Established by the French authorities, the Observatory for Air Quality ("OQAI" in French) aims to develop a better knowledge of indoor pollution, sources and consequences (via measurement campaigns) and to provide adapted prevention and control solutions (professional training, public information, regulation updates, etc.). Between 2003 and 2005, OQAI undertook a national survey to assess the air quality in French dwellings by evaluating 567 dwellings. The results were published in a contributed report in the previous AIR Issue (vol. 30, N°3, June 2009).

Among the analyses undertaken, a specific study on ventilation and IAQ was carried out by a working group which includes various labs and technical centres (CSTB, CET E Lyon, CET IAT, LEPT IAB), as well as public authorities such as MEEDDAT/DHUP (Ministry of Housing), ANAH (housing agency) and ADEME (French environment and energy management agency).

When the first results of the dwelling measurements, which targeted about 30 pollutants, were published in 2006, they clearly showed a specific situation of indoor pollution (including pollutants either not present at all outdoors or appearing in higher concentrations indoors). However, the indoor pollution was not equally distributed in the building stock: 5 to 30% of the dwellings showed above average concentrations. This is the result of multiple pollutant sources (materials, equipment, furniture, cleaning products, human activities, outdoor environment, etc.) as well as of the air change rate in these dwellings. The study focused on this aspect.

The following data are included in the study, in order to characterise the ventilation:
- Visual inspection of the dwellings (ventilation system of dwelling, air inlets and outlets in each room, etc.) and meteorological data;
- Description of occupancy conditions and occupant behaviour via a questionnaire comprising: window opening frequency, bedroom door opening frequency, etc.);
- Measurement of exhaust air flow rate at the outlets;
- CO2 measurements in one bedroom.

![Figure 1 - Distribution of ventilation systems in the French dwellings building stock](image1)

![Figure 2 - Change in ventilation systems installed, by building age](image2)

Continued on page 7
When analysing energy consumption, you will generally want to find the weather station in the location closest to the building you are evaluating. This should give a better representation of the weather at the building than any "reference" station for the larger region in which the building sits.

However, there is an important caveat: many weather stations have missing or erroneous data. This is particularly true of "personal weather stations" (those that aren't ma rked as air ports). The quality of data from these stations varies considerably: some have years of apparently flawless temperat ur e readings, whilst many others have lengthy periods when they clearly weren't working properly.

Degree Days.net has been o program ed to tolerate a certain amount of p roblem data at a ma king estimates where necessary and the n marking each estimated degree-day figure with a "% estimated" value so that you know where the detected problems lie. This works well when a station has just a few days of problem data here and there, but ther e could be a poi nt where Degree Days.net will suggest that you try to find another station nearby.

The airport weather stations tend to go further back in time than those personal weather stations (many of which were set up only recently).

Degree Days.net will generate degree days to any base temperature you choose.

2009 ASHRAE Handbook - Fundamentals

The new edition of the handbook is an important resource for all HVAC&R professionals. Its content covers basic principles, indoor environmental quality, load and energy calculations, HVAC design, building environmental quality, and sustainable design. It has been extensively updated with new content throughout.

Important new material in this volume includes:
- Non-residential Cooling and Heating Load Calculations: New research results on climatic data and heat gains from office equipment, lighting, and commercial cooking appliances.
- Residential Cooling and Heating Load Calculations: Revisions to coefficients to account for new climate data.
- Climatic Design Information: New, extensively expanded data (increased from 4422 to 5564 stations).
- Sustainability: New Chapter: Defining the concept for HVAC&R and describing the principles, design considerations, and detailed evaluation required.
- Thermal Comfort: Revision of technical and office environment studies on task performance.
- Psychrometrics: Revised text on sound rating systems and vibration calculations.
- Ventilation and Infiltration: New, clarifying text on sound ratings, systems, and vibration calculations.
- Insulation and Moisture Control: New, clarifying text on insulation and moisture control.
- HVAC&R professionals' content covers basic principles, indoor environmental quality, load and energy calculations, HVAC design, building environmental quality, and sustainable design. It has been extensively updated with new content throughout.

More information:

http://
Online Standards Actions & Public Review Drafts

The following public review drafts are currently available for review and comment on the ASHRAE website. For additional information or to download a copy of the public review drafts, please visit the ASHRAE website at https://www.ashrae.org.

These drafts are scheduled for a 30-day public review from 1 September to 26 October 2009:

1. BSR/ASHRAE Addendum r to ANSI/ASHRAE Standard 62.2-2007, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings (First Public Review Draft). This proposed change clarifies the requirement that systems must be balanced and not fully ducted. It does not increase mechanical ventilation system flow rates for systems that are balanced and not fully ducted.


4. BSR/ASHRAE Addendum n to ANSI/ASHRAE Standard 62.2-2007, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings (First Public Review Draft). This proposed change extends the duct-tightness requirements to unbalanced systems; and the difference between balanced and unbalanced systems; the difference between ducted and ductless systems; and the effect of mixing. It also increases mechanical ventilation system flow rates for systems that are balanced and fully ducted or systems that are balanced and not fully ducted that have a provision for mixing.

