Healthy MATERIALS

Issue No. 3 Summer 1995

A Communiqué on Material Emission Testing and Standards Activities

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Danish labelling program begins certifying products

The first products certified under the recently developed Danish Indoor Climate Labelling (DICL) system are now appearing on the market.

DICL evaluates materials on the basis of the length of time — the "relevant indoor time value" — required for emissions to fall below certain odour or irritation thresholds. This method has been chosen because it gives the user a single number upon which to base comparisons. The feeling among Danish researchers is that the alternative — a list of emitted compounds, emission rates, modelling results and health assessments — is not of much help to most users.

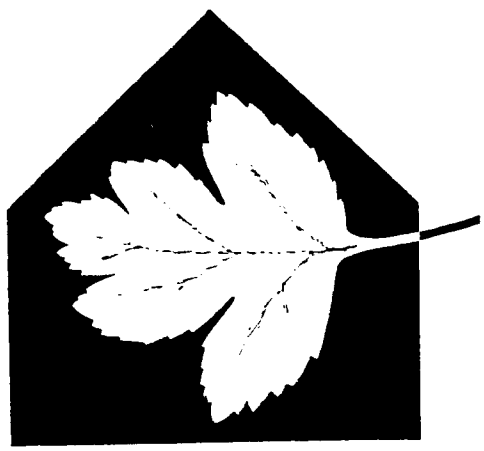
Initiated by the Danish Ministry of Housing in late 1992, the development of DICL has required a multi-agency effort undertaken in close collaboration with manufacturers, consulting architects and engineers, contractors and end users.

Testing of Carpets and Ceiling/Wall Systems

The Danish Technological Institute has developed two product standards to date for textile floor materials (e.g. carpets and backings) and ceiling and wall systems (e.g. gypsum board, mineral and glass wool insulation, metal panels). These product standards, in addition to specifying definitions and guidelines, set maximum allowable time values. Additional product standards — which take about

(*continued on page 3*)

Inside...



CMHC SCHL
Helping to house Canadians

Interest in emissions research grows

Welcome to the third issue of ***Healthy Materials***! This issue emphasizes emissions data, with descriptions of some of the key databases being developed internationally and summaries of two recent material testing projects in Canada. A feature article overviews the wealth of emissions research being undertaken by the U.S. EPA. Recent developments in two material labelling programs — one in Denmark and one in Canada — are highlighted. Jim White's editorial challenges the view that low-polluting materials are too costly.

We are very happy to see continued growth in the number of ***Healthy Materials*** subscribers, now over 900. Although the original intent was to target researchers and standards writers, a large percentage of readers are practitioners — architects, manufacturers, builders, health professionals and building managers — which confirms the increasingly widespread interest in healthier indoor environments.

These first three issues of ***Healthy Materials*** have been funded entirely by Canada Mortgage and Housing Corporation. Starting with the next issue, a subscription fee will be charged to defray some of the costs. If you find the contents of this newsmagazine valuable and wish to continue receiving it, please don't forget to complete the subscription form on the back page!

Terry Robinson, Co-Editor, Scanada Consultants Ltd.

Call for Participation

The National Research Council of Canada is inviting interested agencies and manufacturers to participate with NRC, US EPA and others in a consortium which will steer and fund NRC's three year program of research on material emissions. Benefits include participation on the program's advisory committee, annual briefings by NRC, a limited amount of free testing of materials, early access to test results and opportunities for networking with key experts. The first meeting of the consortium is planned for September.

For further information, contact:
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Acronyms

The following is a list of the more common acronyms used in this issue of ***Healthy Materials***:

ANSI	American National Standards Institute
AQS	Air Quality Sciences Inc.
ASHRAE	American Society of Heating Refrigeration and Air-Conditioning Engineers
ASTM	American Society for Testing and Materials
BRE	British Research Establishment
CCI	Canadian Carpet Institute
CEN	European Standardization Committee
CGSB	Canadian General Standards Board
CMHC	Canada Mortgage and Housing Corporation
CRI	Carpet and Rug Institute (U.S.)
CSIRO	Commonwealth Scientific and Industrial Research Organization
DICL	Danish Indoor Climate Labelling
ECA	European Collaborative Action
EPA	Environmental Protection Agency (U.S.)
FLEC	Field and Laboratory Emission Cell
GC/MS	gas chromatography/mass spectroscopy
GRC	Guideline Review Committee
GSA	Government Services Administration (USA)
HC	Health Canada
HUD	Housing and Urban Development
IASCP	Indoor Air Source Characterization Project
ISO	International Standards Organization
MDF	Medium Density Fibreboard
MMIT	mucous membrane irritation threshold
NKB	Nordic Committee on Building Regulations
NRC	National Research Council
NRCan	Natural Resources Canada
OT	odour threshold
SNTRI	Swedish National Testing and Research Institute
SRC	Saskatchewan Research Council
SRD	Source Ranking Database
SVOC	semi-volatile organic compound
TAGS	Test Atmosphere Generation System
TVOC	total volatile organic compound
VOC	volatile organic compound
VTT	Technical Research Institute of Finland
WG	Working Group

Aussi Disponible en Français

Healthy Materials est aussi disponible en français, sous le titre ***Matériaux sains***. Si vous voulez recevoir votre communiqué en français, s.v.p informez la Centre canadien de documentation sur l'habitation (CCDH).

Danish labelling (cont'd)

nine months to be written, reviewed and approved — are under development. Testing is carried out in accordance with the "Standard for Determination of Emission from Building Products" which was developed by the Danish Technological Institute in late 1994.

The first products to be tested have included twelve wall and ceiling systems and four carpets. For wall and ceiling systems, the critical VOCs are aldehydes. The maximum time value allowable is 30 days. Eleven of the twelve products tested had time values less than 10 days, while one product exceeded the maximum allowable. For carpet systems, the critical VOC is 4-phenylcyclohexene. Carpets with styrene-butadiene backing had a time value of 30 days, while those with textile backings had shorter values.

The first certified products are now available on the market. Peder Wolkoff, of the Danish National Institute of Occupational Health, predicts that about twenty more products will obtain certification in 1995. Additional labelling of interior doors and other flooring products is also expected to start later this year.

A Labelling Board has been established, consisting of representatives of independent institutes, authorities, professional and end users, manufacturers and trade organizations.

The program is voluntary. Manufacturers are also required to specify guidelines for the application, storage, transportation, installation, cleaning and maintenance for each product. Products labelled under the DICL can use the hawthorn leaf logo. Thirty manufacturers are now members of DICL.

Positive Reaction from Industry

Wolkoff indicates that reaction among major building societies has been very positive, with one already referencing DICL as a design criteria.

One of the objectives of the program is to promote the development of low-polluting building products. During the short time the DICL has existed, some manufacturers have already reduced their products' time values considerably. For example, carpets typically had time values of several months but now have time values of one to two months.

DICL focuses on the two most common symptoms associated with sick building syndrome — odour annoyance and mucous membrane irritation. The time values are based on 50% of the relevant threshold level and depend largely on dominant VOCs with slowly decaying emission profiles and low threshold values.

Reliance on Odour Thresholds

Odour thresholds (OTs) are generally two to three orders of magnitude lower than mucous membrane irritation thresholds (MMITs), and therefore the use of OTs represents a more conservative approach from a health perspective, as well as compensating for the hypoadditivity of odours.

Sensory tests are carried out in CLIMPAQ chambers using untrained panels in order to determine OTs and the acceptability of odours. Where known, MMITs and occupational exposure limit values are divided by 4 to correct for continuous exposure and further by 10 to incorporate a safety factor. It is expected that when accepted threshold values for carcinogenic and allergenic effects have been defined, these will be included. The initial testing to determine time values has been done using 225 litre chambers. Procedures have also been developed for using FLEC emission cells. Modelling work will allow long-term time values to be estimated from short-term data.

DICL and the underlying research have received strong support from the Danish Government, particularly the National Agency for Trade and Industry and the National Agency for Housing and Building.

Wolkoff has expressed his enthusiasm for sharing Denmark's experience with IAQ researchers in other countries. *TR*

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TASK FORCE ON MATERIAL EMISSIONS

Positive meeting emphasizes breadth of work being pursued

The fourth meeting of the Task Force on Material Emissions focussed on the quality of emissions data, the use of the TVOC concept and the development of action plans by Working Groups.

Held in Montreal on May 9 in conjunction with the "Indoor Air Quality, Ventilation and Energy Conservation in Buildings" conference, the meeting attracted 40 participants and was characterized by a positive exchange of information throughout.

Task Force Chair Jim White of CMHC began by highlighting the results of the April 18 meeting of the Working Group Chairs, which focussed on a proposed consortium to steer NRC's research and on joint funding of emissions research. Scanada's Terry Robinson summarized progress on the ***Healthy Materials*** communiqué, which now has over 900 subscribers internationally.

Levin on Emissions Data

Hal Levin, chair of the ASTM standards subcommittee D22.05 on Indoor Air and a leading advocate of practical IAQ information for designers, gave a thought-provoking presentation entitled "Data Are Now Available for Many Building Products, So What?" Levin's key message was that such data are meaningless unless test conditions are known and quality control is ensured (see feature article on page 7).

Levin called for the development of standardized test methods (including sample selection and preparation) and for further research on the fundamental properties of material emissions and on health effects. John Burrows of the Canadian Wood Council echoed that manufacturers are reluctant to undertake testing when test methods are not standardized and health effects remain unknown.

Levin noted that greater attention needs to be paid to material durability and the impact on maintenance and cleaning requirements. Standard emission sources need to be available for comparing test methods and labs. He stressed the complexity of the issues involved, making a simple numerical rating system for materials impossible at present.

Updates were then provided on various research and information activities taking place across Canada.

Two Studies Find Great Variability in Emissions

Tom Hamlin of Natural Resources Canada highlighted the findings from Saskatchewan Research Council's testing of materials from the Advanced Houses and R-2000 Programs (see page 20). The very high TVOC emission levels from two carpet samples — probably due to on-site sink effects or contamination from cleaning solvents — sparked considerable debate.

Hamlin noted that the great variation in emission rates meant that it was not possible to use generic data in modeling the impact of materials on IAQ and that product-specific data were required. NRCan's spreadsheet, "CleanAir-2000", is being refined to reflect this. Hamlin also commented on future trends for the R-2000 Program, which may include the adoption of the CCI/CRI carpet guidelines, restrictions on the use of vinyl flooring and ventilation credits for homes with low-emitting materials.

A comparison study for CMHC of emissions from recycled and conventional building materials (see page 21) was outlined by Peter Piersol of ORTECH. Piersol addressed the issue of the optimum time frame for testing (i.e. production line versus site installation) and described two unexpectedly high sources of emissions — form oil on cast-in-place concrete foundations and plastic-wrapped factory-finished solid wood cabinet doors. He also noted the large variation in emissions within product types.

Jay Kassirer of Cullbridge Marketing and Communications presented the results of a characterization study of the indoor environment industries (see page 25).

Saskatchewan Research Council's Peter Freimanis described their large environmental chamber facilities and summarized

the testing work which has been undertaken to date, leading to the development of a database for residential materials.

Marc Bourgeau provided an update on Health Canada's recent activities, including analysis of a 754-home survey of vapour phase organics, development of a new test atmosphere generating system (TAGS-2), predictive modeling in test homes and development of exposure estimates for five Priority Substances. Health Canada is considering an update to the 1987 "Exposure Guidelines for Residential Indoor Air Quality".

