COLD CLIMATE HOUSING RESEARCH CENTER

CCHRC

Internet Web Site:
www.cchrc.org

Promoting the development and advancement of healthy, durable and economically sound shelter for Alaskans and circumpolar people.

CCHRC REPORT

Volume 6 Issue 1 A publication of the Cold Climate Housing Research Center February 2006

Office Phone: (907) 457-3454
Office Fax: (907) 457-3456

Research & Testing Facility

February 2006

The Cold Climate Building & Infrastructure Research & Testing Facility (RTF) officially broke ground in July and has been making rapid progress toward a planned completion the summer of 2006.

The foundation is designed to be adjustable with a series of 50-ton hydraulic jacks in the event that differential settlement occurs as permafrost degrades. Detailed monitoring of the soils and foundation is being done by GW Scientific. Thermistor strings have been installed in the foundation and moisture probes were installed under and in the backfill beneath the slab to monitor ground water fluctuations.

All ventilation, plumbing and electrical rough in is complete in the office wing. The CCHRC office walls on the top floor are completely insulated and sheet rocked. In- floor radiant heat tubing is installed under 1.5 inches of concrete. Permanent heat will soon be warming the east office wing.

Masons have begun constructing the Masonry Heater on the main floor of the office wing. The estimated total weight of the masonry and local river rock is about 12,000 pounds. Hydronic heating coils are being installed for space heating beyond the range of the radiant heat from the fireplace. Research will be implemented to determine combustion efficiency and potential for biomass as a fuel source in Alaska.

The west wing is totally closed in. The garden roofs over the labs and the clerestory and elevator lobby roofs are insulated and waterproofed. Most of the lab walls are insulated on the exterior with 4" expanded polystyrene foam. An additional 2" of rigid foam will be glued on all exterior walls in the spring. The electrical, mechanical plumbing, heating, and ventilation contractors are just ahead of the sheet rockers. The entire building should be sheet rocked and ready for taping and painting in March.

Skuttle Ventilation System Study in South Central Alaska

John Davies

The Cold Climate Housing Research Center (CCHRC) commissioned John Freeman of *Sunrise Energy Works* to study the Skuttle ventilation technique in new housing in the Anchorage area during the winter and spring months of 2004. This study monitored nine houses in a new subdivision to assess the effectiveness of their Skuttle ventilation systems and compliance with the Alaska Building Energy Efficiency Standard (BEES) ventilation requirements.

The Skuttle system consists of a six-inch duct bringing outside air into the return side of the furnace plenum, thus pulling fresh air into the house when the furnace fan comes on. Either two or three bathroom fans exhaust stale air. Each bathroom exhaust fan had one of three different controls: a manual switch, a dehumidistat, or a timer. The control for each bathroom fan operated independently and none of the controls interconnected with the furnace fan. The bath fans operated a very small percentage of the time, thus, the Skuttle system operated primarily as a "supply only" ventilation system when the furnace fan is on.

This study compared the total effective ventilation rate calculated from measurements in each house to the BEES requirement. Each house in the study has a furnace-fan-integrated supply duct (Skuttle) and bathroom exhaust fans. During the study, motor loggers monitored the runtimes of the furnace and the bathroom fans. These fan runtimes and initial airflow measurements provided estimates of the mechanical ventilation rate in each house. Blower door tests of the houses were used to estimate the natural air leakage contribution. Results were used to calculate the daily averages of the total effective ventilation rate. All of the houses were occupied, and data recorded reflected the occupants' normal living patterns.

The BEES allows for a combination of mechanical ventilation and natural air leakage to provide the required ventilation flow rates. AHFC testing policy excludes air coming through the crawl space and garage in calculating natural ventilation flow rates. That exclusion left an average of 38% of natural air leakage usable for ventilation.

The daily average mechanical ventilation airflow provided by the Skuttle ventilation system, as operated by participants in this study, ranged from 6.4 to 40.8 cubic feet per minute (CFM). The runtime for the furnace fan supply was more significant to the amount of mechanical ventilation than the type of bathroom fan control. The total mechanical ventilation flows alone did not provide the 90 to 140 CFM ventilation rates required by the Alaska BEES for these houses. Homeowners may turn off noisy fans, thereby reducing the contribution of bathroom fans to mechanical ventilation.