5. BSR/ASHRAE Addendum q to ANSI/ASHRAE Standard 62.2-2007, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings (First Public Review Draft). This proposed change corrects an error in the values of Table 4.2 that were published in Addendum b to Standard 62.2-2007 currently posted on the ASHRAE website. Ventilation Effectiveness is a function of the ceiling height and occupant density (bedrooms per unit volume) of a dwelling. The values in the table are based on a 3-bedroom house with 1764 ft² of floor area and 8-foot ceilings.


The final REVIVAL project brochure, including results and conclusions, is now available
www._______________

The REVIVAL project addresses one of the main challenges facing cities across Europe.

How do we deal with our existing building stock and make it suitable for the 21st century?

Across Europe, numerous tertiary buildings constructed in the post-war, pre-environmentally-conscious era now seem out-of-date and uncomfortable places to work and live. The obvious solution is to replace them with newer versions, often with environmental consequences. REVIVAL represents an alternate approach, using sustainable techniques to demonstrate that existing tertiary buildings can be refurbished economically, with significant improvements in energy performance and provide an environment with high standards of comfort and pleasant surroundings.

Examples of the principles incorporated in the refurbishment include the use of phase change material to improve the thermal capacity, passive cooling systems, innovative ventilation systems, solar shading, improved HVAC against, improve lighting, a double skin façade and the installation of solar thermal and photovoltaic panels.

The lessons learnt from REVIVAL, together with lessons from other refurbishment projects, will be brought together in a Handbook to Sustainable Refurbishment of Non-Domestic Buildings, to be published by Earthscan in summer 2009. It will fill an important gap in the market for information on sustainable techniques in combination with more established methods to improve energy performance and provide an environment with high standards of comfort and pleasant surroundings.

Developing IAQ sensors and network communication systems: Survey on commercial IAQ sensors as a first step
D. Won and H. Schleibinger

There is no doubt that environmental sensors will have an increasingly important role within building automation systems designed to create and maintain energy-efficient, comfortable and healthy buildings. From the perspective of ventilation and indoor air quality (V&IAQ) controls, temperature sensors are currently the most dominant sensor, followed by RH sensors. For the future, more versatile systems featuring multiple sensors such as CO2 and other indoor air quality (IAQ) sensors are desirable for the automated control of indoor air quality in buildings.

For more information, please contact Abena Poku-Awuah at
_______________, or visit
the Revival website
www._______________

For the REVIVAL project supported by the European Commission, five buildings across as many countries were targeted. The buildings span a range of types:

One school:
- Lycée C Hevronnier, Angers, France

Four office buildings:
- Daneshill House, Stevenage, UK
- Meyer Hospital administrative building, Florence, Italy (constructed in 1936)
- The Albatros, Royal Dutch Navy, The Netherlands (constructed in 1972)

All were refurbished using innovative, sustainable techniques in combination with more established methods to improve energy performance and provide an environment with high standards of comfort and pleasant surroundings.

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There are various issues to be resolved regarding more advanced IAQ control systems, including the development of adequate sensors to enable the network communication systems to be connected to systems designed to create and maintain energy-efficient, comfortable and healthy buildings. From the perspective of ventilation and indoor air quality (V&IAQ) controls, temperature sensors are currently the most dominant sensor, followed by RH sensors. For the future, more versatile systems featuring multiple sensors such as CO2 and other indoor air quality (IAQ) sensors are desirable for the automated control of indoor air quality in buildings.

Three IAQ parameters were selected as candidate dates for V&IAQ controls: volatile organic compounds (VOC), formaldehyde and radon, based on the existence of guidelines and prevalence indoors in Canada. Our survey revealed that commercial VOC sensors (< CDN$5.00) are neither sensitive nor selective enough to meet the requirements of developing by NRC-IRC, which include a detection range of 0.1 to 5 mg/m³ and a resolution of 0.02 mg/m³. Most commercial VOC sensors are base d on photo ionisation detectors (PID) and metal oxide sensors (MOS), which perform poorly at differentiating individual chemical alerts unless they are used in arrays of detectors, and which are not suitable to measure the typically low levels of VOCs indoors without any pre-concentration steps.
On the other hand, several COTS sensors were identified as having the potential to measure typical formaldehyde and radon concentrations in buildings. The formaldehyde and radon detectors identified by NR C-IRC have a price range between CDN $1,000 and $7,000, a resolution of 5 to 10 ppb, a detection range between 0 and 1 ppm and a response time of a few to 30 min. These detectors are based on electrochemical or photoelectric photometry. Several COTS radon detectors (real-time continuous digital sensors), which are available for between CDN $300 and $1,100, were identified as sensitive enough to measure typical indoor radon levels. According to the information provided by the manufacturers, they can meet the NR C-IRC requirements, i.e., a detection range between 20 and 5,000 Bq/m³, a resolution of 10 Bq/m³, and a response time of two to 30 min. However, their performance at lower levels needs to be investigated, as the detection range indicated by the manufacturers is very broad, and typical indoor concentration is 10 w (~ 28 Bq/m³ on average in Canada), with a Health Canada guideline of 200 Bq/m³.

