CCHC Operations Suspended

As was mentioned in the spring issue of Cold Climate Housing News, the grant that created the Cold Climate Housing Center in 1986 will be exhausted this summer. While numerous funding proposals have been submitted to potential private and public sources, only a few small projects have been funded at this time. Therefore, the Center has developed procedures for a systematic shutdown.

We remain hopeful that future funding would allow us to rejuvenate many of the programs and services of the Center. However, at this time, a number of services will cease until additional funds can be sourced.

For instance, this will be the last newsletter you will receive. While a subscription-based newsletter may be considered in the future, as things now stand we will not have the staff to produce additional issues.

Another part of the Center's outreach effort that will be suspended is the Annual Summer School for Building Trades Educators. This comprehensive "train-the-trainer" course has been an important vehicle for getting information on new building technologies to the builders of the future.

Undoubtedly one of the greatest losses will be the Winter Workshops for Building Professionals. Since its inception, this winter workshop series has reached over 1,000 building professionals with the latest information on insulation, air-tightening, moisture control, ventilation, heating and cooling systems, and indoor air quality.

While the CCHC publications will remain available through the Minnesota Extension Service Distribution Center for several months, the development of new publications and updating of existing material will be largely curtailed. A few new publications are planned for release over the next year.

Finally, we will maintain only a skeleton staff in the near future for handling phone and letter inquiries. We will do what we can to respond to future requests for information, including referrals to other potential resources.

In conclusion, I want to take this opportunity to recognize and thank the tremendous faculty and staff of the Cold Climate Housing Center.

Continued on page 3.

Videotape Series Becomes A Reality

After 18 months of planning and preparation, the Cold Climate Housing Center's videotape series on energy-efficient construction and managed ventilation is at last becoming a reality. Having worked intensively with CCHC specialists to prepare the scripts, Teddi Barron, CCHC Education Specialist, is now overseeing the filming and production of the tapes. David Burghardt of Creativision Film and Television is the producer and director for the videotapes which are being shot on location in Scandia, Lino Lakes, Woodbury, and Lake Elmo. Among Creativision's credits are a 5-part energy series for Georgia Public Television; training videos for Continued on page 6.
The Winter Workshop series has been one of CCHC's premier technology-transfer programs, bringing building professionals and CCHC staff together annually to discuss topics in cold climate housing. An extensive evaluation program was designed and conducted in conjunction with the third annual Workshop series, which was held in seven sites across Minnesota during the winter of 1989-1990. The focus of this workshop was to encourage builders to consider new approaches in the design and installation of ventilation systems and the construction of foundations. CCHC instructors identified specific methods that could improve the reliability and function of ventilation systems and foundations. Some of the recommended changes included: discontinuing the use of atmospheric combustion for furnaces and hot water heaters; having the HVAC contractor size and install ventilation equipment; installing exterior foundation insulation; and using techniques to control moisture and/or reduce radon entry through the foundation and slab. In all, there were 13 recommended changes in building practices.

The CCHC believes that a successful educational program brings about an actual change in behavior. Measuring the long-term success of the workshop in changing building practices included a two-phase evaluation. The first phase involved asking builders immediately following the workshop whether they expected to increase the use of some or all of the practices emphasized by the CCHC instructors. In the second phase, participating builders who had indicated that they expected to make changes were contacted by phone the following winter and asked whether they actually made those changes in their building practices during the construction season.

The practices most readily adopted by builders included: providing specific openings for kitchen and bath fans, installing a continuous air barrier through the rim joist assembly, and using an aggregate bed under the entire foundation slab. If builders didn’t make use of a particular method that they initially thought they might, they were asked why. The principal reasons given were: that the change was recommended but the customer was not willing to pay for it; that only a few houses were completed in the previous season, or that most of the builder's work was in remodeling; that the subcontractor did not feel comfortable in implementing the change; and, the builder did not remain convinced of the importance of the particular change in practice.

