

## TRADE BULLETIN

November 3, 2000

To: Johns Manville Customers and Other Interested Parties

Subject: Answering Distorted Claims About Cellulose Insulation

Who can you trust for accurate information?

Not everyone can be a building insulation expert and keep up with all the ongoing research in the construction industry. Applegate Insulation has been attempting to take advantage of builders and others by publishing misleading and incomplete accounts of industry testing, in an attempt to promote its cellulose product. The latest example is "The Cellulose Insulation Journal" issued by Applegate Insulation in July 2000. Simply put, this is not a credible source of information, and there is a danger that many readers may be left with false impressions about insulation products.

Following are corrections to some of the erroneous statements in "The Cellulose Insulation Journal." If you want more information about any of these topics, please contact Johns Manville or find another credible source of accurate information about insulation products.

**Applegate:** "R-19 Batts actually deliver R-11. New research from Oak Ridge National Laboratory (ORNL) confirms that fiberglass batts in 2" x 6" (and 2" x 4") walls provide much less than their labeled R-value."

**Fact:** ORNL has not said that there is any inaccuracy in the labeling of fiber glass batt insulation, which is only one element in wall assemblies.

This ORNL research program is investigating how non-insulation elements like wall framing, corners, window headers, and utilities should be considered in accurately rating the performance of the entire wall. Most energy codes and building computer models already take framing factors into account, but ORNL researchers want to refine those calculations.

Part of the ORNL program involved thermal testing of 2" x 6" framed walls with drywall, sheathing, and R-19 fiber glass batts.<sup>1</sup> The test walls did not include siding or air films, which add to a real wall's thermal performance. Of course, because the wood framing every 24" has a lower R-value than the insulation, the total wall system performance, on average, is less than the R-value of the cavity insulation alone. The total R-value of ORNL's basic test wall was R-16.5. ORNL then used computer modeling to adjust the wall's predicted thermal performance 17% for a "whole-wall R-value" of R-13.6, to account for corners, headers, window framing, and other non-insulation heat paths found in an example 1540 sq. ft. ranch style house. The framing effect and the 17% adjustment for heat paths created by other structural elements applies to walls with any cavity insulation, including cellulose.

Further testing investigated the presence of electrical fixtures, wires, and intentionally poor batt installation around the electrical components as well as other major voids and compressed areas along the edges of all the insulation. This wall measured R-13.2, for a whole-wall R-value of R-11 after the 17% adjustment for non-insulation heat paths. Comparing the totals for well-insulated and poorly insulated walls shows the importance of proper installation, but the real issue being raised by ORNL is a whole-wall design issue. Applegate's statement that R-19 batts deliver R-11 totally misrepresents the ORNL research.

**Fact: Cellulose insulation delivers no higher R-value in a wall than standard fiber glass insulation.**

Johns Manville conducted a wall assembly test program in 1988 and the results were widely disseminated<sup>2</sup>. A 2"x 4" wall with drywall, sheathing, electrical wires, and plumbing pipes was tested with various cavity insulation types. With R-13 fiber glass batts installed correctly, this total wall measured R-11.4 and R-11.5. With intentional flaws created in the insulation, the wall performance dropped slightly to R-10.8. Then the wall was tested with some other insulation materials for comparison. With blown fiber glass loose-fill (bonded product) it measured R-11.5, and with wet-sprayed cellulose (after waiting for more than a month for it to dry out) it measured R-11.0.

**Applegate:** "...1979 when Johns-Manville conducted tests of batt insulated walls..Wall assemblies built to simulate real-world construction and installation revealed that R-19 batts in 2"x6" walls lost from 24% to 49% of their R-value."