The main goal of the test is to determine the applicability of the sensor to V&IAQ control before it is further expanded to a building-scale test. The bench-top and full-scale test will be repeated when the development of advanced formaldehyde sensors has progressed to the National Research Council (NRC-IR). More detailed information on the market survey of COTS IAQ sensors will be available as a NRC-IRC report.

Note:
1. The following five NRC institutes are involved in the project: the Steacie Institute for Molecular Science (SIMS), the Institute for Chemical Processes and Environmental Technology (ICPET), the Institute for Microstructural Sciences (IMS), the Herzberg Institute of Astrophysics (HIA) and the Institute for Research in Constuction (IRC).
2. COTS sensors were identified mainly through Google Search and occasionally through industry literature. Subsequent email and phone contacts to the manufacturers followed when more detailed information was desired.

Industrial Ventilation — The Way to Optimum Performance
V. Krejci and J. Kosner
Brno University of Technology, Czech Republic

When considering ventilation, it is usually the health and comfort-related aspects that cross the mind. This is because people spend significant amounts of their lives indoors, where the amount of fresh air plays an important role in indoor air quality. Local ventilation focuses on air delivery and removal only at the contaminant source. As a rule of thumb, industrial ventilation designers say the air speed drops to a tenth of its initial value at a distance equal to the exhaust opening diameter away from the hood face. The suction effect may be enhanced with various adapters mounted to the duct end. A bell shaped hood, although not amplifying the suction effect noticeably, may lead to substantially lower energy savings because of the reduced entry pressure drop.

The design of an industrial ventilation system usually combines both concepts, depending on the pollution localization. Local ventilation systems are preferred when the contaminant source is close to the point of action, and the air they have to cope with meets the target. On the other hand, local exhaust ventilation focuses on air delivery and removal only at the source of the contaminant. This may lead to a significant operational cost reduction, as much lower air flow rates can be expected. However, one might argue that the result is an energy saving potential associated with total ventilation that can be realized by changing the ventilation strategy from mixing to displacement.

This concept is called total ventilation. Systems integrating this concept maintain the required air quality over a greater part of the ventilated space but do so at a higher operational cost, due to the larger amount of delivered air and rejected air that can cope with the target. On the other hand, local exhaust ventilation focuses on air delivery and removal only at the source of the contaminant. This may lead to a significant operational cost reduction, as much lower air flow rates can be expected.
Another way to reduce the operational cost is to use new technologies such as the Aaberg exhaust hood, named after Danish engineer CP Aaberg.

The device is depicted in Figure 1 along with the flow pattern it generates. The way the hood comibines air supply with extraction causes the flow pattern to become directional; the supplied air constrains the space available for extraction to a hemisphere; and the generated jet entrains the surrounding fluid. This results in an enhanced suction effect that gives the system its other name: REinforced EXhaust System (REE XS). The hood operation depends on the momentum fluxes ratio of supplied and extracted air, denoted as “I”. This ratio has been identified as the hood’s main operational parameter. When around 0.1, the hood-generated flow pattern collapses due to a hydraulic short-circuit flow, meaning the radial jet is completely captured by the extract flow, and thus not present. An optimum value has been identified to lie in the range between 0.5 and 0.6.

Greater values, despite their positive effect on the capture distance, result in a very narrow region where the contaminant may be captured. Despite the fact that the Aaberg hood requires an additional duct and fan, its operation may be beneficial compared to a hood that employs a flange to enhance the suction effect. Figure 2 summarises the performance of the two different hoods.

Figure 2a compares the power input to the particular device that generates air speed of 0.25 m/s or 0.5 m/s at the distance x/d from the hood face where x is the distance (m) and d is the exhaust opening diameter (m). Clearly, a critical distance can be identified below which the flanged hood is energetically more efficient but not significant so. Within this region, both devices operate at rather comparable expenses. The critical distance is about 1.3x/d. By locating the contaminant source at the distance of 2d, the power input and air speed at the hood are plotted against the momentum flux ratio I.

When the Aaberg hood installation is optimised so that the pressure loss of the supply part drops to half of that in the unoptimised case, the figures change a little, as can be seen in Figure 2b. Here, a shift towards a smaller critical distance is depicted. With the critical distance changed from 1.3 to 1, the range of Aaberg hood superiority has broadened.

Figure 2c demonstrates the air speeds at the device when reaching 0.5 m/s at a particular distance. As air speed correlates strongly with noise generation, the chart gives the reader an overview of how noisy the device is in question. Here, the Aaberg hood compares favourably with the flanged hood.

Figure 2d demonstrates the power input of the Aaberg hood to reach the capture velocity of 0.5 m/s at two distances by changing momentum fluxes ratio I. Note that the change in both power input and air speed is moderate; therefore, if there is a need to focus the suction effect and extend the distance between the hood and the contaminant source, the momentum fluxes ratio can be raised, with an acceptable operational cost increase.

