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 QUARTERLY REPORT

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CCHRC: This Quarter in Review

CCHRC held a Design Charette (workshop) for the Research and Testing Facility that is planned for construction on the UAF campus. It was attended by 17 local, national & international experts in their fields along with the CCHRC board and staff. The Charette team worked with initial plans developed by Clai Porter of NCP Design/Build and Jack Hébert. The Charette helped focus and prioritize goals for the building as well as providing technical advice and vision. *(see Design Goals on page 2)*

AHFC included funds for CCHRC as part of its 2003-2004 request in the capital budget recently passed by the Alaska state legislature. The budget makes $500,000 available to CCHRC for projects and operations. This funding level will allow CCHRC to continue its mission and to grow toward the goal of being the number one research center for housing in cold climates. Thanks to Dan Fauske for his faith in CCHRC and to everyone else who supported us in this budgetary process.

In May, Jack Hébert gave a presentation of the REMOTE (Residential Exterior Membrane Outside Insulation Technique) to the IABA (Interior Alaska Building Association).

Evaluating Ventilation Systems with Regard to Indoor Air Quality has completed review and a summary is included in this report. The final report, along with other completed reports, is available at our office, at the local state homebuilding offices and at our website.

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

Message from the President/CEO

Dear CCHRC members and supporters:

A Design Charette was a new concept for me when it was suggested during a CCHRC Board meeting as an important tool to address the design of our Research and Testing Facility. A Design Charette brings together a diverse group of participants to explore, understand, and create and evaluate possible and preferred options. A Charette often generates creative solutions to difficult problems in the shortest time. Our Charette brought together 17 local, state, national and international experts with the CCHRC Board and staff. Architects, engineers, builders, planners, specialists, and members of the University and Fairbanks communities were represented. The Charette was held May 30th and June 1st. Everyone visited the site location, viewed preliminary plans, discussed design goals, and then broke into teams to tackle the difficult issues. The enthusiasm of the participants for this process was exciting and

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Design of Cold Climate Housing and Infrastructure Research and Testing Facility

Research & Testing Facility (RTF): Design Goals - The RTF design should:

- Provide office space for CCHRC and outreach to the public with future expansion in mind
- Provide a cold regions research and testing facility for housing and related infrastructure
- Provide a Structural Lab for UAF engineering faculty and students
- Provide a Frost Effects Lab for DOT/PF
- Be architecturally pleasing on a modest budget
- Insure energy efficiency
- Be highly functional and adaptable
- Employ durable components to minimize life-cycle costs
- Employ recycled building materials where possible
- Ensure building impacts be as sustainable as practicable
- Ensure a healthy interior environment
- Attempt LEED certification if practical for Alaska

RTF Update:

During the spring quarter, Geotechnical Analysis of the building site for the Research and Test Facility was undertaken. Three test holes were drilled 40' deep in a triangular pattern around the proposed building footprint. Analysis of the well logs and samples showed no large segregated ice formations. The permafrost table varies from 14 to 24 feet below grade across the site, with an unknown maximum depth. Another test hole was drilled, centered on the building footprint, for the purpose of a Standard Penetration Test (SPT). This quantified the soil bearing capacity and showed it marginal for support of a building like the RTF, and a significant technical challenge for foundation design.

A shallow foundation system was designed, including 4" of foam insulation beneath the slab-on-grade floors of the laboratory buildings and the office building basement. An additional 4" insulation apron will be included 6' out from the slab (8' near the corners). One to three feet of NFS fill containing thermisters, pressure, and moisture sensors will be placed below and around the slabs, at the bottom of this fill. A grid of perforated PVC piping will be placed on 6' centers, extending out at least 12' beyond the footings. The drainage system will be used not only for drainage during the warm months of the year, but will also be used for forced convection cooling using ambient air as necessary during the cold months of the year. No more than a few hundred watts of fan power will be required to drive the forced cooling, and that only occasionally through the winter. The passive aspects of this design far exceed ASCE Standard 32-01, "Design and Construction of Frost-Protected Shallow Foundations," however the climate and soil conditions are far more severe than those for which the Standard applies.

The active aspects of this foundation design are clearly experimental. The idea is to manage the thermal environment beneath the foundation so that the heating front that gets through the insulation each summer is negated by the cool front that is applied using the forced ambient air cooling system in the winters. Only enough cooling will be applied in the winters to keep the soil unfrozen at 32 °F. Deep thermister strings will be installed below the slabs down to the permafrost table, to measure any heat flux as a result of the presence of the building. This should stabilize the permafrost and keep the seasonal frost out throughout the life of the building, assuming that global warming doesn't significantly warm or increase the flow of groundwater off the adjacent west ridge of the University.