**Fact: Johns Manville conducted a study of wall and ceiling thermal performance for the U.S. Department of the Navy in 1977 through 1979. One series of tests looked at the effect of intentional gaps in wall insulation, where the most extreme case had 15% of the R-19 insulation left out of a 2"x 6" wall assembly.<sup>3</sup> A 15% gap is equivalent to 1 out of 7 wall cavities left completely empty, hardly a realistic situation. That wall measured R-10.3, a 38% reduction from the completely insulated wall at R-16.5. Once again, that measurement included the whole wall assembly where considerable heat flowed through the wood framing in addition to the intentional gap areas. The R-19 fiber glass insulation worked very well where it was present, otherwise the average wall assembly R-value would have been even lower.**

**Applegate:** "Fire testing shows cellulose helps make homes safer. New tests add to the growing evidence that cellulose insulation increases the fire resistance of building assemblies. Omega Point Laboratories conducted full-scale tests on several types of wall assemblies, with the cellulose insulated wall sections proving to be up to 77% more fire resistant than uninsulated sections."

**Fact: The Omega Point testing is interesting but it shouldn't be used to obscure the very serious concerns about cellulose insulation effects on home safety.**

The tested assemblies were interior 2"x 4" walls with Type-X gypsum board on both sides.<sup>4</sup> Walls with no insulation withstood fire exposure for 53 minutes or more, while cellulose insulated walls lasted 76 minutes or more. The results confirmed that gypsum board alone provides relatively good fire protection, and in fact, burn-through of interior gypsum board walls is not a primary fire safety concern in homes. Of far greater concern is smoldering cellulose insulation in attics and the possible deterioration of fire retardant treatments over time.<sup>5</sup>

**Applegate:** "...the cellulose insulation performed so well that members of the International Code Council have agreed to make an exception to their design requirements for one-hour rated walls – often called "common walls" or "party walls". For cellulose insulated one-hour walls, steel electrical boxes on opposite sides of the wall can be installed in the same stud cavity as long as cellulose insulation separates them! (The cellulose between the boxes must be at

least as thick as the depth of the wall cavity.) For fiberglass insulated one-hour walls, the new code forbids installing steel electrical boxes on opposite sides of the wall within the same stud cavity."

**Fact:** The code does not "forbid" anything, it lists the approved practices. No unique exception is made for electrical boxes with cellulose insulation.

The new International Residential Code (IRC) 2000, section R321.3.2.1 reads: "Outlet boxes on opposite sides of the wall shall be separated as follows: 1.1. By a horizontal distance of not less than 24 inches, or 1.2. By a horizontal distance of not less than the depth of the wall cavity when the wall cavity is filled with cellulose loose-fill or mineral fiber insulation..."<sup>6</sup> Section 1.2 is not completely clear because mineral fiber is often defined as either rock wool or fiber glass, leaving the code section open to interpretation. However, standard practice is to position outlet boxes in alternate framing cavities, so the situation covered in section 1.2 is rarely encountered.

There are other more common situations covered elsewhere in the IRC code where fiber glass, a non-combustible material, is specifically acknowledged for fire safety applications. For instance, Section R602.8.1. on fireblocking reads: "Batts or blankets of mineral or glass fiber or other approved non-rigid materials shall be allowed as fireblocking in walls constructed using parallel rows of studs or staggered studs."

**Applegate:** "In a separate battery of tests, the National Fire Laboratory of the National Research Council of Canada...conducted fire resistance tests on wood and steel framed walls...The results were impressive: the cellulose insulation consistently and significantly increased the fire resistance of the walls – by up to 71%! It seemed that no matter how the walls were built, cellulose helped make them safer."

**Fact:** NRC reported a range of results, depending on the configuration of gypsum board, framing, and insulation.<sup>7</sup> In several of the wall assemblies, cellulose insulation increased the fire endurance slightly, but not always. The unbalanced 5/8" Type X gypsum board wall insulated with cellulose performed 17% worse than the wall with no insulation.

**Applegate:** "Like the tobacco industry, the fiberglass manufacturers have denied the dangers of their products for decades." "Fortunately, insulation contractors don't have to worry about the risks of fiberglass because there is an alternative: natural cellulose insulation."

**Fact:** Nearly sixty years worth of scientific research indicates that fiber glass is safe.<sup>8</sup>

In fact, more is known about the safety of fiber glass than virtually any other construction material, due primarily to research programs supported by the fiber glass industry. As part of a major partnership program with industry, OSHA has recently expressed its support for the prudent exposure limits for building insulation installers that manufacturers have recommended – and followed - for years.