Consortium to Steer NRC Research

Dr. Jianshun Zhang reviewed recent progress on the National Research Council's three year emissions research program. Inter-lab comparisons of the performance of room-size chambers are being conducted with US EPA and Australia's CSIRO. Small chamber testing has been performed on a large number of representative building materials. The program's advisory committee has recommended a focus on predictive modelling of IAQ in buildings. Zhang outlined NRC's plans for a government/industry consortium to steer the research and provide additional funding.

Dr. Gemma Kerr of Public Works and Government Services Canada updated the Task Force on their recarpeting studies. Public Works wishes to develop emissions specifications for materials used in federal buildings and procedures for flush-outs during renovations.

Concordia University's Ying Zhang reviewed the basic research being undertaken at the Centre for Building Studies on source emission mechanisms. The effect of air velocity has been found to be significant, while the effect of turbulence has been inconclusive. Concordia has derived a physical model for source emissions, which is now being validated.

NRC test chamber

Labelling Program Expands

Lynne Patenaude from Environment Canada, a new Task Force participant, outlined the extensive expansion of the Environmental Choice Program's guidelines to cover many materials and equipment of relevance to the indoor environment. New guidelines are expected on carpeting, undercushion, resilient flooring, particleboard, fibreboard, fax machines and photocopiers (see page 18).

Jim White reported that CMHC's guide to healthy materials — now renamed "Building Materials for the Environmentally Hypersensitive" has been approved and should be released in the next few months.

Industry Guidelines Tightened

Mike Kronick of the Canadian Carpet Institute highlighted new developments for the CCI/CRI Indoor Air Quality Label, which has now been embraced by 70% of Canadian manufacturers. The requirements are being tightened, with the maximum level for TVOC emissions reduced from 0.6 to 0.5 mg/m^{2}h. On average, the carpets being tested have less than 50% of the 4-PC emission limit.

The Canadian Particleboard Association's Michel Tremblay reported that all manufacturers are respecting CPA's voluntary guidelines for formaldehyde emissions. The industry is considering reducing the maximum level from 0.3 ppm to 0.2 ppm for all products.

Mølhave on TVOCs

The internationally-respected Danish researcher, Dr. Lars Mølhave, addressed issues relating to the use of TVOC as a biological indicator and as a substitute indicator of exposure. No irritation has been found from TVOC concentrations below 0.2 mg/m^3, while irritation is always expected above 3 mg/m^3. Most buildings fall somewhere between, with the response curve depending on the specific components of the mixture and the sensitivity of the occupants. Mølhave believes that in the future, a complex function could be developed to predict the expected level of irritation for any mixture of VOCs.

Working Group Action Plans

The Task Force also heard from the Chairs of the seven Working Groups. The following summarizes the Working Groups' proposed action plans and lists of priorities.

Test Methods
- review existing guidelines and standards,
- identify priority materials,
- develop product-specific test methods for small and large chambers,
- develop methods to extrapolate test results,
- evaluate procedures for emission tests in the field, and
- develop general guides for emission testing.

Builder Update
- test and label products known to be the worst polluters,
- develop an IAQ predictive tool for builders.

Interpretation of Data
- consult with end-users to establish the best formats for emission data,
- review existing data formats,
- prepare a guide to material selection, and
- develop a simple model to combine emissions data with toxicological, exposure and building use data.

Communication Vehicles
- establish an Internet "web page" of material emissions information and a database for emissions data, and
- prepare an inventory of existing communications vehicles.

Health Data
- establish acceptable definitions of priority populations suffering from sick building syndrome and multiple chemical sensitivity,
- establish minimum exposure levels for sensitive individuals in a clean, controlled environment, and
- begin testing sensitive individuals to determine biological responses to pollutants.

International Activities
- disseminate information on international developments to Task Force members.

Manufacturing Industry Response
- investigate international standards which may impact on Canadian exports.

Dr. John Molot, in addition to presenting the priorities of the Working Group on Health Data (see above), summarized additional resource material he had collected on health effects. He emphasized that most testing to date has involved healthy individuals and so we know little about the impacts of pollutants on more sensitive segments of the population. Molot believes that NRC's large chamber would be ideal for human exposure studies and also noted that CMHC's prototype house for the environmentally hypersensitive would be useful in de-adapting sensitive individuals prior to being tested. Molot called for a multi-disciplinary team to pursue such a testing program, including various neurological and immunological medical experts, Health Canada, provincial Ministries of Health, NRC, CMHC, Public Works and manufacturers.

The review of proposals for jointly-funded research was deferred until the next meeting of the Task Force, which will be held in Ottawa during the week of October 16-20. The Chair invited interested agencies and Working Groups to bring forward additional proposals by then. *TR*

To become a member or associate of the Task Force or to receive copies of the Minutes:

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Manufacturing Industry Response: John Burrows, Canadian Wood Council, Tel: (613) 731-7800, Fax: 731-7899.
Builder Update: John Broniek, Canadian Home Builders' Association, Tel: (613) 230-3060, Fax: 232-8214
Communication Vehicles: Dr. Jim Robar, CMHC Research Division, Tel: (613) 748-2316, Fax: 748-2402.

EMISSION DATABASES

How meaningful are emissions data?

Practitioners — as well as researchers and standards writers — are increasingly demanding data on building material emissions. As more emissions testing is undertaken internationally, such data are becoming available, but concerns have been raised over comparability.

As Hal Levin eloquently described in his recent presentation to the Task Force on Material Emissions, these data by themselves are not meaningful unless information is also available on the sample characteristics and test conditions.

How old are the samples tested? Are the samples taken from the production line, a building supply warehouse, a construction site or an existing installation? How are the samples prepared and preconditioned prior to testing? What are the physical characteristics — thickness, density, backings, finishes — of the samples? Are the samples representative of current product lines? What are the test chamber's environmental conditions, such as air change rate, air flow, temperature and humidity? Which air sampling and chemical analysis methods are used? Which test standards are followed? Do the results represent an initial emission rate, an emission decay rate over time or a chamber concentration?

Including such information in emission databases will greatly accelerate progress on international test standards, exposure modelling and labelling programs.

Survey reveals current state of database development

*To encourage the exchange of emissions data, **Healthy Materials** surveyed a number of agencies and labs this spring to determine the type and extent of data being gathered, how such data are being recorded and whether there is a willingness to share these data with others. The following highlights some preliminary observations and summarizes the responses received to date.*

Responses to the Material Emission Databases Questionnaire suggest that most agencies' databases are based exclusively on their own testing. Most cover a wide variety of building materials, but there has not yet been much testing of assemblies. Virtually all testing follows recognized standards and guidelines.

In terms of sample testing information, virtually all databases include chamber test conditions and loading ratios and most cover sample sources, sample preparation and material characteristics. Less common — yet vital to comparative data interpretation — is information on the age of samples tested and the rate at which emissions decrease over time.

With the exception of results which are proprietary to manufacturers, many agencies appear willing to make their data available to others.

Air Quality Sciences (AQS), USA
With one of the largest databases in the world, AQS has tested over 6000 samples from a very wide selection of building materials and assemblies. Testing is undertaken in over two dozen environmental chambers, ranging in size from 0.05 m^3 to 26 m^3. The chemical compounds most commonly tested for include VOCs, SVOCs, aldehydes, particulates and ozone, following protocols — often developed by AQS — of ASTM and EPA. Emission data are available for the purposes of establishing test requirements. *Contact: Marilyn Black or David Nicholas, Air Quality Sciences Inc., tel: (404) 933-0638, fax: (404) 933-0641.*

Anderson Laboratories, USA
Data on chamber concentrations and toxic potency for approximately 40 samples of various building materials have been assembled, based on Anderson's own work. Testing is carried out in glass chambers in accordance with ASTM E981. *Contact: Rosalind Anderson, Anderson Laboratories Inc., tel: (617) 364-7357, fax: (617) 364-6709.*

British Research Establishment (BRE), UK
BRE's database — "BreEmit" — contains the results of about 50 tests on a wide variety of materials and assemblies. Testing for alkanes, aromatic hydrocarbons, aldehydes and

terpinene is undertaken in two environmental chambers and six stainless steel micro-chambers in accordance with EUR 13593 guidelines for small chamber VOCs and EUR 12196 for formaldehyde emissions. The database is still under development and is therefore not yet available for circulation, but much of the data is or will soon be published. *Contact: Chuck Yu, BRE Materials Division, tel: +44 923 664637, fax: +44 923 664786.*

Canadian Carpet Institute (CCI)
Based on the U.S. Carpet and Rug Institute's (CRI) IAQ labelling program, CCI's program is resulting in a large amount of data on 42 types of carpet products, with their database growing by more than 1100 test results per year. Testing for 4-PC, styrene, formaldehyde and TVOCs is performed by Air Quality Sciences Inc. in small chambers in accordance with ASTM D5116-90 and the program's quality assurance plan. Data are the property of the participating manufacturers. Databases are also under development for carpet undercushion and adhesives. *Contact: Michael Kronick, Canadian Carpet Institute, tel: (613) 232-7183, fax: (613) 232-3072.*

Concordia University, Canada
Drawing on both their own testing and published data, Concordia's database is in the early stages of development. Testing of paints and wall assemblies for TVOCs is undertaken in 50 L and velocity-controlled chambers, based on ASTM D5116-90. The data are available to others. *Contact: Fariborz Haghighat, Concordia University, tel: (514) 848-3192, fax: (514) 848-7965.*

European Commission (EC), Joint Research Centre, Italy
The EC's Indoor Pollution Unit has assembled a database on about 45 samples, including cleaning products as well as building materials. VOC testing is undertaken in accordance with EUR 13593 guidelines in 0.28 m^3 stainless steel and 0.45 m^3 glass chambers and with FLEC. Results are expressed as a ranking of the ten most important compounds by concentration. Data are available to others. *Contact: Maurizio De Bortoli or Helmut Knöppel, EC Joint Research Centre, Environment Institute, tel: +39 332 789230 or 789204, fax: +39 332 785867.*

Georgia Tech Research Institute, USA
Several hundred samples of building materials, furniture and biocides have been tested. VOC testing is conducted in small chambers, large chambers and FLEC in accordance with ASTM D5116-90 and EPA's Carpet Policy Dialogue. Those data which are not confidential are available. *Contact: Charlene Bayer, Georgia Tech Research Institute, tel: (404) 894-3825, fax: (404) 853-0113.*

Health Canada (HC)
The Canadian Indoor Source Profile Database (CISP) has been developed for Health Canada by Bovar-Concord Environmental for use in indoor source apportionment, dispersion and other studies to assess the human health hazard from airborne organic pollutants. The CISP database system consists of two files, one which contains source profile and emission information, and another which contains bibliographic information. The database contains information on over 500 chemicals and on emission rates and source profiles for over 300 source types, including 158 interior materials and furnishings, plus consumer products, cigarette smoke and combustion devices. Five different reports formats are available: source profiles; compounds; source profile for user-specified sources; sources containing user-specified compounds; and input files for receptor modelling using EPA's CMB7 software. Data are available to others. *Contact: Rein Otson, Bureau of Chemical Hazards, Health Canada, tel: (613) 957-1646, fax: (613) 954-2486 or Claude Davis, Bovar-Concord Environmental, tel: (416) 630-6331.*

Helsinki University of Technology, Finland
As part of the European Data Base for Indoor Pollution Sources in Buildings, data is being gathered on emissions from HVAC systems, focussing on supply air filters and ductwork. Testing most commonly includes carbonyl compounds, VOCs and MVOCs and follows test methods developed by Finland's VTT Technical Research Centre. Data are not yet available for use by others. *Contact: Olli Seppänen, Helsinki University of Technology, tel: +358 0 451 3600, fax: +358 0 451 3611.*