Although the Aaberg hood may seem superior to the flanged, it does demonstrate an important drawback: the jet stability. When violated, the jet stability will deteriorate the hood’s performance up to a level that no contaminant is captured. Consequently, the ventilation system design which employs the Aaberg hood is quite elaborate.
Ventilation requirements have evolved over time
Half of the building stock was built before 1967, i.e. before the first regulations requiring whole-house ventilation, in 1969 9.70% of the buildings have mechanical ventilation and 3 natural ventilation installed (ventilation through lower and higher openings in the walls, passive stack ventilation or shunt ducts). Only 1.1% of the buildings have balanced ventilation systems.

Natural ventilation is present in older or retrofitted dwellings, while this system has almost disappeared from new buildings. It is present in 41% of collective dwellings (apartment buildings) but only 29% of individual houses. Mechanical ventilation is equally present around 20% below the desired ventilation rate. Scan dinavian countries have almost disappeared from new buildings. It is present in 41% of collective dwellings (apartment buildings) and 62% too low, respectively.

Ventilation in French Buildings
P. Deroubaix1, JP Lucas2, O. Ramalho3, J. Ribéron4 and S. Kirchner2
1 ADEME, 2 CSTB

In dwellings with mechanical ventilation, exhaust air flow rates measured varied considerably from one dwelling to another. For instance, for dwellings with four main rooms, measured values of minimum total flow rate (French regulations in clude both minimum and peak flows in the kitchen) varied from 8 to 269 m3/h (sum of minimum flow rates in each service room), with an average of 85 m3/h and a standard variation of 51 m3/h.

These air flow rates have been compared to mandatory air flow rates from the period they were built. Dwellings built before 1969 were assumed to have been retrofitted; the y were therefore compared to current values, which the year assumed to achi eve. This comparison showed that 56% of these dwellings provided lower air flow rates. In the kitchen, the minimum air flow rate was not achieved in 46% of the cases, and in the peak air flow was never exceeded (84% of the cases too low). In the bathroom and toilets, as well, the air flow rates did not reach the desired levels (63.5% and 62% too low, respectively).

When doors remained closed in the bedrooms at night, CO2 levels increased, together with the risk of stuffiness. Scan dinavian countries have achieved an average 0.1 m3/h per occupant to solve the problem from the IAQ point of view. In view of the large number of available data, it would be necessary to improve air flow control. The technique is to supply air flow predominantly where people are spending their time (bedrooms at night and living rooms in the day, generally).

The occupant’s role in a dwelling’s air change
Window opening data, obtained from surveys of the occupants, was not systematically measured in the Master bedroom. CO2 levels varied considerably: 40% of dwellings, they reached values higher than 1500 ppm during the night (from 1 to 5h10 each night).

On the basis of CO2 levels, an equivalent air change rate has been calculated. Regardless of the door and window opening conditions, the air change rate remains close to 18 m3/h. If both doors and windows are closed, the rate decreases to 10 m3/h.

In post-1985 buildings, with mechanical ventilation installed, the air change rate at night was lower. It also corresponded to the lower air change rates required in the regulations.

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In post-1985 buildings, with mechanical ventilation installed, the air change rate at night was lower. It also corresponded to the lower air change rates required in the regulations.
Air management is a central and important part of the energy objectives targeted in new and retrofitted buildings. It is therefore a double challenge to preserve IAQ while reducing energy consumption. Improving building air tightness and reducing energy losses from ventilation on must be achieved while taking into account the overall results, i.e. not only the energy losses, but also the improved training in the field of ventilation.

Many more results are still to come from this very large field experiment. They will be published (in French) on www.aivc.org.

An additional analysis of cases involving large amounts or very small amounts of contaminant pollution is planned, and will evaluate the ventilation status in those situations.
Canadian National Research Council’s Indoor Air Initiative

The Canadian Government has identified the health and well-being of Canadians as a key priority. Consequently, the government’s Clean Air Agenda, the National Research Council’s Institute for Research in Construction (NRC-IRC) and the National Research Council’s Institute for Research on Matter (NRC-IMR) have initiated a national initiative to improve indoor air quality and health outcomes for occupants. This initiative is supported by an Indoor Air Research Laboratory which mimics ventilation scenarios in typical Canadian homes. A second project deals with the development of methods that will be able to improve ventilation rates and air flows in homes and buildings. The study will be carried out in the homes of approximately 100 families living in houses and apartments in the Quebec City area.

Field Intervention Study on Ventilation and Respiratory Health in the Greater Quebec City Area

The study will start in 2008 and will run for four years. A multidisciplinary team will be involved in the study, including representatives from a variety of fields, such as public health, medicine, and environmental studies. The study will involve the measurement of the air tightness of each room over the year. The air tightness will be measured, in order to predict the impact of different ventilation strategies. The air tightness will be measured using different techniques, such as tracer gas decay measurements introduced by constant emitter Rs f perfluorocarbons (PFT tracer gas technique). Air flow directions and speeds can also be ‘visualised’ by particle image velocimetry (PIV).