Initial concerns arose over some of the findings from early animal tests where massive doses of fibers were injected into laboratory animals bypassing natural defense mechanisms. In subsequent studies of worker populations, laboratory animal inhalation testing, and research into the solubility of glass fibers, those questions about fiber glass effects have been answered and the products proven safe.

Similar health questions have been raised by scientists and workers about blown-in cellulose insulation, but the response of cellulose insulation manufacturers has been to steadfastly ignore it, or in some cases, to both increase their criticism of the fiber glass industry and their use of scare tactics about fiber glass

products. Installers should instead be more concerned about the unknown effects of exposure to a material whose manufacturers consistently refuse to test for possible hazards.

A product's raw materials source and its hazards are two distinct attributes. Calling their product "natural" does not excuse the cellulose insulation industry from their responsibility to determine the safety of their products and to develop safe work practices. Cellulose insulation consists of chopped, bleached, and processed fibers plus adhesives and inks from printing, and 20% *artificially* added fire-retardant chemicals with known health hazards of their own. Applegate misleads the marketplace both by referring to cellulose insulation as a "natural" product and in inferring that its product has no hazards.

**Applegate:** "It is a little known fact that even properly installed loose-blown fiberglass attic insulation can lose up to 50% of its R-value under certain conditions."

**Fact:** Testing by Oak Ridge National Laboratory (ORNL)<sup>9</sup> and individual manufacturers has defined the performance of fiber glass attic insulation at a full range of temperatures. ORNL confirmed that at moderately cold temperatures, the R-value of fibrous insulation actually increases. At extreme temperatures below zero (F), the R-value of low-density fiber glass blowing wool products can be temporarily reduced up to 35-50% due to the onset of natural air convection. However, to assess the real-world impact of attic convection, ORNL then modeled the annual effect in 27 U.S. cities across all climate areas. In a cold climate area like Chicago, additional energy costs due to convection were projected to be about \$0.003/sq.ft. at the R-38 level, or \$3.00 per year for a 1000 sq.ft. attic. In cities like Memphis, Atlanta or any other milder climates, there was no effect whatsoever. Also, it should be noted that fiber glass batts showed no effects from convection at even the coldest temperatures tested.

**Applegate:** "Overblowing results when contractors blow in fiberglass to the depth listed on the bag label but cover a larger area than prescribed. The fiberglass is fluffed with too much air. In these instances, the labeled R-value is not achieved because too little fiberglass has been installed. Put simply, overblowing is under-insulating. The customer doesn't receive the R-value they paid for."

**Fact:** Like all materials and products in a house, insulation requires proper installation for it to work as it is designed. Fiber glass products come with coverage charts that spell out exactly how much material is required to insulate a given area. Some blowing machines can be adjusted to overblow fiber glass loose-fill insulation to some extent if the installer chooses to disregard the manufacturer's coverage instructions and installs the material to the minimum thickness only. Some blowing machines install the required insulation at the minimum listed thickness while others require slightly more thickness. With a little care by the reputable contractor, who should be held to a workmanship standard by the builder, the correct attic R-value is ensured. Installers are required to leave a signed receipt or attic card confirming that the right amount of material was installed.

Cellulose insulation is certainly not the solution, because an unscrupulous or careless contractor can misapply it as well. Because regular cellulose loose-fill settles 20% or more after installation, and even chemically "stabilized" cellulose settles to some extent, the initially installed thickness of insulation may not be sufficient to provide the correct R-value once settling has occurred. Extra thickness must often be installed to ensure the correct long-term R-value.

**Applegate:** "Studies at universities, national laboratories, private research facilities, and hundreds of homes and buildings have shown that cellulose is from 20% to 50% more effective than fiberglass."