Ortech Corporation, Canada
Covering a variety of interior materials, office furniture and workstations, Ortech's database contains information on about 80 samples. Testing in 55 L and 1 m^3 chambers for toluene, xylene, aliphatic hydrocarbons, formaldehyde and TVOCs is undertaken in accordance with ASTM D5116-90. Most data are proprietary, but some have been published by clients and are available. *Contact: Peter Piersol, Ortech Corporation, (905) 822-4111 ext.545, fax: (905) 823-1446.*

Saskatchewan Research Council (SRC), Canada
Approximately 60 samples have been tested, including the most common interior materials and kitchen cabinets. Tests are conducted for VOCs and formaldehyde in 51 L, 171 L and 23 m^3 chambers, following ASTM D5116-90 for VOCs, ASTM E1333-90 for formaldehyde and SRC's General Test Method. Data are available to others with client permission or if already published. *Contact: Peter Freimanis, Saskatchewan Research Council, tel: (306) 933-6138, fax: (306) 933-6431.*

Swedish National Testing and Research Institute (SNTRI)
Using FLEC, SNTRI tests a wide variety of interior finishing materials and assemblies for VOCs, formaldehyde and ammonia, in accordance with Swedish trade standards based on Nordtest Method NT Build 358. Approximately 1000 samples have been tested, with an average of five chemical compounds identified per sample. Data are for internal use. *Contact: Hans Gustafsson, Swedish National Testing and Research Institute, tel: +46 33 165270, fax: +46 33 123749.*

Technical Research Centre (VTT), Finland
VTT has developed an emissions database known as DaME with about 100 samples representing various building materials and assemblies. Testing for VOCs, aldehydes and ammonia is carried out using small stainless steel chambers and FLEC, in accordance with Nordtest Build 358 and EUR 13593 small chamber VOC guidelines. Public parts of VTT's database may be available to others. VTT's data has also been used to establish the preliminary phase of an emissions database for the Nordic Committee on Building Regulations (NKB). The NKB database is intended to be a user-friendly source of information to researchers and authorities, and contains information on products tested, chemical pollutants and health effects. *Contact: Kristina Saarela, VTT Chemical Technology, tel: +358 0 456 5292, fax: +358 0 456 7022.*

In addition to the above questionnaire responses, the **U.S. Environmental Protection Agency (EPA)** has provided information (see article on page 13) on their Source Ranking Database (SRD). This development involves a major, multi-year effort to systematically review and compare indoor pollutant sources to identify high priority product classes for more detailed evaluation. In addition to chemical-specific emission rates, the SRD contains data on product formulations, product use, typical loading ratios and environmental conditions in buildings, size of exposed populations, and both quantitative and qualitative health hazards. SRD also incorporates a scoring system which combines exposure and hazard data. *Contact: Christina Cinalli, U.S. EPA, tel: (202) 260-3913, fax: (202) 260-0981.*

Table 1. Emission Database Sample Information

For each sample, is information available on: (A=always, U=usually, S=sometimes, N=no)	Agency or Lab												
	AQS	And	BRE	CCI	Con	EC	GTR	HC	Hel	Ort	SRC	SNT	VTT
Age of Sample?	U	S	S	A	U	S	S	N	A	S	S	A	A
Source of Sample?	A	A	S	A	U	S	S	U	A	U	A	A	A
Sample Preparation?	A	A	A	A	U	U	A	N	A	U	A	A	A
Chamber Conditions?	A	A	A	A	A	A	A	N	A	A	A	A	A
Loading Ratio?	A	A	A	A	A	A	A	N	A	A	A	A	A
Material Characteristics?	A	U	A	A	U	U	U	S	A	U	A	A	A
Decay Rates Over Time?	U	N	A	S	U	S	U	N	?	S	S	U	A

***Healthy Materials** thanks all those researchers who responded to the survey questionnaire. We know that there are many more emission databases internationally for which we do not yet have detailed information. Agencies who have not yet responded or who did not receive a questionnaire are invited to reply this fall, since it is our intention to publish further information on emission databases in the next issue. The questionnaire is reprinted below in a condensed format. TR*

Material Emission Databases
Questionnaire

General information: company/agency, address, key contact person, telephone, fax, name (if any) of emissions database.

1. Approximately how large is your database (i.e. approximately how many different samples have been tested)?

2. Does your database draw:
   ☐ primarily from your own material testing program? ☐ primarily from published data?
   ☐ from both your own testing and published data? ☐ from other sources (specify)?

3. What type of building materials are included (e.g. paints, composite boards, drywall)?

4. What type of construction assemblies are included (e.g. kitchen cabinets, carpet/undercushion/adhesive assemblies)?

5. For which chemical compounds or categories of compounds are emissions data most commonly included?

6. Which emission test standards are followed?

7. What type of chamber facilities are used?

8. For each sample tested, is information available on the following?
   (A=always, U=usually, S=sometimes, N=no)
   ___ Age of the sample?
   ___ Source of the sample (e.g. manufacturer, building supply yard, construction site)?
   ___ How the sample was prepared or preconditioned prior to testing?
   ___ Chamber environmental conditions (e.g. air change rate, temperature, RH)?
   ___ Loading ratios?
   ___ Material characteristics (e.g. thickness)?
   ___ Decay rates over time?

9. Are the test results usually expressed as:
   ☐ an emission factor (e.g. $\mu g/m^2h$)? ☐ a chamber concentration (e.g. $\mu g/m^3$ or ppm)? ☐ other format (specify)?

10. Are some or all of the data available to be shared with others? Under what conditions?

11. Any other comments? (e.g. known limitations)

EMISSION TEST FACILITIES

The last issue of ***Healthy Materials*** *included an overview of emission testing facilities in Canada, with brief articles on six public and private labs. Health Canada has recently provided an article on their facilities.*

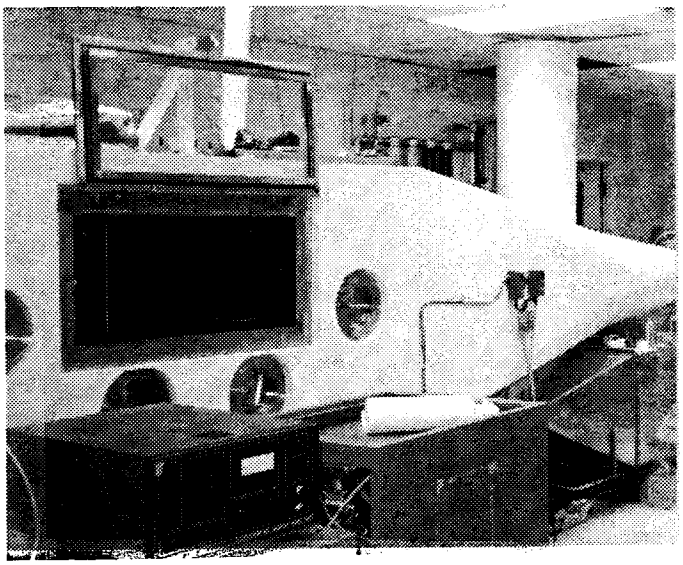
Capabilities of Health Canada's TAGS expanded

by Rein Otson, Health Canada

The lack of information on the validation of sampling methods and monitoring equipment became apparent during research on human exposure to airborne organic compounds in the 1980s. Consequently, in 1985, Concord Environmental (now part of Bovar-Concord Environmental), was contracted to develop and construct a unique, versatile, reliable and controllable dynamic (flow-through) test atmosphere generation system (TAGS).

Under an agreement with Health Canada, Bovar-Concord maintains the TAGS which has been improved over the years, most recently in 1994 by an increase in size (2.2 m^3 exposure zone) and capabilities. The apparatus can now be used for a variety of investigations, including testing for emissions from materials and consumer products, investigating the behaviour (chemical and physical) of airborne particles and vapours, and testing the performance of safety and environmental remediation and monitoring equipment.

The TAGS consists of a 3.7 m^3 double shell stainless steel chamber, with an observation window and glove access, particle and vapour generation units, and a compressed air (cleaned) supply unit of 3 m^3/min capacity. The air temperature and relative humidity can be set between 5-40°C and 15-95% RH, respectively. An Andersen impactor and a quartz crystal microbalance for determining particle concentrations and size distribution, and an on-line GC and other equipment for monitoring other atmospheric components are available. The effects of UV light on pollutants (e.g., O_3, SO_2 and NO_x) can be examined, and equipment is available for testing of materials under various atmospheric conditions.



Test Atmosphere Generation System (TAGS)

Results of tests which demonstrate the capabilities and versatility of the TAGS have been reported in several articles. Recent tests have showed that the homogeneity of concentrations of CO_2 and toluene, respectively, were 0.4% and 1.9% relative standard deviation (RSD) at 80 and 54 locations in the exposure zone at a laminar flow rate of ~0.07 m/s. The air temperature was stable within ± 0.5°C over the specified range over 24 hours. Particle concentrations of 83 to 560 $\mu g/m^3$ were homogeneous within 7% RSD, and the particle size distribution ranged between 0.05 and 25.0 μm.

Use of the TAGS by other agencies and firms (for a negotiable fee) can be arranged. A variety of support services and equipment (e.g. GC-MS analysis) are also available.

For further information:
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CONFERENCE SUMMARY

Emissions research highlighted at Montreal Conference

The second of a new series of conferences that focuses on the interactions between energy conservation, ventilation and IAQ included many presentations relating to current work on material emissions.

Hosted by Concordia University, the "2nd International Conference on Indoor Air Quality, Ventilation and Energy Conservation" was held in Montreal from May 9th through 12th. The third in this series will be held in France in 1996. The President of the Conference was Dr. Fariborz Haghighat of Concordia.

A number of papers specifically focused on emissions — in theory, laboratory experiments and field measurements, as well as deductions based on those activities.

"Emissions Testing Data and Indoor Air Quality", by H. Levin was a keynote address that looked broadly at the need for emission data, on the one hand, and the necessity of carefully investigating the test conditions that produced existing data on the other. Little data can be directly compared because of variations in the sampling, preparation, testing and analysis of volatiles. Standardization is a critical need.

"Toxic Emissions from Air Fresheners", by R.C. Anderson presented very recent work on the reaction of mice to VOC's from air fresheners. At higher loadings, reactions were severe. Air fresheners may be important and risky sources of VOCs wherever they are used to mask odours.

"Chemical and Sensor Evaluation of Building Materials Using TD/GC/FID/Sniffer Multicoupling Analytical Method", by P. Karpe, S. Kirchner and S. Hubert presents chamber studies on six plastic and carpet floor coverings that were able to identify 40 to 99% of the compounds emitted. Both the carpet and plastic floor coverings would be expected to create an odour problem in newly-floored rooms. The backings are likely the strongest sources of odours.

"Analytical Tools for Investigating Indoor Environments to Assess Potential Human Exposures in Canadian Buildings", by R. Otson and P. Fellin presents, among other things, the design and results of a small emission cell designed for field evaluation of sink/re-emission effects of materials in buildings. Sensitivities were adequate to the task.

"Review of the Effect of Environmental Parameters on Material Emissions", by L. De Bellis, F. Haghighat and Y. Zhang notes that the literature presents variable, sometimes conflicting, results on the effects of temperature, relative humidity and air velocity on emission rates from materials. The complexity of the processes and lack of uniformity in the approach to investigating the effects contributes to the disarray.

"Estimating the Mechanism of Material Emissions: Effect of Air Velocity on Material Emission", by Y. Zhang and F. Haghighat presented work in a specially-designed chamber where mean velocity and turbulence levels are varied to study the effects of these parameters on emission rates of some chemicals/sources. The evaporation of water is used as the test standard, since it is well-studied and the literature is extensive.

A number of other papers included emission data and/or discussion of emissions rates from materials.

