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[From the Associate Director](#)

[Sick building syndrome](#)

[Rural Wisconsin](#)

[Training vision](#)

[UW projects](#)

[Solar air collectors](#)

[Commentary](#)

[Next article](#)

[Contents](#)

Spring 2000 Vol 5 No 2

article **2** of 7



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[home](#)

## e<sup>2</sup> Newsletter

**Lessons learned:**

# 'Sick Buildings'

**provide clues to keeping energy efficiency dry**

**By Teresa Paprock**

"Horror stories," Dave Osborne calls them. And he's got plenty.

The South Area Vice President of the Wisconsin Builders Association is talking about some really scary stuff: brand-new homes with walls that rot away; electrical outlets that drip water; trapped molds and gasses causing inhabitants to become sick. A big villain here is moisture—a problem the Energy Center of Wisconsin is helping to solve (more on that later).



People have been building dwellings for thousands of years. So what's the problem now? Well, strangely enough, it all started with the best of intentions.

The fuel shortages of the 1970s made builders very aware that they needed to find ways to conserve energy. So, they "tightened up" buildings. Insulation was added, walls got thicker, and ventilation decreased. Vapor barriers were added, trapping moisture inside. The drafty buildings of yesteryear were replaced by these supertight structures. Heat stayed in, but so did moisture and contaminants that used to escape through the drafts.

Sure enough, energy use decreased. But before long, people began to complain to health-care providers about a litany of symptoms: headaches, nausea, dizziness and fatigue, nose and eye irritation, sore throat, sensitivity to odors, and difficulty in concentrating. Eventually the problems were traced to residences and workplaces that were lacking in proper ventilation, and maybe complicating factors—chemical contaminants (from cleaning compounds, carpeting, and so on) and biological contaminants (viruses, bacteria, and especially molds). Of course, in some "tight" buildings, these elements are trapped indoors, causing heightened problems for inhabitants.

When health problems cannot be traced back to a single overriding cause (such as a gas leak or asbestos), the building is said to have sick building syndrome.

The problem is widespread. "One statistic says that 50 percent of the houses built in the last 10 years in Minnesota have mold or rot," says Osborne, who's also with ConServ Products in Oregon, Wisconsin. These are major factors in sick building syndrome. Unfortunately much of the damage is inside walls, behind paneling, or under siding, where it can escape detection for a long time.

Many lessons have been learned over the last few years. Now we know that energy efficiency is possible without forsaking proper ventilation. Unfortunately, a lot of homebuilders aren't getting the message. They're still using outdated methods of keeping warmth inside, so that moisture is trapped, mold grows, walls rot, and people get sick. "Moisture is the mother of many medical evils," says UW-Health/Physicians Plus allergist Dr. John Ouellette.

Dr. Ouellette deals with the effects of sick building syndrome. Even though the allergens in such dwellings can certainly affect people who are already sensitive to these substances, "you don't have to have allergies to be sick," he explains. In fact, according to Dr. Ouellette, a hallmark of sick building syndrome is that it affects a sizeable percentage of people—at least 20 percent of workers in a workplace. Many of those individuals might not suffer from allergies per se.

That type of observation isn't possible in a private residence, however, where there may be only one or two people, Dr. Ouellette points out. If you're sick in solitude, it becomes harder to recognize your home as the culprit. And in a workplace, people may collectively complain and demand a solution. This might not happen in a private residence.

Dr. Ouellette mentions the truly shocking example of the Tri-State Homes, which were the subject of a Governor's Task Force in 1987. These 2,700 "pre-fab" homes, manufactured by Tri-State in Mercer, Wisconsin, were scattered all over the Midwest. Inhabitants began complaining of nasal congestion, wheezing, shortness of breath, and burning of the eyes and throat. Poor ventilation was eventually discovered to be at the root of their problems. What's more, parts of the homes were rotting away invisibly.

"One state employee wanted to put a wood stove in his house," says Dr. Ouellette. "He took off the siding, and the house was black and rotten underneath. His wife and child had been sick all the time." A double-blind study found the homes had higher humidity; higher levels of carbon dioxide, formaldehyde, nitrogen dioxide, and airborne particulates; and higher fungal counts than similar homes in a control group. A significant percentage of inhabitants complained of health problems, compared to those living in the control group houses.

Which brings us to what the Center is trying to do about it. The Center is in the process of some important research—the Moisture Measurement Protocol, the results of which will pave the way toward drier, healthier homebuilding in the future. A test house at Highway T and Thompson Drive on Madison's east side has been fitted with 125 moisture probes, and will be monitored nine months to a year starting in June by the Center and Oak Ridge National Laboratories. Researchers hope to determine

what factors most affect the amount of moisture in walls.

"You can put a vapor retarder on the inside wall, which will prevent moisture from being driven out into the wall," says Center project manager Craig Schepp. "But you still have to deal with interior moisture gains." The biggest problem here in Wisconsin, he explains, is not the kind of moisture that comes from rain, but rather the kind of moisture that's caused by condensation when the indoors-side of exterior walls is warmer than the outdoors-side. This occurs when the heat is on during the winter months, and is exacerbated by cooking, bathing, and so on.

The electric probes are inserted into exterior wall studs and sheathing throughout the house. Among the variables to be considered: wall orientation, rain effects, story (ground level or above), proximity to windows and electrical outlets, use of the interior space, and overhangs. The probes will be wired together to feed into a single data storage device. "The house will be unoccupied, and we'll be using humidifiers to make it as humid as possible to test worse-case conditions," says Schepp.

Builders have plenty of options already for building healthy, comfortable homes. For example, Osborne talks about using a thin exterior wall with Styrofoam brand sheathing that provides better, drier insulation than thick walls. Better air ventilation and exhaust systems are being developed.

The Moisture Measurement Protocol research will be another piece in the puzzle. It will help builders understand effects of moisture on durability, temperature control, and structural integrity in residential wall systems. The findings will promote the design of homes that are energy efficient and well ventilated. To your health!

For more information about the Moisture Measurement Protocol project contact Craig Schepp at 608.238.8276 x116, [cschepp@ecw.org](mailto:cschepp@ecw.org).

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