**Fact:** There is no body of evidence that cellulose insulation is more effective than fiber glass insulation.

**The 20% number probably refers to the conclusion of a technically flawed demonstration at the University of Colorado School of Architecture and Planning that has been criticized by industry and independent authorities for comparing two test structures with different R-values and only partially finished walls.<sup>10</sup> The 50% number probably refers to the ORNL attic tests<sup>9</sup>, which as discussed above, have no significance for most climate areas. We have no idea where studies of “hundreds of homes and buildings” supporting cellulose are, but we do know of many field and laboratory tests where fiber glass insulation performed well. In the right application, either product type can be an effective insulation, but fiber glass insulation has a proven track record with repeated performance documentation.**

**Applegate:** “Cellulose contains from 75% to 85% post-consumer recycled newsprint. Fiberglass products contain from 0 to 35% pre-consumer recycled glass. Cellulose insulation has a considerable environmental advantage.”

**Fact: Johns Manville’s fiber glass product line has been independently certified to contain a minimum of 25% recycled glass, of which at least 18% is post-consumer glass.<sup>11</sup>**

**While a typical cellulose product has a higher recycled percentage, when analyzed more carefully, cellulose really doesn’t have an environmental advantage. Comparing insulation options in a typical house, cellulose insulation brings more pounds of non-recycled materials into the building due to its greater installed weight and 20% chemical loading. Fiber glass is a more resource-efficient insulation. Furthermore, cellulose insulation robs newsprint from the recycling stream so that more virgin timber is required for paper production. In contrast, most of the material recycled in Johns Manville fiber glass is 3-color mix glass cullet that cannot be reused in bottle production.**

**Applegate:** “Manufacturing fiberglass insulation for a home consumes six times more energy than manufacturing cellulose insulation to insulate the same home to the same R-value.”

**Fact: The “six-times more energy” estimate appears to be way off base.**

**Valid life-cycle methodology for comparing “embodied energy” or other environmental impacts of products requires the consideration of raw materials. The embodied energy of cellulose insulation includes the energy-intensive paper mills and chemical plants, plus fuel burned in transportation of the heavy materials. Once this is factored in, the energy comparison between cellulose and fiber glass changes dramatically. (Remember that with either insulation type, the energy saved once the product is installed in a building quickly outweighs the energy expended in manufacture, for a huge net benefit.)**

## References

- <sup>1</sup>Christian, J.E., and J. Kosny, "The Whole Wall Thermal Performance Calculator-On The Net", Conference Proceedings, Thermal Performance Of The Exterior envelopes Of Buildings VII, December 6-10, 1998.
- <sup>2</sup>Manville Building Insulation Technical Data Bulletin FGBI-39, Reprinted May 15, 1992, Sprayed and Blown Sidewall Insulations vs Batts
- <sup>3</sup>R.H.Neisel, "A Study Of The Effects Of Insulation Gaps On Building Heat Losses, Final Report", November 7, 1979, Johns-Manville Sales Corporation, Prepared For The United States Department Of The Navy, Civil Engineering Laboratory, Naval Construction Battalion Center
- <sup>4</sup>Energy Design Update, Vol. 20, No. 2, February 2000, "New Tests Show Cellulose Insulation Increases the Fire Resistance of Walls"
- <sup>5</sup>Final Report Survey On Fires Involving Cellulose Loose-Fill Insulation, Project No. 13220-94648, October 29, 1993, Omega Point Laboratories
- <sup>6</sup>International Residential Code for One- and Two-Family Dwellings, January, 2000, International Code Council, Inc.
- <sup>7</sup>Results of Fire Resistance Tests on Full-Scale Insulated and Non-Insulated Gypsum Board Protected Wall Assemblies, 1996, Research Highlights, Technical Series 96-212, National Research Council Canada, National Fire Laboratory, CMHC-SCHL.
- <sup>8</sup>"Health & Safety Aspects of Fiber Glass", HSE-64C, May, 1999, Johns Manville
- <sup>9</sup>Wilkes, K.E., P.W. Childs, "Thermal Performance of Fiberglass and Cellulose Attic Insulations", Conference Proceedings, Thermal Performance of the Exterior Envelopes of Buildings V, December 7-10, 1992.
- <sup>10</sup> Review of paper "Fiber Glass vs. Cellulose Installed Performance (S. Boonyartikarn and S. Spiegle, 1990) by D.W. Yarbrough, 1996
- <sup>11</sup>Scientific Certification Systems, Oakland, CA