### Implications

The results of this evaluation indicate that educational programs like the Winter Workshop are an important part of stimulating changes and improvements in the construction of cold climate housing. It also illustrates that convincing builders of the importance of a particular practice is only part of the behavior change process. Builders in turn serve as consumer educators about the importance of various practices in building a safe, reliable house. CCHC recognizes the importance of raising consumer awareness and has directed efforts to educate consumers on the key attributes of a well-functioning cold climate house. These efforts include a large collection of CCHC publications, demonstration projects of energy-efficient houses, consulting efforts, and consumer sessions offered along with the 1990-91 Winter Workshop series. Evaluation efforts, like the one described, have been a critical component of many CCHC programs and have served to identify on-going needs to meet the challenge of providing safe, durable, and energy-efficient houses in cold climates.
Cold Climate Housing Statistics

Since 1986, the Cold Climate Housing Center has provided information and services to thousands of building and housing professionals. The Center's primary audience has been the state of Minnesota and the upper midwest region, but individuals throughout the nation have been reached as well. And while most programs have been tailored toward professional builders and educators, homeowners and consumers have also been assisted on a regular basis. Following is a summary of CCHC's involvement in various activities over the years.

Workshops and Seminars
- 35 builder workshops and training sessions have reached 1,014 building professionals.
- Three, week-long summer schools for building trades educators have been attended by more than 90 instructors.
- 504 extension agents and housing educators have received in-service training during 11 workshops. At least 36 programs statewide reaching 1,000 consumers resulted from one such in-service.

Publications, Newsletter and Videotapes
- 21 factsheets and publications have been developed and published, with more than 85,000 copies distributed.
- A quarterly, 8-page newsletter is sent to approximately 6,500 building professionals, housing educators, and consumers.
- A 14-minute videotape showing the "hidden details" of a model home's construction was produced and has been used by building trades instructors.
- In conjunction with the University of Minnesota Department of Mechanical Engineering, three video programs on kitchen exhaust systems were produced.
- Currently under development is a 12-part videotape series promoting the construction of energy-efficient, healthy, comfortable, and durable houses (see article on page 1).

Computerized Literature Database
- A bibliographic database of more than 2,600 citations on topics related to cold climate housing can be searched by author, title, and keyword.

Other Activities
- In 1990 CCHC received the Minnesota Extension Service Issue Team Award in recognition of outstanding contributions by an interdisciplinary team addressing an issue important to Minnesotans.

CCHC Operations
Continued from page 1.

They should take great pride in knowing that they have advanced the cause of energy-efficient homes in Minnesota and beyond. They have successfully carried out the CCHC mission of promoting energy-efficient housing design, construction, and operating practices which ensure an affordable, durable, comfortable, and healthy living environment for owners and occupants, and which benefit the environment and economy of the Upper Midwest. While in many ways we have just begun, we rest assured that the momentum begun through this effort will have a lasting impact on the building industry and the citizens of this cold climate region.

Cold Climate Housing News is a publication of the Minnesota Extension Service. All requests to reprint or abstract any portion of this newsletter must be submitted in writing to the Cold Climate Housing Center.

If you have questions or comments regarding this newsletter, contact:

Linda Y. Yun, Managing Editor
Cold Climate Housing Center
203 Kaufert Laboratory
2004 Folwell Avenue
University of Minnesota
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Are you moving or receiving duplicate mailings? Please send your name and address, with any corrections, to the address above.

Thank you.
The House Doctor

The intent of this column is to discuss issues or problems currently being encountered by contractors, builders and consumers in building and maintaining homes in cold climate regions.

Up In Smoke:
The Failure Of Chimneys Is No Illusion

Stan Wrzeski, Housing Technology Consultant

This summer CCHC will be publishing a report explaining the problems associated with chimneys (and atmospheric combustion) in homes. This article highlights some of the issues to be raised in that report.

The chimney is a venerable icon. As children, our first caricature of home probably included a slightly-askew chimney and a crayon line of smoke. Indeed, the soothing vision of smoke emanating from a chimney figures prominently in the CCHC logo on the cover of this publication. Unfortunately, there is increasing evidence that chimneys don't work -- not only in newer tightly-constructed homes, but also in older homes that have undergone substantial envelope or mechanical system modifications.