The Indoor Air Research Laboratory

The intervention strategy for the field study homes will be mo delled in the Indoor Air Research Laboratory (IARL). The laboratory is fully automated and is designed to be inherently flexible in its physical configuration, to allow the modelling of a wide variety of Canadian house designs and construction. The laboratory, named the NFRC Ottawa Campus, is designed to fit the NFRC Ottawa Campus and is no w fully commissioned. The NFRC research team is currently developing a nd o p timising the c onstructions, was built on the NFRC Ottawa Campus and is no w fully commissioned.

Validation of ‘Indoor Air Quality Solution’ Technologies

Another project under the Indoor Air Quality Initiative, called the ‘Indoor Air Quality Solutions’ project, targets devices and technologies to improve indoor air quality. These solutions and technologies can be ‘stand-alone’ devices that aspirate, purify and re-lease air directly from the space, or ‘in-duct’ devices that treat the air in the duct. At a first step, a worldwide scan of tec hnologies, b oth commerc ial units and d rela te d test protocols – currently available and d use d – were scrutinised, le ading to a samp l e of more than 50 techno logies and related test protoc ols. The key task of this project is to identify the most relevant solutions for the Canadian context.
In order to achieve this in an inclusive and a pluralistic way, the Technical Advisory Committee (TAC) was created, with key stakeholders from Canadian scientific institutions and government.

Based on the TAC’s recommendation, the protocols for these technologies will be scientifically assessed: (i) stand-alone portable air cleaners, (ii) air duct cleaning systems and (iii) heat recovery ventilation systems (HRVs) with several modifications.

Currently, the protocols for these methods are being evaluated and improved where applicable, including a lowing a comprehensive and useful assessment and test facilities are being upgraded for the project. For the evaluation of the portable air cleaners, NRC-IR C’s 55 m full-scale chamber has been retrofitted with improved ventilation controls, allowing test runs at a range of RH measures (35 to 90%) and temperatures (17 to 27°C). Additionally, the system can generate man Y OCs in different concentrations at the same time. The residential HRVs systems and air heating, ventilating and air conditioning (HVAC)-mounted air modification systems for commercial buildings will be tested in the IARL. The CCIAQB will position its expertise in the ventilation field to play a significant role in characterizing new alternatives.

The Project Managers are:
- Indoor Air Initiative: Dr. Hans W. Schleibinger
- Ventilation Field Study: Dr. Pierre Lajoie (Principal Investigator, INSPQ) for health sciences; Dr. Hans Schleibinger, Dr. Daniel Aubin, Dr. Doyun Won (all NRC) and Denis Gauvin (INSPQ) for building sciences
- Indoor Air Research Laboratory: Dr. Iain Macdonald (NRC)
- Indoor Air Quality Solutions: Dr. Zuraimi Sultan (NRC)
- CCIAQB: Heather Cannon, Chair (Westende Group Inc.), Luc Saint-Martin, Secretary (NRC)

The CCIAQB was created in 2008 as part of the Indoor Air Initiative and under the auspices of the NRC and with the participation of Health Canada. It is the primary Canadian national stakeholder forum and operates to gather the ‘best of knowledge’ information on the design and operation of buildings related to IAQ. This activity will provide guidance to government, industry and the public based on reliable and unbiased information on IAQ solutions and technologies. Furthermore, the CCIAQB will seek input from all provinces and territories to define knowledge gaps and will thus play an active role in catalysing new research and technological breakthroughs.

The Canadian Committee on Indoor Air Quality and Buildings (CCIAQB)

The CCIAQB was created in 2008 as part of the Indoor Air Initiative and under the auspices of the NRC and with the participation of Health Canada. It is the primary Canadian national stakeholder forum and operates to gather the ‘best of knowledge’ information on the design and operation of buildings related to IAQ. This activity will provide guidance to government, industry and the public based on reliable and unbiased information on IAQ solutions and technologies. Furthermore, the CCIAQB will seek input from all provinces and territories to define knowledge gaps and will thus play an active role in catalysing new research and technological breakthroughs.

The main focus of the CCIAQB is to:
- Provide guidance to government, industry and the public based on reliable and unbiased information on IAQ solutions and technologies.
- Identify knowledge gaps in the design and operation of buildings related to IAQ.
- Gather input from all provinces and territories to define knowledge gaps.
- Play an active role in catalysing new research and technological breakthroughs.

The CCIAQB will consist of 18 members, with representation balanced between regulatory, environmental, and public sectors. Additionally, the committee will be technically and scientifically supported by experts from Health Canada and NRC. The CCIAQB will position its expertise in the ventilation field to play a significant role in characterizing new alternatives.

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Now the CCIAQB has long-sought goals that proper ventilation levels can lead to healthier, more productive environments.

CDC and HUD Recognize Benefits of ASHRAE Ventilation Guidance

Call to propose healthy homes as a component of ASHRAE Standard 6.2.2-2007 as resource

ASHRAE has long sought goals that proper ventilation levels can lead to healthier, more productive environments.

