1993 to determine the prevalence of fires involving cellulose loose-fill insulation. The purpose of the study was to obtain information on, experiences with, and knowledge of fires involving cellulose insulation in order to be able to make a judgment of the ongoing, potential fire hazards of cellulose. 47% of those responding indicated that they were aware of fires involving cellulose within the past five years. Most of the respondents indicated that documenting such fires was very difficult because cellulose was often not the first item ignited; therefore, it does not appear as a unique item on fire reporting data bases. However, 73 fire incident reports were submitted by twelve states and municipalities. Those reports established that cellulose insulation was involved in fires due to overheated objects and in the spread of fires from living areas into attic spaces, including rekindling.

Fire Safety and Federal Standards

Fiber Glass Insulation

In response to a petition from the Metropolitan Denver District Attorney's Consumer Office (1976), the Consumer Product Safety Commission extensively investigated the fire safety record of mineral fiber and concluded that a safety standard was not needed.

Cellulose Insulation

The same petition, however, requested the CPSC to establish a mandatory safety standard for cellulose insulation. Congress found that "such standards are reasonably necessary to eliminate or reduce an unreasonable risk of injury to consumers." The CPSC published an interim consumer product safety standard for cellulose. This standard has since been amended to incorporate newer flame resistance and corrosiveness test procedures, which are based upon ASTM C 739. The flame resistance tests are the smoldering combustion test and the attic floor radiant panel test. The CPSC does not require testing of flame resistance permanency.

Conclusion

The fire safety of cellulose insulation has been a concern of builders, code officials and fire officials across the country for many years. A memorandum from the Maryland State Fire Marshal summarizes this concern. The 1992 memo was written to Maryland Fire Chiefs alerting them to the potential for a "continued burn" once cellulose insulation has become involved in a fire:

"Unless the cellulose insulation has been removed from the area of origin, and perhaps even from areas beyond the area of origin, 'hot spots' may continue to smolder for many, many hours before erupting into full flame. Also heat and fire can possibly spread via ductwork, wiring and piping which is covered by the cellulose insulation."

For More Information

For more information on any of the studies and sources cited in this fact sheet, contact NAIMA.

Note: This edition of Insulation Facts is a combination of two previously published Insulation Facts: Insulation and Fire Safety (#5) and Update on Cellulose Fire Safety (#17).

About NAIMA

NAIMA is the association for North American manufacturers of fiber glass, rock wool, and slag wool insulation products. Its role is to promote energy efficiency and environmental preservation through the use of fiber glass, rock wool, and slag wool insulation, and to encourage the safe production and use of these materials.

For more information, contact:

NAIMA
44 Canal Center Plaza, Suite 310
Alexandria, VA 22314
Phone: 703-684-0084
Fax: 703-684-0427
E-mail: insulation@naima.org
Website: http://www.naima.org

NAIMA BUILDING INSULATION COMMITTEE MEMBERS

CertainTeed Corp.
P.O. Box 860
Valley Forge, PA 19482
800-233-8990

Johns Manville Corp.
P.O. Box 5108
Denver, CO 80217
800-654-3103

Knauf Fiber Glass
One Knauf Drive
Shelbyville, IN 46176
800-825-4434

Owens Corning
One Owens Corning Parkway
Toledo, OH 43659
800-GET-PINK

PUB. NO. BI472 8/97