"The Use of the TVOC-Concept in Source Characterization and Regulation of IAQ" — the keynote address by L. Mølhave — included a short discussion of emission rates at the component and summary level. It presented the need for, and limitations of, some sort of summation of rates, before we have all of the knowledge that we need to determine sensory synergy and antagonism. It also presented cautions/limitations on using TVOC when genotoxic effects are known or suspected.

"Effects of Ventilation, Temperature, Sources and Sinks of VOC Levels in a Residence", by R. Otson, P. Fellin and C.S. Davis investigated the emission, adsorption and re-emission of three locally-released chemical pollutants in a test house. Sink effects were chemical-specific and carpets were about ten times more effective than drywall in absorbing these chemicals.

"Improving Indoor Air Quality During Recarpeting of Two Floors of an Office Building", by G. Kerr and L.C. Nguyen Thi presents a case study of emission rates from standard and low-emission adhesive use during carpeting. They also discuss the removal of 4-PC with gas filtration. Emissions *can* be reduced.

"The Energy Consequences of Excessive Pollutant Source Strength", by J.H. White presented a simplified look at the several costs of using large amounts of polluting material, and either ventilating to get rid of the excess pollutant, or living with the higher concentrations. For the user, lower-pollution materials may cost more per square metre yet cost much less when all of the costs are considered. *(See the editorial in this issue for further details.)*

"Integrated Models of Gas-Phase Air Cleaning Devices and Multizone Building Systems", by J.W. Axley was a keynote address that presented the theoretical and experimental work that is creating workable models of gas-phase filter modules that can be used in larger IAQ models also under development with Axley's input. There is a strong thrust towards a good physical and aerodynamic science understanding of the processes, rather than simple correlations of data that have no physical significance.

"Prefilters and Fine Filters and a Source of Contaminants", by P.O. Pasanen, A-L. Pasanen, P. Kalliokoski and A. Toumainen presents a summary of the compounds and odours from HVAC filters that become sources of contaminants back into the air once they are loaded (specific source rates were not identified in this paper). *JW*

A two-volume set of proceedings can be purchased for $100.00 from:
Dr. Fariborz Haghighat
Centre for Building Studies, Concordia University
1455 De Maisonneuve W., Montreal QC H3G 1M8
Tel: (514) 848-3192, Fax: (514) 848-7965.

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PROFILE

EPA pursues comprehensive emission research program

Probably no single agency is as active in material emissions research and standards development as the U.S. Environmental Protection Agency. This article provides an overview of the broad range of activities currently underway.

The U.S. Environmental Protection Agency (EPA) is engaged in a comprehensive approach to material emissions which involves systematic characterization of indoor sources, detailed studies of priority products, dialogues and joint projects with industry, theoretical modelling and the development of new test methods and test facilities.

As with many large agencies, EPA's organizational chart is quite complex, and recent re-organization has changed the names of some of the groups. There are three major areas within EPA where emissions-related work is being pursued.

- In Washington, the **Indoor Air Division** (under the Office of Radiation and Indoor Air) has a staff of 22, one and a half of which are actively involved in emissions work, primarily policy development.

- The **Economics, Exposure and Technology Division** (under the Office of Pollution Prevention and Toxics), also based in Washington, has five to six persons working on emissions research. This number almost doubled during the Carpet Policy Dialogue process.

- At Research Triangle Park in North Carolina, the recently renamed **Air Pollution Prevention and Control Division** (part of the National Risk Management Research Lab under the Office of Research and Development) undertakes emissions research with three to four EPA staff plus numerous contractors.

Indoor Sources Characterized

EPA's most significant emissions project at present, according to John Girman, Chief of the Indoor Air Division's Analysis Branch, is the "Indoor Air Source Characterization Project" (IASCP), which is a joint venture of the Office of Radiation and Indoor Air, the Office of Pollution Prevention and Toxics and the Office of Research and Development.

IASCP aims to determine those classes of products that are major contributors to indoor air exposure.

IASCP aims to determine those classes of products that are major contributors to indoor air exposure and to take actions to reduce such exposures. Based on the success of the Carpet Policy Dialogue — which led to an industry-led voluntary testing program, the development of standard test methods, an exploration of ways to reduce emissions and extensive consumer education — IASCP is examining other classes of products. The project involves selecting or developing appropriate test methods, testing a preliminary sample of products and analyzing emissions for individual chemical components.

Exposure and Hazard Data Combined

EPA's "Source Ranking Database" (SRD) provides a mechanism for screening-level comparisons of many indoor air pollutant sources to identify high priorities. The SRD uses a standard product classification scheme and includes data on exposure (including chemical-specific emission rates, loading factors and air exchange rates), hazard information and an overall ranking which combines exposure and hazard data. The analysis considers both annual average concentrations for chronic and cancer effects and peak concentrations for acute effects.

More detailed analyses are then undertaken on product classes identified as being of most concern. This includes a market analysis, validation of test methods, limited product testing and screening level risk assessments.

Such a detailed analysis is underway for paints. A study of several analytical methods has led to the selection of three:

- ASTM D2369 Standard Test Method for Volatile Content of Coatings and ASTM D4017 Standard Test Method for Water in Paints and Paint Material by Karl Fischer Method — for TVOC emissions;
- bulk analysis of diluted paint samples by GC/MS — for determining individual VOCs/SVOCs and TVOC;
- small chamber testing using 52.7 L electropolished stainless steel chambers — for determining emission rates over time for individual VOCs/SVOCs and TVOC.

The ASTM D2369 and D4017 standards and the bulk analysis are inexpensive methods which are useful in determining TVOC content and identifying specific toxic agents of concern, while the more expensive chamber testing provides the emission rate data essential to exposure assessment. FLEC emission cells and mass transfer modelling are also being assessed as alternates. Numerous paint samples have been tested and analyzed.

Dialogue with Paint Industry

According to Christina Cinalli, IASCP's primary researcher, EPA will be launching an informal stakeholder dialogue with industry in late summer with the presentation of preliminary findings on the latex and alkyd paint studies. Discussions may include strategies for removing certain specific chemicals from paint formulations. Information on the emission characteristics of paints may be incorporated into the specifications of the Government Services Administration — the agency responsible for federal buildings.

"We should hopefully have the rankings completed by the beginning of next year," says Cinalli. Over the next couple of years, EPA plans to introduce rankings on one product class per year. Data on consumer products, such as air

fresheners, are also being added to the SRD, drawing on the results of an EPA consumer product survey.

Cinalli notes that product loading may not be significant in comparison with emission rates, which have been found to vary by orders of magnitude.

EPA will be holding a workshop for emissions researchers at the end of the year to discuss the algorithms and modelling associated with IASCP.

Formaldehyde Sampled in Test House

EPA is conducting a joint study with the National Particleboard Association on urea formaldehyde bonded wood products (see "Industry and EPA launch test house" in Issue No.2).

A test house has been constructed in Maryland and extensive time-integrated formaldehyde sampling began in April. Four sets of materials and components are being examined, each for approximately six weeks. According to Sid Abel, EPA's liaison, this phase of the project should be completed by mid to late fall. The second phase, involving the construction and testing of four manufactured homes in Pennsylvania, has not yet started.

TVOCs from Cleaning Products

A project being undertaken by the Office of Pollution Prevention and Toxics for the Government Services Administration (GSA) involves assembling information useful in the selection of cleaning products.

A wide range of environmental attributes have been examined, three of which relate to indoor emissions: TVOCs, fragrance and irritation. For TVOCs, the total content is measured, based on the State of California's requirements. Irritation is measured on a Draiz scale.

Screening level risk assessments have been undertaken on four types of cleaners. The process has been a voluntary one, with ongoing meetings held with vendors and federal purchasers.

According to Pat Kennedy, Chief of the Exposure Integration Section, EPA is now ready to implement a pilot program for the most frequently used cleaning products, such as degreasers and cleaners for glass, hard surfaces and toilet bowls. "Federal Supply and Services will be requesting vendors to supply information shortly," says Kennedy. "Such information should be available to federal purchasers by the fall."

Will the program eventually impact other buildings? "FSS is a significant customer. It's quite possible that this program will spill over to the private sector, although exactly how is not clear at this point."

And the reaction from vendors? "There's a mix of folks out there," explains Kennedy. "Some smaller companies look at environmental attributes as their market niche and have been very enthusiastic. Others were concerned that EPA was setting up a system with only a limited number of attributes, but their concerns have been taken care of by ongoing dialogue. Vendors will also have the opportunity to discuss other attributes of their products in the GSA Catalogue."

Dry Cleaning Emissions

Another project which includes indoor emissions along with a broad range of other environmental parameters is the "Design For the Environment" Program, which is examining the environmental implications of various industrial and commercial processes and promoting alternatives. One significant area is dry cleaning. Emissions of perchloroethylene and other petroleum solvents can be problematic not only for workers by also for occupants in multi-use buildings, such as apartments, where dry cleaning outlets are located.

EPA's Ohad Jehassi has been working with the industry for a couple of years to reduce exposure to such emissions through showcasing alternative cleaning methods and

developing guidelines for improved practices. A final report on this work is expected in the summer of 1996.

Developmental Work on Latex Paint

At Research Triangle Park, the current focus of activity for the Air Pollution Prevention and Control Division is a detailed study of latex paint emissions (see "EPA Completes First Phase of Latex Paint Study" by Bruce Tichenor in Issue No.2).

The first part of the study was completed in 1994, involving source characterization in small chambers and the development of sampling and analysis techniques. The second part consisted of static and dynamic chamber testing to determine VOC emission rates and the evaluation of source emission models. This work has recently been completed.

Gypsum Prolongs Emissions

One of the most interesting findings, according to Bruce Tichenor, is the effect of gypsum board on the rate of latex paint emissions. With a stainless steel substrate, the emissions drop to virtually zero within a week, while with a gypsum board substrate, significant emissions are still being measured after eleven months, and Tichenor predicts that such emissions may continue for another two years. VOCs are being absorbed into the gypsum board and then being re-emitted slowly through diffusion.

"I don't know if this is good news or bad news," notes Tichenor. "The good news is the reduction in the initial rates of emission. The emissions occur over a longer time period, but at much lower levels."

The presence of sinks also has a dramatic effect on initial concentration levels. Carpeting and gypsum board are strong sinks for ethylene glycol, the dominant VOC emitted, but not for Texanol®, the second most dominant. VOCs adsorbed by such sinks are re-emitted, but only very slowly.

The third part of the study is now underway and involves test houses with increasingly comprehensive testing configuration. Source and sink models will also be validated. Tichenor hopes that this work will be completed by the end of 1995.

This work will lead to the development of a proposed ASTM test method for latex paint emissions. "The results so far are changing our proposed approach," says Tichenor. "Quantifying the emission rate is not that simple. It's not clear how much we can generalize the effect of the substrate and sinks."

Additional projects at Research Triangle Park involve using the FLEC device for measuring formaldehyde emissions from pressed-wood products. This work is being undertaken in support of the EPA/NPA joint formaldehyde study noted above. Tichenor praises FLEC as "a nice tool for measuring sources which are fundamentally diffusion-limited."

Office-Size Chamber Commissioned

EPA's new 30 m^3 chamber is now being commissioned and will be available for use shortly, simulating a full office environment. Joint evaluation studies are being planned with Canada's National Research Council and Australia's CSIRO, and will include comparative emission rates from standard sources.

EPA is collaborating with Research Triangle Institute and Underwriters Laboratories to study emissions from office equipment. The first phase — a literature review — has been completed, covering a range of equipment including copiers, printers, fax machines, blueprint machines, computers and video display terminals. Such equipment is associated with elevated levels of ozone, TVOCs and particulates in office environments. The current phase of the study involves developing guidelines for emission testing in dynamic chambers. This will be followed by round-robin validation of the test procedures.