But the foundation needs to hold for the worst case. For this eventuality the slabs are being designed with waffle-style reinforcing ribs beneath, to keep the slab/footing system intact during any future major subsidence due to permafrost melting. In that situation the building can be saved through drilling of piles and jacking. Injection of grout or urethane may be necessary beneath the slab during this transient period, as there may be large water tanks in the basement of the office building by that time for seasonal energy storage and/or aquaponics experiments.

In other progress this past quarter, the architectural design was completely revised from a single building concept, to a modular concept with the office building at the head (east end), with laboratory modules to be added around a utilidore spine extending westward. Two laboratory modules are initially planned, one for materials and structures testing at very low temperatures, and one for a Soil Frost Effects Laboratory.

Plans for the summer quarter are to complete the structural, electrical, and mechanical systems design, and to begin construction of the foundation system if construction funding becomes available.

An Investigation of Indoor Air Quality & Ventilation Strategies in New Homes in Alaska

CCHRC Report 2003-001, Authors: Ginny Moore, Phil Kaluza, Alaska Building Science Network – September 2002
Additional Principal Investigators: Marquam George, Steve Wisdom, and Robert Maxwell
Funded by Alaska Housing Finance Corporation, Grant No. 01G11-021

ABSTRACT
Sixty-five homes located in Anchorage, Fairbanks, Juneau and Kenai Alaska, and with a range of ventilation systems, were monitored for carbon monoxide, benzene, temperature, relative humidity and particulates over a 48-hour period. Statistical techniques were used to relate air quality characteristics to variables describing architectural, behavioral and environmental characteristics in the homes.

The project's primary objectives were:

1. To determine if there are significant differences in carbon monoxide, benzene, and relative humidity concentrations in homes with different types of ventilation systems;
2. To determine if different garage/house configurations ("tuck-under", "one wall-attached" or "not attached"), affect carbon monoxide and benzene concentration inside homes;
3. To identify architectural, behavioral and environmental factors that might affect air quality; and
4. To determine if there is a correlation between carbon monoxide and benzene concentrations, so that the simpler, less expensive carbon monoxide measurement might be used as a surrogate for benzene exposure.

Within the limitations of this study, homes equipped with HRVs as a whole-house ventilation strategy had lower concentrations of carbon monoxide, benzene, and relative humidity than either of the other types of ventilation. There was a significant correlation (strongest for homes with tuck-under garages and furnaces) between house and garage concentrations of carbon monoxide and benzene, indicating garages as a strong source for both benzene and CO in the home. Benzene concentrations clearly exceeded the Minimal Risk Level (MRL) in 41% of the homes and probably exceeded the MRL in an additional 14%. Therefore, it is likely that in 55% of the homes tested benzene concentrations exceeded the Minimal Risk Level.

This report is available from CCHRC either in hard-copy (call, email, or write us to request a copy) or elec-

Projects—Current

Building America in Alaska: The Mobile Test Lab (MTL) has been in operation in Juneau for a couple of months and gathering data on wall performance in Southeast Alaska. If you are in Juneau, stop in to view the MTL in operation to see the varied temperatures and humidity in each wall assembly. UAA Chancellor Lind took advantage of this opportunity recently when he had his contractor check out which wall was performing better before they put an addition on his home in Juneau.

CCHRC is currently identifying funds to construct another MTL so wall performance can be studied in another of Alaska's extreme climates.

Other Current Projects:

Healthy House Initiative
REMOTE Study
Combustion Air/CO Study
Infrared Thermography Study
Strawbale House Monitoring Project
Housing Authority Consultation
Health House VOC Monitoring

Current Rendering of RTF—Southeast view

Projects—Proposed or Under Consideration

Development of Product Testing Lab:
Affordable Ventilation Strategies:
Modular Housing in Alaska:
IAQ at Military Facilities in Alaska:

Further Information on all projects available at: www.cchrc.org

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the knowledge gained was invaluable. We hope to keep everyone involved updated on the building so we can call on them with design questions in the future. Thanks to all that contributed and John, Rose and Gail for putting a great event together in short order.

Wayne Mundy, who has been on the CCHRC Board of Directors since November 2001, has resigned due to accepting a new professional position. Wayne was a valuable member of our board with much experience in housing industry as well as a perspective from rural Alaska. We are looking to fill his vacated seat on the board with someone from rural Alaska. Please call our office if you are interested or have someone to suggest. Our thanks to Wayne and best wishes in his new pursuits.

The Bush RAC, under John Woodward's direction as chair, has met several times by teleconference. They are working on a prioritized list of rural building concerns for CCHRC to direct research projects toward.

My thanks to all the statewide RAC members and chairs for their interest and time. Your priorities are ours. We continue efforts to design effective projects that address the issues identified and generate workable solutions. This is no easy task.

I hope your summer has been as beautiful as ours here in Interior Alaska. Take time to enjoy it. Best:

The CCHRC Quarterly 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.

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