Contact person is W. Angel, w
ASHRAE’s Annual Meeting Includes Technical Session on Residential Ventilation Standards
Louisville Kentucky, USA, 24 June 2009, John Talbott, P.E.

A technical session on “Is sues with Ventilation an d In door Air Quality i n ASHRAE Resi dential S tandards” was held as part of ASHRAE’s three days of technical programs. This session was sponsored sol ely by t he S tandards Project Committee (SPC) on residential ventilation, ASHRAE Stand ard 6 2.2. Usually a n ASHRAE SPC wo uld not solely spon sor a tec hnical pro gram; however t his SPC is inv olved in su bstantive developments that are of interest to many in ASHRAE. Th e session outlined th e i ssues currently under analysis and consi deration with hi n the ASHRAE’s ventilation standards.

Max S herman pres ented a paper on the v aluation of in f iltration to wards meeting resi dential v entilation n eeds. The pa per ou tlined t he va rious ways infiltration has been included in a number of ASHRAE st andards. It was reported th at the u nderlining premises and m athematical e xpressions within these standards are fa und on the knowledge base of 20 years ago. Sherman suggested th ere is a need to u pdate these standards to r eflect the late st in our collective understanding of the i nteractions inv olved. Both improved mat herial ex pressions and enhanced co mmittee consensus a re needed. S pecifically, the au thor pointed o ut th at t he v arious com mittees’ need to determine for indoor air quality re a sonably the re vent air exchange. There were also t he ke y pollutants of co n centration and the extent to which infiltration is of sufficient quality as a dil ution me dium. O nc e this is es tablished, th e m athematical ex pressions can be used to e stablish and compare ventilation p erformances o f v arious systems. Ex amples of p erformances differ ences would in clude: i) r iterative and cont inuous o peration, b alanced v.s. unbalanced and exhausts only v.s. supply only.

Aaron Townsend present ed two papers which r eflected the ongoing rese arch currently supported by ASHRAE S tandard 6 2.2. The overall objective of this research is to dev elop t he a nalytical basis fo r r ad justing th e S tandard 6 2.2 v entilation r equirements. It is e nvisaged t hat th e a dj ustment w ould be in t he f orm of a multipl ier that would ad just t he r equired v entilation r equirements.

The first paper by Townsend described the creation of a c alibrated computer model t hat w ould extend th e results obtained in previous fi eld re searc h on r esidential ve ntilation. Th e previous research was bas ed on t he r acer g as t echniques. Th e computer model was based on the CONTAM software develop ed by the National Institute of Standards and Technology. CONTAM is a multi-zone air flow w ith t he t echniques which is commonly used in v entilation research. In CONTAM, the user specifi es th e a ttri butes of the buildi ng’s zones, air f l ow pathways between zones, cont aminants and sinks and o ther relevant inp uts. Numerous runs were presented that compared the tracer gas de cay plot s with t he computer generated pl ot s. R esults were evaluated u sing st andard statistical techniques, a nd b ased the tr acer g as model w as validated. A b sert re ement was o btained for r cases with mixing, and least agreement for the natural infiltration case.

The se cond Townsend p ap er pr es ented the application of the calibrated model. Spe cifically, t he m odels were exercised over a ra nge of p arameters in or d er t o co ver a ra nge of co nditions. Th e r e were used t o evaluate u sing st andard statistical techniques, a nd th e co nclusion was that g ood g reement was achieved. Best ag reement was ob tained fo r c ases with mixing, and least for the natural infiltration case.

Paul Francisco pre sented the final pa per of the session, which reported the results of a field study of unvented gas fireplaces. C urrently, th e ASHRAE 6 2.2 S tandard spe cifically mentions in its scope that unvented appliances are not addressed. Th is is not to say there are no p ossible IAQ p roblems w ith th ese products, but rather that the committee kn owledge of these products is not developed to a point where specific recommendations or requirements can be elucidated. Th e p ap er foc u sed o n the possible moisture problems associated with th e appl iances. An analysis of th e in terior m onitoring data o b tained in o ur previous fi eld research w as presented. Th e w hose d ata w as presented w as used to evaluate t he com puter model. Th e computer model w as evalu ated using st andard statistical techniques, and th e co nclusion was that the computer model was validated. A b sert re ement was o btained for r cases with mixing, and least agreement for the natural infiltration case.

It is envisioned t hat th e a djustment w ould be in t he f orm of a multipl ier applied t o t he ex isting v entilation r equirement.

The first paper by Townsend described the creation of a calibrated computer model that would extend the results obtained in previous field research on residential ventilation. The previous research was based on tracer gas techniques. The computer model was based on the CONTAM software developed by the National Institute of Standards and Technology. CONTAM is a multi-zone air flow with a networked model which is commonly used in ventilation research. In CONTAM, the user specifies the attributes of the building's zones, airflow pathways between zones, contaminants and sinks and other relevant inputs. Numerous runs were presented that compared the tracer gas decay plots with the computer generated plots. Results were evaluated using standard statistical techniques, and the conclusion was that a good agreement was achieved. Best agreement was obtained for rare cases with mixing, and least agreement for the natural infiltration case.