Estimates of the natural air leakage contribution to ventilation varied widely. Several participants left crawl space vents open for the study period, while vents were closed in other houses. The air leakage model assumes leakage is evenly distributed throughout the house envelope. If actual leakage is largely in the crawl space and the upper house is relatively tight, then airflow through the upper envelope will be reduced and will be overestimated by the model. Calculations of the daily average total effective ventilation were likely over-estimated for the houses in this study that had crawl space openings. Calculations ranged from 73 CFM to an unlikely high of 657 CFM.

To better assess ventilation effectiveness, several other indoor air quality (IAQ) parameters were monitored for the four-month study period. Measurements of carbon monoxide and benzene levels showed a pattern of garage-to-house pollutant transfer. Carbon dioxide (CO_2) accumulated in bedrooms at night, and decayed slowly. These results support the estimates of relatively low total effective ventilation. They also reinforce the probability that the higher estimates of natural infiltration misrepresent the actual contribution of infiltration to the total ventilation. The pollutant transfer pattern and the CO_2 buildup also indicate that mechanical ventilation is more important than natural infiltration in distributing ventilation air effectively.

If the system design had provided balanced flow by linking the bathroom exhaust fans and the furnace supply, it would have been possible for it to meet the BEES ventilation requirement. Balanced flow is possible with an interlocking control that operates the furnace supply and bathroom exhaust at the same time.

Balanced flow gives better source control for clean supply ventilation air. Exhaust-only ventilation (when just bath fans are on) tends to pull air from polluted crawl space and garage zones and likely increases ventilation needs. Supply-only ventilation (when just the furnace fan is on) tends to drive moisture into walls and ceiling assemblies.

The recommended improvements for the Skuttle system in this study are to provide interlocked control on the furnace supply and bathroom exhaust fans and to switch to low-noise bathroom exhaust fans. This would increase the effective ventilation flow rates with better distribution to bedrooms and give balanced ventilation with cleaner source air.

CCHRC Update — Gail Koepf

So much has been accomplished since our last publication! Bringing the RTF project to this point has required so much time and attention that our former quarterly reporting has fallen behind. To reflect this reality, we have dropped the "Quarterly" from the title and will strive to get reports out as needed. The web site is available at all times and we attempt to keep that updated.

CCHRC held a groundbreaking ceremony for the RTF last July, and as we have reported here, the construction is well on the way to a summer 2006 completion. Our annual meetings were held along with the Alaska State Home Building Association meeting here in Fairbanks in October. At those meetings, we elected Richard Green to the board of directors and reluctantly said goodbye to one of our founding members and original directors—Richard Tilly.

As the RTF construction project progresses, CCHRC is making changes to help it through the coming transition. We are in the process of adding two seats to our board of directors to make a total of 11 directors.

We have added a new staff member to help with our research projects. Cole Sonafrank has joined us in the position of Assistant Research Director and will be helping to keep us organized and our research projects moving along.

The Capital Campaign has attracted sizable in-kind contributions from some of the housing industry's biggest suppliers and also from local Alaskan suppliers. We have also received cash contributions from the Alaska State Home Building Association (ASHBA) and some of their locals along with many individuals. We are very grateful for our many supporters and wish to thank them. Please see our website for a complete listing. Without all this support, the RTF would not be a reality. We hope they take the same pride in the RTF progress as we do. Their generous contributions have also allowed our application to the Rasmuson Foundation for a matching $500,000 to be used for equipment.

CCHRC Special General Membership Meeting called to ratify bylaw changes and elect two new board seats.

The meeting will be held at the CCHRC office in Fairbanks on April 11, 2006 at noon. All members will receive a mailing with further details.

We have also initiated an Industry Advisory Council (IAC) for businesses who wish to have input on the direction of CCHRC research and to establish an ongoing association with CCHRC. We would like to recognize Thermo-Kool of Alaska as our first member at the Corporate level and therefore our first IAC member.