Pollutant source management is one of the options being evaluated for cost effectiveness in a new EPA project which is developing practical guidance on IAQ control techniques in a variety of typical building types. The first case study is weighing the relative costs per unit reduction in VOC exposure for source control, ventilation and air cleaning. *TR*

For further information on the above EPA projects:
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Christina Cinalli, Tel: (202) 260-3913, Fax: (202) 260-0981.
John Girman, Tel: (202) 233-9317, Fax: (202) 233-9555.
Ohad Jehassi, Tel: (202) 260-6911.
Pat Kennedy, Tel: (202) 260-3916.
Bruce Tichenor, Tel: (919) 541-2991, Fax: (919) 541-2157.

Australia studies paint emissions

by Steve Brown, CSIRO

The Commonwealth Scientific and Industrial Research Organization (CSIRO) is a statutory authority with the primary function of carrying out scientific research to assist Australian industry and the community and to contribute to Australia's national and international responsibilities.

"Source Control of Indoor Air Quality" (for which I am Project Leader) has as its major focus the assessment and control of VOC emissions from indoor materials using dynamic environmental chambers. Most of our effort over the last two years has been directed to building the chambers (small dynamic environmental chambers of 51 L and a room-sized environmental chamber of 33 m^3) and analytical capabilities. Our major experimental work is to start in the next couple of months and will be on air velocity effects on paint emissions.

Emissions work to date has included:

- participation in CEC interlaboratory small chamber comparison of paint emissions;
- single emission trials with three materials in small chambers (paint, lacquer, carpet);
- emissions from three wet paints for a manufacturer: an acrylic, an enamel and a "zero VOC" paint.

Following our previous activities, we also have an interest in asbestos and formaldehyde emissions from indoor materials.

In regard to other emission work in Australia, another project at this Division is using computational fluid dynamics to model air and pollutant movement in buildings, and these models will no doubt be useful for assessing impacts of source emissions.

The Australian Wood Panels Association has steered the reduction of formaldehyde in pressed-wood products over the last decade and now claim that 90% meet European low-emission limits. The Australian Gas Association has been evaluating NO_2 emissions from unflued gas heaters and have developed a low-NO_x heater.

For further information:

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NEWS BRIEF

Fact Sheet on Emissions Available from APA

A revised version of "Facts About Structural Wood Panels and Formaldehyde Offgassing" is now available from APA—The Engineered Wood Association. The fact sheet describes the manufacturing differences between structural composite panels, such as softwood (exterior) plywood, oriented strand board and waferboard, which use phenol formaldehyde (phenolic) adhesives, and hardwood (interior) plywood and particleboard, which use urea formaldehyde adhesives. Since the phenolic polymers do not break down once reacted, the only source of formaldehyde emissions from structural panels is unreacted or free formaldehyde in the resins. The fact sheet cites large scale chamber testing undertaken in the 1980s, which indicated that formaldehyde levels from newly manufactured panels are below 0.1 ppm and approach zero after several months of aging.

For further information:
APA—The Engineered Wood Association, 7011 South 19th Street, P.O. Box 11700, Tacoma WA 98411-0700, tel: (206) 565-6600, fax: (206) 565-7265.
In Canada: Patrice Tardif, APA—The Engineered Wood Association, 5972 Waverly, Montreal QC H2T 2Y3, tel/fax: (514) 270-7573.

PRODUCT LABELLING

New EcoLogo guidelines out for public review

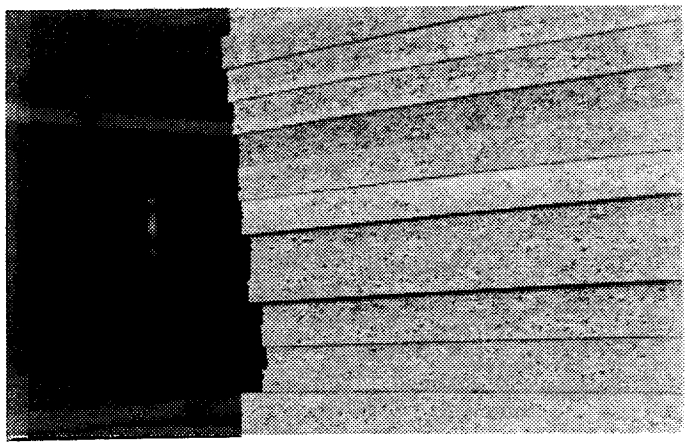
Environment Canada has expanded its Environmental Choice[M] Program in recent months to cover a much greater range of building materials and has included indoor emission limits in many of its newest guidelines.

The EcoLogo[M] is Environment Canada's label for products which demonstrate improved environmental performance. Guidelines have already been established for about thirty categories of products and this number will approximately double with the publication of many new guidelines this fall. Criteria for the voluntary program address a broad range of environmental issues, such as waste reduction, recycled content, energy consumption, minimal packaging and emissions.

While existing EcoLogo guidelines for paints, coatings, adhesives and sealants (see Issue No.1) have addressed indoor pollutant emissions as part of a reduction in overall atmospheric emissions of VOCs, the newest guidelines specifically mention IAQ impacts and include indoor emission limits for many of the most common sources of indoor air pollutants.

The following EcoLogo guidelines are currently being finalized or are undergoing public review. Any changes incorporated into the final requirements will be reported in the next issue of ***Healthy Materials***.

Particleboard: Setting limits for formaldehyde emissions has sparked a debate between those who wish to see emissions reduced below the concentrations recommended in Health Canada's "Exposure Guidelines for Residential Indoor Air Quality" (i.e. action level of 120 $\mu g/m^3$ or 0.1 ppm, target level of 60 $\mu g/m^3$ or 0.05 ppm) and industry representatives, who feel that the current ANSI 208.1-1993 "Particleboard" standard of 370 $\mu g/m^3$ or 0.3 ppm is adequate. The draft guideline proposes a maximum concentration level of 180 $\mu g/m^3$ or 0.15 ppm, when tested in accordance with ASTM E1333-89 "Standard Test Method for Determining Formaldehyde Levels From Wood Products Under Defined Test Conditions Using a Large Chamber".



Fibreboard: As for particleboard, establishing EcoLogo guidelines on fibreboard formaldehyde emissions has been controversial. For medium density fibreboard (MDF) and hardboard, the proposed maximum concentration has been set at 180 $\mu g/m^3$ or 0.15 ppm, when tested in accordance with ASTM E1333-89. For low density fibreboard (insulation board), adhesives that release formaldehyde are not permitted.

Carpets: A "total load point" approach is proposed, combining the issues of indoor air emissions, recycled content and recyclability. As a minimum, carpets must meet the Canadian Carpet Institute's IAQ labelling program standards, which specify maximum emission rates (in mg/m^2hr) of 0.1 for 4-PC, 0.05 for formaldehyde, 0.4 for styrene and 0.5 for TVOCs, based on ASTM D5116-90 "Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products". To earn the Ecologo, the manufacturer must go beyond the CCI/CRI standards **or** address recycled content/recyclability **or** pursue some combination of both.

Carpet Undercushion: Similar to the requirements for carpets, a "total load point" approach is used and the CCI/CRI standards for 4-PC, formaldehyde, styrene and TVOC emissions have been proposed as the minimum for both polymeric cushion and fibre-type underlay.

Resilient Flooring: The requirements for vinyl and linoleum flooring also follow a "total load point" approach based on indoor emissions, recycled content and recyclability. The proposed maximum TVOC emission rate, when tested in accordance with ASTM D5116-90, is 1.0 mg/m^{2}hr. Some combination of reduced emissions and/or reduced landfill burden is required to obtain EcoLogo certification.

"EcoLogo can't take full credit for the move to low-VOC paints, but has certainly been one of the factors in changing the market..."

Prefinished Hardwood Flooring: Finishes must be water-based or 100% solid UV curable, with VOC emissions resulting in indoor concentrations no greater than a proposed maximum of 0.5 mg/m^3 when tested in accordance with ASTM D5116-90.

Office Panel Systems and Demountable Partitions: TVOC emissions from office panel systems are limited to a proposed maximum concentration of 0.5 mg/m^3 when tested in accordance with ASTM D5116-90 and the State of Washington's "Environmental Chamber Protocol for the Measurement of Pollutant Outgassing from Office Furniture". For both panel systems and demountable gypsum partitions, adhesives must not contain aromatic solvents, halogenated solvents, formaldehyde or various toxic compounds, nor have a VOC content in excess of 3% by weight. Surface coatings must similarly be free from halogenated solvents, formaldehyde and various toxic compounds, not contain aromatic solvents in excess of 8% by weight, nor have a VOC content in excess of 335 g/L.

Guidelines for gypsum wallboard, office furniture and photocopiers are currently being finalized and will be published shortly.

Environmental Choice is the second oldest environmental labelling program in the world, after Germany's "Blue Angel" program. The greatest market impacts to date have been with paints, papers and recycled oil. "EcoLogo can't take full credit for the move to low-VOC paints, but has certainly been one of the factors in changing the market," notes Lynne Patenaude of TerraChoice Environmental Services, the agency which now delivers the Program.

Guideline development begins with the preparation of a Technical Briefing Note which documents the environmental issues and impacts of a product category. Draft guidelines are debated by a Guideline Review Committee (GRC), with representatives from industry, environmentalists and the scientific community. A six week public review process is undertaken, followed by a final review by the GRC. *TR*

If you are interested in participating in the development or review of future guidelines, contact:
Lynne Patenaude, Environmental Choice Program
Tel: (613) 952-0264, Fax: (613) 952-9465.

NEWS BRIEF

Workshop Brings Together Health Professionals and IAQ Specialists

A "Health and Housing" workshop held March 3 in Ottawa succeeded in opening a dialogue between the health and IAQ disciplines. Hosted by Health Canada and CMHC, the one-day session provided about 200 invited participants with a synopsis of the key issues relating to residential indoor environments and an opportunity to discuss possible directions for action. Keynote speakers included Dr. Jack Spengler of the Harvard School of Public Health, Dr. Thomas Houston of the American Medical Association, Dr. Irving Broder of the University of Toronto's Gage Research Institute, Dr. David Miller of Agriculture Canada, Dr. Robert Dales of Health Canada, Jim White of CMHC and Jack Cole of NRCan's R-2000 Program. Broder noted that in studies of occupant well-being, VOC levels ranked third in importance in a list of twelve physical and psychological factors.

EMISSIONS TESTING

Variation in emission rates highlights need for product-specific data

A study undertaken for Natural Resources Canada of new, leading-edge Canadian housing has found an extremely wide range in the emission characteristics of products within a material type. For most product types, this variation is one to two orders of magnitude. For the carpet samples tested, emission rates varied by a factor of 3,000.

The Saskatchewan Research Council (SRC) and Figley Consulting Associates Ltd. used small environmental chambers to measure emissions from 43 materials taken from six of the "Advanced Houses" demonstrations in Vancouver, Saskatoon, Waterloo, Hamilton, Ottawa and Halifax and from the "R-2000 Healthier Homes" demonstrations in Halifax.

In both of these demonstration programs, builders had attempted to meet Health Canada's "Exposure Guidelines for Residential Indoor Air Quality" by selecting lower-emission materials. However, the design teams found that little data was available to enable such decisions to be made on a quantitative basis.

Materials tested included carpeting, carpet underpad, spray-in-place polyurethane foam insulation, medium density fibreboard, particleboard, interior plywood, structural and architectural composite wood products, sheet vinyl flooring, latex paint and various finishing materials.