The second Townsend paper presented the application of the calibrated model. Specifically, he measured over a range of parameters in order to cover a range of conditions. The results were evaluated using standard statistical techniques, and the conclusion was that a good agreement was achieved. Best agreement was obtained for rare cases with mixing, and least agreement for the natural infiltration case.

Paul Francisco presented the final paper of the session, which reported the results of a field study of unvented gas fireplaces. Currently, the ASHRAE 62.2 Standard specifically mentions in its scope that unvented appliances are not addressed. This is not to say there are no possible IAQ problems with these products, but rather that the committee knowledge of these products is not developed to a point where specific recommendations or requirements can be elucidated. The paper focused on the possible moisture problems associated with the appliances. An analysis of the interior monitoring data obtained in our previous field research was presented. The data obtained in our previous field research was used to evaluate the computer model. The computer model was evaluated using standard statistical techniques, and the conclusion was that the computer model was validated. Best agreement was obtained for rare cases with mixing, and least agreement for the natural infiltration case.

It is noted here that the Standard 62.2 committee has considered the results and issued an addendum that includes system coefficient limits in the Standard. The paper oposed a ddendum presents the adjustments in a generalised format with only a few different adjustment factors. This format captures the major findings of the study without over complicating the standard with numerous adjustment factors.
The implementation of energy efficient buildings policies in 5 continents
14 October 2009
Brussels, Belgium

The seminar is focused on the implementation of energy efficient buildings policies in 5 continents.

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- control and regulatory instruments,
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What are the policies implemented not only in Europe but also in other continents?
What are the property and construction actors concerned by those policies?
What about indoor climate?
What is the cost and the impact of the policies?
What are the main success factors, the main failure factors?

The seminar will bring some answers, dealing with the implementation of energy efficient buildings policies in Europe, the USA, China, Brazil and South Africa.


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You have dedicated yourself to the research, development and application of computational building performance modelling and simulation on for high performance buildings. What are your general beliefs about the future of computer-based tools in our world today? It is used to simulate everything from war to economic growth. Modelling an d simulating complex tools have become more widely used. Thus, the building fabric, air flow in and through the building, daylighting and a vast array of system types and components. At the same time, graphical user interfaces that facilitate the use of these complex tools have become more and more powerful, and more and more widely used. Thus, the building simulation discipline has matured into a field that offers unique expertise, methods and tools for building performance evaluation. When used appropriately, it has the potential to increase competitiveness, productivity, quality and efficiency in buildings and in the construction industry, as well as facilitating future innovation and technological progress.

What opportunities do you see in simulation and computational building performance modelling and in particular in relation to ventilation on an indoor climate?

The indoor or climatic (temperature, air flow and quality) resu lts from various interactions between the building and the heating, ventilation and air-conditioning (HVAC) system under the influence of both occupants and the outdoor climate. These are all quite complex and dynamic sub-systems in their own right. In order to analyse and predict (future) overall behaviour, we need to properly account for this complexity in an integrated fashion. This is possible with computational building simulation. It is not a trivial exercise in any way, and I strongly feel that the quality of the results depends more on the quality of the simulation software. You are a professor at the Technical University of Eindhoven, a part-time professor at the Czech Technical University and, in 2007, a visiting professor to Kyoto. What are the main differences a nd similarities between these countries in terms of energy efficiency and in particular, ventilation. In general terms, I think that there are more similarities than differences. Most differences seem to stem from local conditions and or regulations. Most similarities can be found in commercial buildings. Natural ventilation is much more common in the Netherlands than in either the Czech Republic or in Japan, as far as I know. Of course, this is related to the climate. The Netherlands has a mild, maritime climate, whereas the Czech Republic has a continental climate. The climate in Japan ranges from quite cool in the north to subtropical in the south. The Netherlands and the Czech Republic are heating dominated, whereas co-ooling in the Czech Republic is not as common as it is in Japan. The interest in green building design is increasing. From what I could observe, there is, however, more interest in the commissioning, operation and management of ventilation systems in Japan than in the other countries. In residential buildings, the differences appear larger. In The Netherlands and the Czech Republic, the vast majority of houses use natural ventilation and mechanical extract systems without heat recovery. Only the newest houses have balanced ventilation with heat recovery. As far as I know, most of houses in Japan have mechanical extract systems with heat recovery. Only the newest houses have split air conditioning systems for air temperature regulation.

Are there significant differences in how to teach students, and in the interest of the students to wards ventilation in natural indoor climate, in the Netherlands, Japan and the Czech Republic? In general, I don’t see many big differences. Teaching in English (with or without a Dutch accent!) is not yet very common in either the Czech Republic or Japan, which makes it a bit harder for the students. I also notice that in Eindhoven we emphasise the relationship and interaction between building physics and building services, whereas in most other places the study focuses on either the one or the other.

Over the almost 30 years since you started research field in the 1980s, what changes have you found most remarkable?