How A Chimney Works
A chimney operates much like an exhaust fan. However, instead of using electro-mechanical energy, it uses the energy of rising hot air. Older furnaces lose much of their energy up the chimney. This excess heat helps make the chimney work like a very strong fan -- strong enough to draw outside air into the home whenever the furnace fires.

Higher-efficiency furnaces send more heat into the living space, leaving less heat in combustion byproducts. A chimney won't draft properly. These high-efficiency furnaces require a small fan to push the low-temperature combustion effluent through the vent pipe and to the outdoors.

How A Chimney Doesn't Work
Today's homes aren't just tighter. They have more exhausting devices: larger fans, laundry dryers, downdrafting range ventilators, central vacuum systems, even induced-draft furnace blowers. These exhausting devices can easily overwhelm the small forces necessary to make a chimney work properly. The 4-inch water heater flue may be the largest opening in a home's envelope. Whenever an exhaust fan is used, the flue is a convenient source of make-up air (the air brought in to "make-up" for exhausted air).

Even without exhaust fans, there is a natural negative pressure (suction) in the basement due to the "stack effect" of rising warm air in the home. Even greater pressures are generated within the loose-fitting return-air duct panning of most furnaces. Whenever the blower runs, the "leaking" suction in the return-air duct creates additional suction in the basement.

More exhausting appliances, stack effect, and leaky return-air ducts all increase the likelihood that air will be drawn down the chimney flue, a dangerous condition called "downdrafting."

Fireplaces
Fireplace chimneys are typically larger than those used by space- and water-heating equipment. In fact, a large fire can create pressures exceeding those of a furnace blower. However, a wood fire which is just starting or just drying -- the time when incomplete combustion is most likely to generate toxic effluents -- can be easily downdrafted by a larger exhaust fan.

Homeowners unwilling to forgo the aesthetics of a fireplace should be told of the likelihood of downdrafting if larger exhaust fans are operated. A direct-vent, gas-fired fireplace is safest. For more typical fireplaces, specify ducted outside combustion air and tightly fitting fireplace doors.

The Human Costs
When a chimney downdrafts, moisture and toxic combustion byproducts are drawn into the living space. Low levels of toxic effluent may not cause death, but rather more subtle symptoms such as headaches, fatigue, or increased respiratory infections. The cost of living in such conditions, which may never be diagnosed by a physician, is inestimable in terms of lost productivity, increased health care costs, and lives of reduced satisfaction.

Delivery System Problems
Building scientists can calculate the conditions which will cause a chimney to downdraft. Unfortunately, these calculations are not a practical design tool because it is impossible to predict the envelope leakage and pressures generated within the home until construction is completed.

Furthermore, house pressures
The 'Sick House' Investigation Reviewed

Sylvia Fuoss, Design, Housing, and Apparel

"The house I built is killing my family, and I need to know why."

In March 1990, these words began the investigation by a CCHC task force into indoor air quality (IAQ) problems of an energy-efficient, mechanically-ventilated, owner-built home in the metro area. The task force included an industrial hygienist, a mycologist, and a soil scientist from the University of Minnesota (U of M), an engineer from the Minnesota Department of Health, four CCHC specialists, a private IAQ contractor, and the coordinator, a U of M doctoral housing student. In spite of numerous tests which ruled out structure-related contaminants, the task force could only conclude with some opinions on the cause of the family's problem. In addition, there was a new awareness for the complexities and expense of IAQ investigations in the private home. Further study is probably not possible since the house has been sold.

During the time they lived in the house, the family experienced bleeding problems, and flu-like and central nervous system symptoms. These included nausea, dizziness, vomiting, diarrhea, short-term memory and attention span loss, skin rashes and small holes in the bottom of the feet, among others. These symptoms are consistent with exposure to a variety of environmental toxins. Since leaving the home, in March 1990, the family's health has slowly improved. The family's dog also experienced health problems while living in the house. The dog briefly improved after the family moved, but since then has been euthanized.

Task force members assessed the linkage between building systems and the indoor air quality in this house, and recommended staged testing to identify possible pollutants. Tests targeted carbon

Continued on page 7.

change over time. Is it reasonable to expect that a homeowner will arrange for a recalculation of their house pressure whenever they purchase a new exhausting appliance or replace windows and doors? Who will do these calculations? And will building permits be required to verify that they're done?