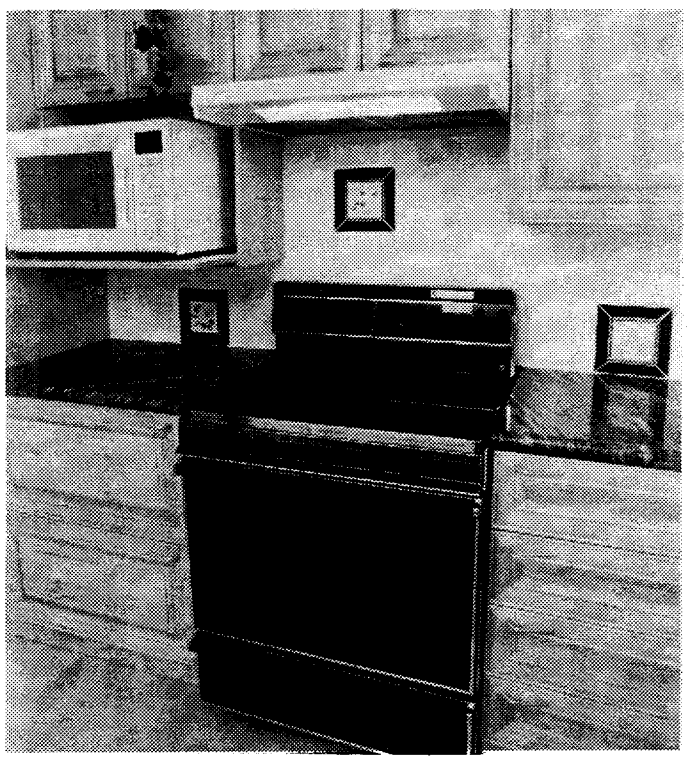
TVOC emissions were measured for 37 samples, formaldehyde for 20, and polycyclic aromatic hydrocarbons, 4-PC and styrene for a smaller number. Samples taken from the Advanced Houses were 6 to 18 months old, while those from the R-2000 homes were new. The findings are summarized in a report entitled "Building Materials — Volatile Organic Chemical Emission Characterization and Database Development".

Carpets Contaminated On-Site?

The seven carpet samples produced the greatest variation. Four were well below the Canadian Carpet Institute's TVOC guideline of 600 $\mu g/m^2h$, with three being below 100. However, two had very high TVOC rates in the order of 50,000 $\mu g/m^2h$. Emissions from these two samples included C_{10} to C_{13} hydrocarbons, which are common constituents of cleaning solvents and other petroleum-based products. SRC researchers speculate that these two samples may have become contaminated on site from cleaning or finishing operations, and recommend that changes may be required to construction processes to prevent carpets from acting as significant secondary sources of emissions.

Sheet vinyl flooring samples were generally found to have higher TVOC emissions than carpeting, with emissions rates from 948 to 9,408 $\mu g/m^2h$. Latex paints claiming to be "low emitting" did indeed have lower TVOC emissions that conventional products.

Most product types exhibited large variations in emission rates — in most cases by one to three orders of magnitude. The report therefore notes "the inherent weakness with indoor air quality analysis which uses only generic or average values" and which could seriously over- or under-predict pollutant concentrations in buildings. This finding highlights the need to obtain product-specific emissions information.



Interior of the B.C. Advanced House →

All Components Need to be Examined

SRC also observes that TVOC emission rates for most product types fall in the range of tens to hundreds of $\mu g/m^2h$, and therefore recommends that to significantly improve IAQ, all components of a building should be examined, rather than singling out individual product classes as "problem" materials.

Since an objective of the project was to standardize test procedures, a methodology sheet was developed for each product type with respect to product characteristics, sample preparation and conditioning, aging, loading ratios, test procedures and rationale for the methodology. Procedures were based on ASTM D5116-90, ASTM E1333-90, CAN/CGSB 51.23-92 and other standards currently under development.

Table 2. Range of Emissions for Typical Materials

Product Type	No. of Samples	TVOC Emission Factor ($\mu g/m^2h$)	
		Maximum	Minimum
Carpet	7	56,223 652[1]	18
Carpet Underpad	2	356	33
Vinyl Flooring	5	9,408	948
Foam Insulation	2	68	45
MDF	4	835	57
Composite Wood Product Assemblies	4	1,378	459
Structural Composite Wood Products	3	386	55
Low-Emitting Paint[2]	2	42	9
Conventional Paint[2]	2	308	243
Interior Finishing Materials	4	479	21

Notes: 1. Excluding two samples with high emissions from possible on-site contamination from petroleum-based products.
2. At 120 hours.

For further information:

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Peter Freimanis or Jerry Makohon,
Saskatchewan Research Council
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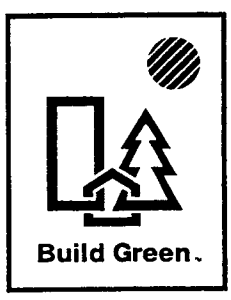
Dr. Don Figley,
Figley Consulting Associates Ltd.
Tel/fax: (306) 374-8141

Editor's Note:
The variability of emission rates is a theme which comes up several times in this issue. So far, most programs and policies are addressing material emissions as though there were one number that could be assigned to a line of products. This assumes the same product is consistent and that results from different samples should be reproducible. This is not going to be the case, because emissions are not a designed-in characteristic of products, but the accidental outcome of processes. Addressing this high variability will prove to be difficult, just as it is in the airtightness of buildings. We have to learn to think in terms of distribution diagrams of variable emission rates, over time, between samples of a given product and between different products of the same type. Averages have no useful meaning when the worst is three decimal orders more polluting than the best available product that fulfills the same function. Just as we are still groping with variable airtightness and how to properly handle it in building codes, it may take time to handle the inherent variability of emission rates as well. The sooner we start, however, the better for all concerned.
JW

Surprise sources of emissions discovered



A comparison study of recycled and conventional materials found little difference in average emissions, but did uncover some unusual sources of high emissions.

The great increase in availability and popularity of recycled building materials in recent years has been paralleled by an increase in concern over the indoor emissions from such products. Canada Mortgage and Housing Corporation commissioned ORTECH Corporation to examine volatile organic compounds and formaldehyde emitted from a

selection of 37 recycled and conventional products. The recycled materials were drawn from the Build Green Program, a joint venture of the Greater Toronto Home Builders' Association and ORTECH.

A total of 37 materials were tested, including carpet, carpet undercushion, structural lumber, foundations, insulations, counter tops and cabinetry, and drywall/fibreboard. Tests were performed in a 55 litre chamber according to ASTM D5116-90, at 23°C, 50% R.H. and 0.5 air changes per hour.

Samples were obtained directly from the manufacturers, although in some cases, manufacturers refused to participate, necessitating the purchase of materials from retail outlets. Very few manufacturers were able or willing to provide chemical information on their products.

Recycled Materials Similar to Conventional

ORTECH's final report, "Build Green and Conventional Materials Off-Gassing Tests", concludes that the TVOC and formaldehyde emissions from Build Green and conventional materials are generally equivalent, with two exceptions.

As can be seen in Table 3, the range of emission rates within a product category was found to be very wide. ORTECH researchers attribute this great variation to the lack of standardized emission test methods and the lack of attention paid by manufacturers to material emissions. The report recommends that off-gassing criteria should be an integral part of product formulation and that the results be made available to construction professionals.

The findings also included some interesting surprises:

- **Cast-in-place concrete** had the highest TVOC emission rate at 2,300 $\mu g/m^2h$. These emissions are not from the concrete itself, but from the form oil release agent applied to the formwork, some of which remains in the concrete after the forms are stripped.

- **Solid wood cabinet doors** had very high emissions of TVOCs at 1,500 $\mu g/m^2h$ and formaldehyde at 9,100 $\mu g/m^2h$. ORTECH researchers believe this is due to the stain and lacquer finish applied to the door, which was then shrink-wrapped in plastic, allowing no opportunity for off-gassing.

- **Gypsum drywall** obtained from building supply outlets, rather than from manufacturers, had higher TVOC and formaldehyde emissions than expected, probably due to the products acting as sinks for emissions from other building materials stored nearby.

Table 3. Comparative Emissions From Recycled and Conventional Materials

Material Category	Type[1]	No. of Samples	TVOC Range $\mu g/m^2h$	HCOH Range $\mu g/m^2h$
Carpet	BG Conv	2 4	<1 10 - 500	<1 <1 - 48
Carpet Undercushion	BG Conv	3 1	<1 - 470 <1	<1 12
Structural Lumber	BG Conv	3 2	67 - 290 46 - 360	4 - 8 4 - 23
Foundation Systems	BG Conv	2 2	<10 - 280 26 - 2,300[2]	<4 - <5 <1 - <3
Insulation	BG Conv	2 6	6 - 8 <1 - 150	5 - 35 <1 - 300
Counter Tops	BG Conv	1 2	7 9 - 590	<1 <1 - 175
Cabinetry	BG Conv	1 1	130 1,500[3]	177 9,100[3]
Drywall/ Fibreboard	BG Conv	3 2	<1 - 220 20 - 25	23 - 1,000 60 - 250

Notes:
1. BG = Build Green products; Conv = Conventional products.
2. High TVOC emissions from cast-in-place concrete due to presence of form release agent.
3. High TVOC and HCOH emissions from solid wood cabinet door due to factory applied finish.

For further information:

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Peter Piersol, ORTECH Corporation
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NEWS & ANNOUNCEMENTS

AQS develops Emissions Test Protocol for laser printers

by Karen Cantrell, Air Quality Sciences Inc.

Air Quality Sciences Inc. (AQS) has established environmental chamber test protocols for the analysis of chemical and particulate emissions from laser printers. The laser printer is placed into an environmental chamber that realistically simulates the indoor environment. The printer is operated as it would normally for an established period of time. During its operation, chamber air is monitored continuously for total volatile organic compounds, individual VOCs, formaldehyde, particulates and ozone.

The U.S. Environmental Protection Agency has identified office equipment, including laser printers, as a source of indoor air pollutants, particularly VOCs, ozone and particulates. Exposure to elevated levels of these pollutants can result in human irritation and more severe health effects in some individual cases.

This protocol is also applicable to other types of office equipment, including photocopiers and computers, and is currently being used by office equipment manufacturers. The Research Triangle Institute and EPA are developing similar protocols and an ASTM standard is likely.

Environmental chamber technology (ECT™) is an advanced technology for accurately evaluating these emissions from laser printers. AQS, a commercial provider of environmental chamber studies and IAQ pollutant measurements, pioneered the research and development of environmental chambers. AQS works internationally with product manufacturers, government agencies and industry associations to study indoor air quality, to analyze products as part of the research and development process, to assess a product's impact on indoor air quality and to assist in improving a product's indoor air quality performance.