Computer power and accessibility! We used punch cards in the Numerical Methods course in the 1970s, but nowadays computers are everywhere. Looking back there has been a huge increase in hardware capabilities (Moore’s law), but it is remarkable that progress in software in general, and in building performance simulation in particular, is much slower than what we expected in the 1970s and 1980s.

The main reasons for this are that:
1. Building performance edication is not so trivial after all,
2. not many people use this software, so software development is not profitable, and
3. buildings are systems with many changing. For example, over the last decade, new systems have included displacement ventilation, cooled ceilings, chilled beams, personalised ventilation, atria, full glazed facades, mechanical ventilation, concrete core conditioning, phase change materials, etc.
As a researcher, what areas most interest you, and what are you most proud of? What should young researchers be looking for?

As a researcher, I am most interested in better practical applications, quality assurance and rapid software prototyping using combinations of existing and new building performance modelling and simulation tools. All in view of improving the sustainability of the built environment.

What am I most proud of? My students!

Young researchers should take into account the increasing awareness that in design practice, as well as in the building simulation research community, there is no need for "more of the same". However, there is definitely a need for more effective and efficient design decision support applications.

What topics should be dealt with in ventilation and indoor climate research now and in the future?

From my point of view, the influence of people, especially their stochastic behaviour, should certainly be dealt with. Other stochastic effects, such as wind forces, should also be properly accounted for. We need to decrease the gap between predicted and real energy use, as well as be able to identify confidence intervals for our predictions.

We need to think about the robustness of building and systems in view of future changes in usage and climate. We need better early phase design tools. In other words, there is lots of work for the future!

Finally, what are your goals for your career in the future?

In a nutshell, that would be to continue to do interesting and (I hope) relevant research together with pleasant people, and to disseminate our findings via publications and organisations such as IBPSA.
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The 3rd International Workshop on Natural Ventilation
T. Kurabuchi and T. Ogasawara

The Third International Workshop on Natural Ventilation was held jointly by four institutions: the Tokyo University of Science, the Technical University of Denmark Global COE Program, the National Institute for Land and Infrastructure Management, and the Building Research Institute of Japan. The goal of the workshop was to bring together researchers and practitioners in the field of natural ventilation to meet and exchange information on the latest research trends and results regarding natural ventilation and cross-ventilation, and to build interest in natural ventilation research among young researchers and students.

The first workshop was held in 2003, with 36 presentations invited to participate. The results were published in the March 2004 edition of the International Journal of Ventilation. The papers presented in the second workshop in 2005 were published in the June 2006 issue of the International Journal of Ventilation.

For this third workshop, 12 presentations were made by eight invited researchers and four researchers from the host organization. The titles of the presentations were:

- Presentations on ventilation mechanics and thermal comfort
- T. Kurabuchi (Tokyo Univ. of Science, Japan) - "Domain Decomposition Technique Applied to the Evaluation of Cross-ventilation Performance of a Building"
- P. Heiselberg (Aalborg Univ., Denmark) - "Buoyancy-Driven Natural Ventilation through Horizontal Openings"
- H. Kotani (Osaka Univ., Japan) - "Paper Revie w of Cross-v entilation Research"
- R. de Dear (Univ. of Sydney, Australia) - "The Thermodynamics of Horizontal Comfort in Naturally Ventilated Indoor Environments: 'The Pleasure Principal'"

Presentations related to heat load & application
- M. Ohba (Tokyo Polytechnic Univ., Japan) - "Study on the Reduction of Cooling Loads in Detached Houses by Cross-Ventilation Using Local Dynamic Similarity Model"
- S. Nishizawa (NILIM, Japan) - "Verification of effective cross ventilation on energy saving by the experiment simulating occupant behaviour"
- M. Santamouris (Univ. of Athens, Greece) - "The Efficiency of Night Ventilation Techniques"
- Y. Takemasa (Kajima Technical Research Institute, Japan) - "Natural Ventilation with Dynamic Facades – Japanese Example"

This workshop attracted more than 90 participants, with active discusssions and information exchanges not only between researchers but also with building designers and manufacturers of building components. The papers for the workshop are scheduled to be published in the December 2009 issue of the International Journal of Ventilation.

**Information on AIVC supported conferences & events**

**30th AIVC conference and Builtair, Berlin, 1-2 October 2009**
The combined conferences “30th AIVC conference and Builtair - Trends in high performance buildings and the role of Ventilation” and “International Conference on Buildings and Ductwork: Airtightness” aim to focus on key items of the present ventilation challenges. More information: www.aivc.org and www.builtair.de

**3rd International Conference PALENC, Rhodes Island, Greece**
Adapting to change: new thinking on comfort
The International Conference will be held on 9-11 April 2010 at Cumberland Lodge, Windsor Great Park, UK
More information: www.nceub.org.uk/

**3rd International Conference PALENC 2010 – Cooling the Cities the Absolute Priority**
29 September - 1 October 2010, Rhodes Island, Greece
More information: http://palenc2010.conferences.gr