The Economics of Eliminating Chimneys in New Homes

A sealed-combustion furnace typically costs $200 more than an atmospheric combustion furnace. A power-vented water heater will cost $200-300 more than an atmospheric combustion unit. (Specify a unit with a spark ignition. A standing pilot may be extinguished if outside air backdrafts the vent pipe.)

This $400-500 additional cost will be offset by the savings of $150 for a Class B chimney assembly which is no longer required. So the additional incremental cost of eliminating atmospheric combustion space- and water-heating equipment is around $400.

Homeowners will easily recoup the additional cost in the first 2-3 years of occupancy through energy-savings alone. In addition, the lifecycle costs associated with a chimney penetration through the roof (a source of flashing water leakage) and the thermal envelope (a source of heat loss) are avoided. There's also the substantial benefit of eliminating a chimney chase which occupies valuable floor space in the living area.

Chimneys are undependable. The home is a dynamic environment in which air pressures may vary due to weather conditions and changing lifestyles. Homes retain their value because of their ability to accommodate changing households or lifestyles. The chimney in a modern cold climate home is intolerant and cannot accommodate the very changes that allow a home

References


Oatman, L. 1990. Carbon Monoxide Concerns in Cold Climate Houses. Cold Climate Housing Center, University of Minnesota (publication NR-FO-3887).

Burger King, IBM, and Lanier; and syndicated programs for Sports Illustrated Productions.

The 12-part videotape series focuses on the house as a dynamic, performing system. Building science principles and how-to techniques of airtight construction and managed ventilation are emphasized. More than 150 construction shots and 70 graphics will be included. Primary construction is being supervised by John Fick of CCHC who is working with builder-owner Duane Lee. Other cooperators are Meridian Homes; Hans Hagen Homes; Energy Conservatory; Shelter Supply; Quality Insulation; Advanced Certified Thermography; Minnesota Department of Health; and Ron Weber.

The tapes are targeted primarily toward contractors, project managers, supervisors, subcontractors, and crews. However, one tape is designed for consumers of new homes. Following are descriptions of each videotape:

- **Consumer Video**
  This 30-minute video shows consumers how to select a new house that is energy-efficient, healthy, comfortable, and durable. A lively approach is used to present the concept of the house as a performing system. Building science principles and recommended construction features are presented in an easy-to-understand format.

- **Cure for the Common Callback**
  Targeted for the general contractor or project manager, this 15-minute tape addresses the primary causes of costly callbacks--overlooked airtightening details and inadequate ventilation. Through a light, non-technical approach, the systems approach to building effective homes is introduced. Systems approach builders and their clients discuss their experiences.

- **The Ins and Outs of Building Science**
  Interactions that occur in a house system are guided by certain building science principles. In this 20-minute video, project managers and others will learn how heat, moisture, and pollutants move and how their movement impacts house performance. Transmission; airflows; diffusion; and temperature, pressure, and vapor concentration differences are discussed. Graphics and demonstrations are used to visualize the principles. And common callbacks and recommended systems approach construction features are presented to illustrate the problems and solutions.

- **Performance Indicators for New Houses**
  This 9-minute video introduces builders and interested consumers to tests used to indicate house performance: blower door, infrared thermography, flow hood, and backdraft test. It provides an informal look at what these tests can show and what the results can indicate in terms of a house's energy efficiency and ventilation effectiveness.

- **Systems Approach to Envelope Design**
  Basic design issues related to building an energy-efficient, durable house envelope are presented in this 10-minute tape. Building shape and orientation, room and window placement, and landscaping are discussed. Specific envelope components are detailed as well: insulation, air barrier, vapor retarder, weather barrier, windows and doors, and ground moisture and soil gas control systems.

- **How to Install an Air Barrier and Insulation at the Rim Joist**
  This 4-minute video will provide step-by-step instructions for improving the rim joist--commonly the leakiest area of the wall system. Builders and crews will learn how to improve thermal integrity and airtightness at the rim joist.