For more information:
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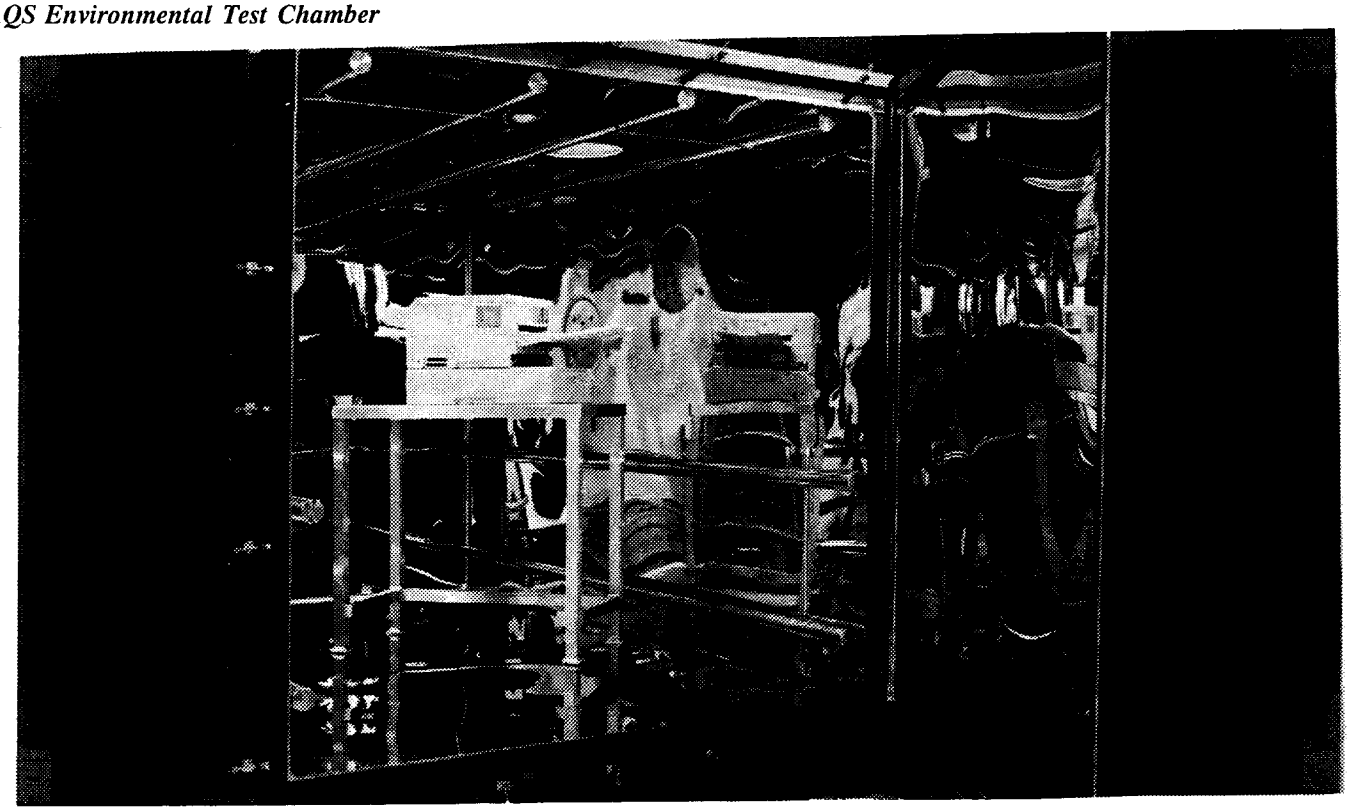
AQS Environmental Test Chamber



Screening protocols developed for housekeeping products

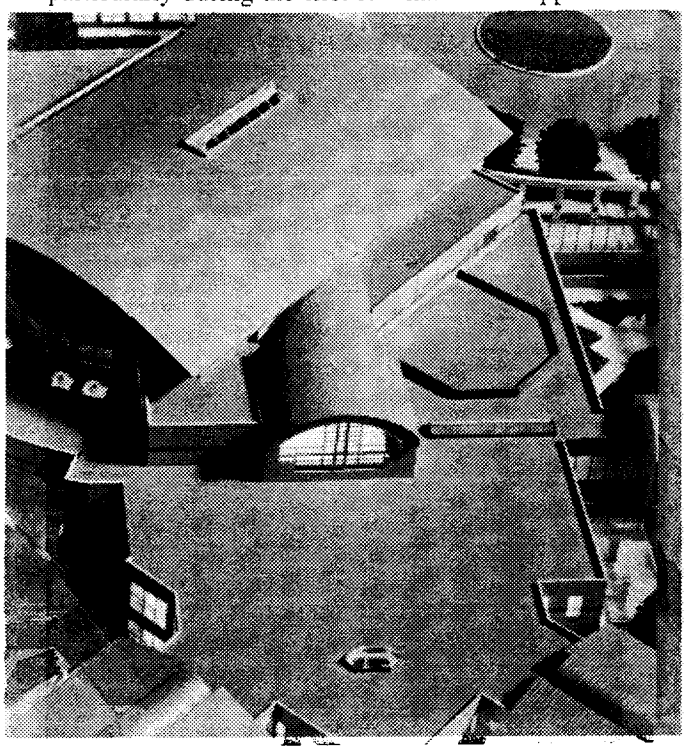
by Bruce Small, Green-Eclipse Inc.

The Green Workplace Office of the Ontario Realty Corporation — the agency responsible for provincially owned or occupied buildings — commissioned a study to develop ways of streamlining the assessment of potential indoor pollution sources in government buildings.

The report, "Practical Emission Screening Protocols for Products That Affect Indoor Air Quality", builds upon the experience gained in screening building materials for the Whitby Mental Health Centre. Housekeeping products proposed for use at the Centre were used as examples for the exploration of a practical and inexpensive screening procedure.

Liquid Cleaners Create Spikes

The technical investigation of emissions from housekeeping product samples concluded that housekeeping materials are a significant source of volatile organic compounds. Liquid cleaning materials create a "spike" of contaminant loading — particularly during the first few minutes of application of the product — which easily dwarfs the static source of pollutants in most health institutions. The entire process of housekeeping requires rethinking in terms of potential indoor pollution exposures.



Model of Whitby Mental Health Centre

The investigators recommend a "user-based" emission screening protocol which is intended to be carried out primarily by in-house staff with outside advice as needed, and is designed for economy by the early elimination of unsuitable products, so as to minimize expensive laboratory testing.

The protocol contains the following distinctive features:

- a re-examination of the problem before lining up alternative products;
- user standards tailored to the site and to the needs of the occupants;
- information beyond that usually given in Material Safety Data Sheets;
- early elimination of obviously unsuitable products;
- selective laboratory tests and encouragement of users' tests;
- final recommendations by a user committee;
- *in situ* monitoring of product performance and health effects.

Recommendations for Testing

The study includes a series of laboratory tests on sample housekeeping products. Analysis of the test results leads to the following conclusions about emission testing:

- Headspace testing is an appropriate first step to identifying volatile organic compounds (VOCs) which can be released from both dry and wet products;
- Small chamber emission tests are not applicable for determining the full array of emissions from wet, fast-evaporation products such as cleaners and floor finishes;
- Chamber tests may, however, contribute to the knowledge of longer term emissions following the early release of perfumes and other volatiles;
- Product application tests are useful for confirming and quantifying the presence of VOCs released during application of wet products;

- If toxic or irritating compounds are identified by headspace testing, passive organic vapour badges or active collection pumps are recommended to quantify actual inhalation exposures during product application.

The investigators — Green-Eclipse Inc., ORTECH Corporation and Janis Kravis Architect — have also made several recommendations for action by the Ontario Government. These include establishing pilot groups to test the screening protocol, conducting a review of cleaners and floor finishes, and beginning a comprehensive review of all materials and products used in provincially-held buildings.

For further information:

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Canadian indoor environment industry characterized

by Jay Kassirer, Cullbridge™ Marketing & Communications

The indoor environment industries in Canada are experiencing a rapid growth that will accelerate over the coming decade, presenting significant opportunities for related products and services in Canada and abroad. Industry Canada, Canada Mortgage and Housing Corporation, and the Ontario Ministry of Environment and Energy's Green Industry Office commissioned Cullbridge to undertake a study entitled "Characterization of the Indoor Environment Industries" and to prepare directories.

A self-administered questionnaire was sent to 900 qualified companies. One third responded. Interviews were conducted with 34 companies, 16 industry associations and specialists from stakeholder groups.

The indoor environment sector is essentially multidisciplinary. It draws emerging industries together with more traditional ones, spawning the development of new products and services and improvements to those already existing. The companies involved can be classified into five groups: 1) inspection, monitoring and controls; 2) ventilation, air filtration, air conditioning and related equipment; 3) healthier lighting systems; 4) low-pollution building products, materials and technologies; and 5) related services.

A Growth Industry

This is a billion dollar industry sector in Canada, growing at about 10% per year and employing over 5,000 people. Exports, representing a third of these revenues, are growing at a rate of about 25% per year. Note that many service providers were not included in this study and so the size of this industry has been underestimated accordingly.

A series of workshops across Canada is being planned for the fall, with sessions on marketing, training needs and assistance programs.

To register for workshops (if you are not already listed in the directories):
Cullbridge Marketing and Communications
809 Quinlan Road, Ottawa, Ontario K1G 1R8
Tel: (613) 733-6013 Fax: (613) 733-3306

To order the report or the directories, contact the following:

Characterization of the Indoor Environment Industries
and/or
Healthier Indoor Air Environments: Canadian Sources of Residential Products and Services
Canadian Housing Information Centre (CHIC)
Canada Mortgage and Housing Corporation
700 Montreal Road
Ottawa, Ontario K1A 0P7
Tel: (613) 748-2367 Fax: (613) 748-4069

The Indoor Environment Industries: A Directory of Canadian Manufacturers and Service Providers (WordPerfect® diskette)
Philippe Lalonde, Environmental Industries Directorate
Industry Canada
235 Queen Street, Ottawa, Ontario K1A 0H5
Tel: (613) 954-3211 Fax: (613) 954-3430

EDITORIAL

How much does it cost to use polluting materials?

by Jim White, CMHC Research Division

Some say we cannot afford to use low-pollution materials. In reality, we cannot afford to use high-emission-rate materials within our buildings.

The latter is true because the assertion that we cannot afford low-emission products focuses solely on first costs, not the total cost paid by the householder and society. It is important to realize that there are several possibilities in assigning costs: either the consumer pays for the more costly materials, the consumer pays for extra ventilation to bring indoor concentrations down to acceptable levels, or the consumer pays by getting sick. In all cases, the consumer pays.

In a paper presented to the "2nd International Conference on Indoor Air Quality, Ventilation and Energy Conservation", I looked at a case where a large amount of formaldehyde-emitting material was used in a modern Canadian home.

This case was modelled on a real problem house in the Prairies. In this paper, all of the sheet products met the HUD standard emission rates, but as in the problem house, there were several sources, not just one. The paper also looked at the differences between standard test conditions and the standards for exposure in a typical Canadian house. Therein lies much of the problem.

Pressed-wood products are tested in a chamber where the air exchange rate is 0.5 AC/h and the limit on chamber formaldehyde concentrations is 0.3 ppm. In real Canadian houses the continuous air exchange rate is likely to be about 0.125 AC/h and Health Canada's "Exposure Guidelines for Residential Indoor Air Quality" suggest that 0.05 ppm formaldehyde should be the target level.

For the emission rates not to increase ambient formaldehyde concentrations beyond this target level, the total amount of product used would have to be (0.5/0.125)*(0.3/0.05) = 24 times less than the loading in the standard test conditions. In the problem house and the presented case the loading was actually higher than standard test conditions.

If the house were ventilated at a rate designed to bring the indoor concentrations down to Health Canada's guideline levels, the cost of moving and conditioning the extra ventilation flow was calculated as equivalent to about $10 per sheet of pressed-wood product in the first year alone. There is a very large margin available, in this worst-case situation, for more investment in the board so there will be less ongoing investment in ventilation.

In reality, the consumer would put up with the odour and the cost of illness that corresponds to such high exposures, rather than use all of that extra ventilation (it would actually be impossible to produce the required rates in a cold climate and still live in the house). We do not know much about the real medical costs of such exposures, of course, but they exist, even if we do not know them precisely.

There is no excuse for producing high-emission products when it costs less over the long term for the consumer to purchase lower-emission products. Remember, in the long run the consumer pays, or the consumer pays, or the consumer pays. When and how the payment will be made varies, but not who pays!