CCHRC plans to move into the new RTF office space sometime this summer and will hold an Opening Ceremony for the RTF on September 23, 2006. We certainly hope to see you all there. Also in the planning process is a Circumpolar Housing Conference to be held in March 2007 during the International Polar Year to introduce the potential of Alaska and the CCHRC Research and Testing Facility to the international housing industry. We have ambitious plans!

If your membership has lapsed, you will find a membership renewal form enclosed. Membership information is also available at our web site.

Message from the President/CEO — Jack Hébert

Science wasn't on the minds of most Interior homeowners last month. The average temperature in Fairbanks was minus 22 degrees Fahrenheit for January 2006 with plunges of sub 50 below temperatures. That cold spell put the need for reliable and durable shelter in perspective for all residents., and they were either grateful for their home's performance or anxiously contending with one of the many things that can, and do, go wrong with furnaces, insulation and plumbing in the extreme cold. No one can deny that Alaska's interior is a good place for perfecting building design, materials and techniques.

Over the past five years, CCHRC has developed strong private and public sector partners across Alaska, the nation and the world. This has resulted in a successful capital campaign to fund the construction of this $5.2 million dollar, world-class facility in Fairbanks.

Currently under construction on the University of Alaska Fairbanks campus, the RTF will be a lab for testing building materials and methods for Alaska's weather—from the brutal cold of the Interior to the relentless rains of Southeast.

The building itself will serve as a model facility using cold climate construction methods and materials. While this is state-of-the-art science and research, the results will be practical and applicable. It will result in better products and better homes. Builders are already incorporating the results of our research to construct better houses. Additionally the research has implications for other cold climates worldwide. If something works well here, imagine how well it will work in Minnesota or at high altitude regions around the world. As our supply of available cheap energy declines, the energy use of the home is one of the biggest challenges to solve. As the concerns about global warming continue to grow, the energy use of the home must be addressed.

With the completion of the RTF construction this summer, CCHRC will have the ideal location and the building and equipment to conduct this necessary research and testing. What we learn from our research will allow more of our neighbors here and around the world to be thankful when nothing happens when the mercury plummets. Nothing except a warm and healthy home!

COLD CLIMATE HOUSING RESEARCH CENTER
P.O. Box 82489
Fairbanks, AK 99708-2489

Phone: 907-457-3454
Fax: 907-457-3456

CCHRC has moved!
Please Note New Address

Internet Web Site:
www.cchrc.org

Come see us at the Home Shows

DATE	EVENT	CCHRC REPRESENTATIVE
Mar. 3-5	**Juneau Home Show**	**Mike Musick**
Mar. 17-19	**Anchorage Home Show**	**John Davies**
Mar. 31-April 2	**Fairbanks Home Show**	**Mike Musick**
Mar. 31-April 2	**Mat-Su Home Show**	**John Davies**
Apr. 8-9	**Kenai Home Show**	**Mike Musick**

Current Project List

Regional Housing Authority Consultation
Health House VOC Monitoring
Combustion Air/CO Study
Strawbale House Monitoring Project
Kenai Indoor Air Quality Study
Frost Protected Shallow Foundation Study
Housing Needs Study
Permafrost Monitoring Study
Mobile Test Lab Study
BEES Study
Cook Inlet Housing Authority Energy Efficiency Study

The CCHRC Report is sent to members, funding agencies and to those requesting information about CCHRC. Response to this report is welcome.

The RAC is appointed by the Board of Directors to advise CCHRC on research projects. Contact a committee member in your area with your input and concerns.

Research Advisory Committee
Regional Chairs

Southeast Marquam George
8752 N. Douglas
Juneau, AK 99801
(907) 586-2060
blu@alaska.com

South Central Bob Lutje
P.O. Box 111646
Anchorage, AK 99511
(907) 345-8861
bob.lutje@acsalaska.net

Interior Mike Musick
P.O. Box 170
Ester, AK 99725
(907) 479-6190
mikemusick@gci.net

Bush John Woodward
P.O. Box 3407
Homer, AK 99603
(907) 235-6560
johnwood@ptialaska.net