- **Airtight Sealing of Wall and Ceiling Penetrations**
  This 15-minute "how-to" video will give crews step-by-step instructions on 12 different airtight
sealing installations such as electrical outlets, wall intersections, windows and doors, tub/shower units, soil stacks, and attic scuttles. Poly, interior strapping, and airtight drywall approaches will be shown.

- **Raised Heel Truss**
  Step-by-step instructions will be given to crews in this 3-minute tape which describes a technique for preventing condensation or ice dams at the overhang. Achieving a high R-value, preventing airflow through the insulation, and maintaining attic ventilation are explained and demonstrated.

- **The Basics of Ventilation**
  Project managers and ventilation installers will be introduced to basic ventilation design issues in this 14-minute tape which uses graphics to illustrate concepts. Recommendations for basic ventilation requirements are presented along with various types of systems and discussions about how, when, and where to ventilate.

- **Air Handling Principles**
  This 6-minute continuation of the Ventilation Basics tape covers the rudimentary aspects of how fans work and how ducts effect air movement. Fan rating, airflow rate, and static pressure are defined. Duct resistance to airflow is discussed and depicted with demonstrations of system performance under different fan and duct combinations.

- **How to Install Ventilation Ducts**
  Aimed primarily at ventilation installers, this 5-minute "how-to" tape will provide step-by-step instructions on effective duct layout and installation, with a focus on proper sealing and insulating.

- **Noise Reduction for Bath Fans and Range Hoods**
  This 5-minute tape will show ventilation installers how to install fans and hoods to minimize noisy operation and thereby encourage use by homeowners.

The series will be completed in September, but plans for distribution have not yet been finalized. For more information, contact Teddi Barron at 612/624-2767.

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The 'Sick House'

Continued from page 5.

monoxide from combustion appliances, hydrogen sulfide from sewer gas, mercury from biocides in paints, arsenic-derived gases possibly from improperly processed wood preservatives, formaldehyde from consumer products, pathogenic gases from some rare molds, pesticide residues in water moving into the sump, and volatile organic compounds from several sources.

The tests identified no serious contamination in the house from these sources, although they did show traces of volatile organic solvents usually not found in significant amounts in an unoccupied dwelling.

Satisfied that the source of the problem was not in the house, the task force began to look more carefully at the site around the home. The group was interested in testing whether or not the source of the problem was related to a nearby wetland adjacent to an industrial dump-site, which was known to have polluted the groundwater in the area. They reached consensus in developing a hypothesis suggesting a semi-volatile toxic chemical from the dump may have been dissolved by a volatile organic solvent and carried through an existing groundwater plume into the wetland and eventually to the house. It was discovered that testing for these classes of chemicals is expensive and difficult to arrange. Lack of a funding source prevented a complete test of the hypothesis. Cost of one possible round of tests, for instance, was estimated at $4,500. Scheduling access to the specialized laboratory with the proper equipment was not accomplished before availability of the materials was lost when the house was sold. On the advice of legal counsel, full disclosure of test results was provided in the sale.
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<td>CD-FO-3569-D</td>
<td>Exterior Wall Airtightness/Air Barriers/Vapor Retarders</td>
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<td>HE-FO-3722-C</td>
<td>Performance of Downdraft Kitchen Range Exhaust Systems</td>
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<td>HE-FO-3713-C</td>
<td>Performance of Kitchen Range Exhaust Hoods</td>
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<td>HE-FO-3725-D</td>
<td>Residential Kitchen Ventilation</td>
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<td>CD-FO-3566-C</td>
<td>A Systems Approach to Cold Climate Housing</td>
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<th>Also available are two video tapes on range exhaust systems (call the CCHC for more information on obtaining these):</th>
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<tr>
<td>HE-VH-3593 &quot;Performance of Kitchen Range Exhaust Systems&quot;</td>
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<tr>
<td>HE-VH-3594 &quot;Kitchen Range Exhaust Systems&quot;</td>
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### Please Note:  
Many of these publications are in limited supply, and with the closing of CCHC, their future availability cannot be guaranteed.

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