***Healthy Materials** welcomes readers views on topics relating to material emissions.*

EUROPEAN UPDATE

Several important developments in emissions research are unfolding in Europe. In addition to activities in individual countries and research centres, such as the Danish Indoor Climate Labelling program described in the cover article, there are a number of significant continental initiatives. These include the European Collaborative Action's "Indoor Air Quality and Its Impact on Man" program, the CEN (European Standardization Committee) Technical Committees on Indoor Air Quality (TC264) and Wood-Based Panels (TC112), and the European Data Base for Indoor Air Pollution Sources in Buildings project under the European Union's Joule II program.

Many thanks to Nils Duberg of the Swedish National Flooring Trade Association, Dr. Helmut Knöppel of the EC's Joint Research Centre, Dr. Lars Mølhave of Denmark's Institute of Environmental and Occupational Medicine, Dr. Göran Stridh of Sweden's Örebro Medical Centre Hospital and Dr. Peder Wolkoff of Denmark's National Institute of Occupational Health for providing ***Healthy Materials*** *with the latest information on various initiatives taking place in Europe. We look forward to hearing more from European researchers in the future.*

ECA drafts procedure for material evaluation

Emissions-related activities within The European Collaborative Action's "Indoor Air Quality and Its Impact on Man" program are currently focussed on two Working Groups dealing with material evaluation and TVOCs.

Working Group 10 — "Evaluation of Building Materials and Products" — has recently developed a draft procedure for the characterization and evaluation of building materials with respect to VOC emissions.

This procedure combines chamber measurements of TVOCs and individual VOCs with sensory evaluation of emissions at three days and thirty days after unpacking a freshly-produced sample. Prescreening for some particularly toxic compounds is also undertaken after 24 hours.

WG 10 met in Berlin on April 27-28 to finalize the draft procedure and a revised draft is now being reviewed by the ECA Steering Committee, which will consider the procedure for approval at its next meeting September 8-9 in Ispra. Lars Mølhave will be presenting a summary in a plenary at the Healthy Buildings '95 Conference in Milan in September.

Working Group 13, which is developing a definition of TVOC and guidelines for TVOC measurement and concentrations, met in Denmark on June 12-14. The discussions are reported to have been controversial. No reports are yet available from WG 13.

For further information on European Collaborative Action:

Maurizio De Bortoli or Helmut Knöppel
EC Joint Research Centre, Environment Institute
T.P. 290, 21020 Ispra (Varese), Italy
Tel: +39 332 78 92 30 or 78 92 04
Fax: +39 332 78 58 67.

CEN and ISO collaborate on test methods

Formed in 1994, Working Group 7 — "Emission of Chemical Substances from Building Materials" under the CEN Technical Committee on Indoor Air Quality — is developing the framework for a standard on emission determination.

Collaboration has been arranged with ISO's Technical Committee 146 on Air Quality. CEN/TC264/WG7 is focussing on material sampling, sample preparation and

preconditioning, emission chamber testing and the reporting of results, while ISO/TC146/SC6 is concentrating on the sampling of chemical substances from chamber air and the analytical procedures.

Other CEN Technical Committees, such as those for paints, carpets and wood-based panels are assisting with the development of material sampling and sample preparation procedures. Working Group 10 of the European Collaborative Action is providing input on background levels of VOCs in emission chambers.

WG7 discussed a first working document at its March meeting in Braunschweig and decided to split the standard into two parts — one dealing with traditional emission chambers and the other with emission cells. The next meeting of WG7 will take place in Paris on October 23-24.

Draft on Formaldehyde Testing

Another CEN working group — CEN/TC112/WG5 under the Technical Committee on Wood-Based Panels — has developed a draft standard for chamber testing of formaldehyde emissions. "Wood-Based Panels — Determination of Formaldehyde Release — Part 1: Formaldehyde Emission by the Chamber Method" (prEN 717-1) describes three options for determining steady-state formaldehyde concentrations comparable to average real-life conditions using large test chambers over 12 m^3 and small chambers of 1 m^3 and 0.225 m^3.

For further information:

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Rainer Marutzky, CEN/TC112/WG5 Secretary
Fraunhofer Institut für Holzforschung
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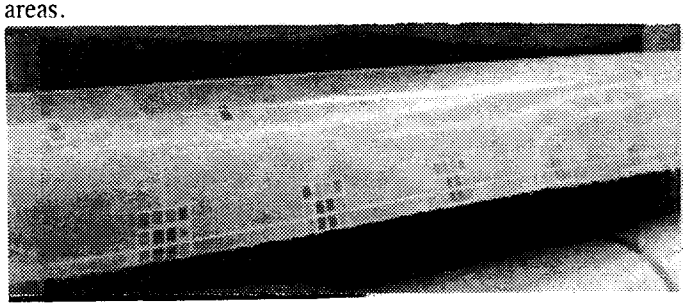
Architects appreciate Swedish Flooring Program

Sweden's voluntary program of emissions testing and declaration for flooring materials appears to be successful in providing data which is consistent and comparable, according to Nils Duberg of the Swedish National Flooring Trade Association. Architects are able to use such data as one factor in their material selection process.

Duberg notes that Swedish flooring manufacturers and suppliers developed the program in response to growing market demand in the late 1980s for information on material emissions, particularly those products with large surface areas.



Recent developments in the program include the release of a second trade standard for smoothing compounds.

Dampness Impacts Emissions

Research has been conducted on the impacts of humidity on flooring emissions. This work has found that damp concrete increases the risk of alkaline degradation of the floor covering and adhesive, with the emissions from the degradation process being several times higher than the emissions from the flooring itself. The conclusion, according to Duberg, is that there is no point in choosing a flooring material on the basis of its emission factor, if it is then laid on a damp base.

The trade standard developed by the industry calls for the testing of VOC emissions at 4 weeks and 26 weeks. Longer-term testing has confirmed that the 26-week result is a good representation of emission performance, with emissions always decreasing after this point. The typical emission rate after three years is about 50% of the 26-week

value. Many smoothing compounds have been found to have no detectable emissions after 26 weeks.

The flooring manufacturers' major concern, according to Duberg, is that there is still insufficient data on the relation of VOCs to health. A recent suggestion by the Swedish National Board of Housing, Building and Planning that all building materials have a chemical emissions declaration was therefore met with criticism.

For further information:

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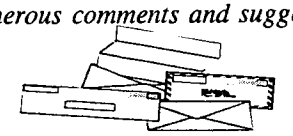
Wanted: Information on Low-Emission Materials

Practitioners — particularly architects, interior designers, contractors and building managers — have a pressing need for information on alternative, low-emission building products. While there are some new information sources available (see reviews of "Environmental by Design" in Issue No.1), this is a rapidly evolving field and increasing numbers of alternatives are being introduced to the market. The demand for such products is clearly increasing, enhanced by demonstration programs of "healthier" housing and buildings, the expansion of environmental labelling programs and growing public concern over indoor air quality.

Healthy Materials is interested in hearing about the development of new low-emission products and also about modifications to existing products which have been undertaken to lower emission levels. Send us product literature, emission test results and examples of applications. We would be pleased to include information on these developments in future issues.

READERS' VIEWS

Readership has increased by almost 50% since the second issue of Healthy Materials was released. The following has been extracted from the numerous comments and suggestions received.



Complements

We were delighted to notice the international attention to our work on emissions that was published in your newsletter. We have even had reactions on your article from Berkeley CA. *Nils Duberg, Swedish National Flooring Trade Association, Stockholm, Sweden.*

I am organizing efforts to change regulations and build housing for people with Multiple Chemical Sensitivity. I am inspired by the little I know of efforts in Canada on these issues and look forward to learning more. *Jeanne Perrin, Environmentally Accessible Building Project, Revere MA*

Your publication is wonderful. I work for the B.C. Ministry of Health, in a "sick" building. Your publication contains a lot of information that will be helpful for lobbying to have our building upgraded. *Stan Simister, Courtney BC*

I'm very interested in learning more about healthy materials in houses. A neighbour recently had a house built which is causing his wife all sorts of troubles; I've suggested she be tested for allergic reaction to formaldehyde, and the house be tested for elevated levels of the same. This about exhausts what I can recommend, so I'm excited about your newsletter. *Felix Marti, Marti Construction, Ridgeway CO*

Practical information on materials emissions is always welcome, as I write articles on this and related subjects for our customers as well as builders, architects and interior designers. *Donna Leban, Green Mountain Power Corporation, South Burlington VT*

Thanks in advance for taking the time to pull together this information. Our organization works hard to encourage the use of more energy-efficient and materials-efficient building materials, so I look forward to learning more about your

findings in Canada. *Chris Caldwell, Natural Resources Defence Council, San Francisco CA*

We are developing practical tools for making knowledgable choices of environmentally sensitive materials — this publication sounds to be of great benefit. *P. Connell, Fowler Bauld & Mitchell, Halifax NS*

Excellent! Comprehensive, addresses exactly the issues we struggle with in the field. Thank you so much for all the time and expertise to produce such a valuable information source. *Mike O'Brien, O'Brien & Associates, Portland OR*

I have seen volume 1 of ***Healthy Materials*** which I was much impressed by. Many thanks to you [Jim White] and Terry Robinson - the newsletter serves a real need in the Canadian housing construction community. *I.G. Theaker, Integral Design/Engineering, Vancouver BC*

Keep up the excellent work. *Jeff Burton, IVE Incorporated, Bountiful UT* ▪ Nice Work! *Jack Halliwell, Halliwell Engineering & Associates, East Providence RI* ▪ Looks like this will be a great source of info for us. *Elizabeth Stutt,* Allergy & Environmental Health Association, Nepean ON ▪ Thanks for developing such a newsletter. It sounds like it should be very helpful in the public work that I do. *University of Wisconsin — Extension, Madison WI* ▪ I am a journalist who works reporting building science and technology news, and I think I could well the use of the information contained therein. *John D. Wagner, Montpelier VT* ▪ Extremely helpful, keep up the good work! *Markus Stoffel, Environmental Building Supplies, Portland OR* ▪ Kingston ON ▪ Excellent newsletter. *Burton Milburn, Hanford Environmental Health Foundation, Richland WA.*

Suggestions

We would, in particular, be interested in articles about material and techniques for remediation of existing sick buildings as well as for new design and build... I would also welcome a table of "unhealthy" emissive materials (i.e. those for which a health danger is already recognized), with indications of the most stringent standards, recommendations and guidelines for exposure levels, drawing on the most stringent standards whether from Canada, USA, individual provinces or states, Europe or other countries. *Bernard Miller, Montreal QC.*

Excellent. Should discuss maintenance of materials re: types of products and what emissions they may be contributing to the environment. *Judy Newcombe, Newcombe Design Associates, Toronto ON.*

Evaluations or durability info on new products; new products and how to get a hold of them, especially regionally. *Joan Maisonneuve, Alberta R-2000 Coordinator*

Have you ever considered advising the architectural orders of each province so they can advise their members in their regular information bulletins?... Very informative. *Lyse Tremblay, Architect, Longueuil QC*

Get the Healthy Materials Guide [CMHC's "Building Materials for the Environmentally Hypersensitive"] published ASAP. There will always be some happy and some unhappy manufacturers. I think people's safety and health come first. *Tony Green, Hamilton ON*

Great idea. Good to see life cycle approach being used. Would like to see demo project data/feedback from model and real homes, offices, etc. to help "debug". Also information on costs/economics and suppliers to help people apply the results of emission testing. *Tom Phillips, ARB/RD, Sacremento CA*

Forward copies to all Respiratory Medicine Departments in Hospitals. Research chemical and dye allergies from cotton fabrics used by those who sew and quilt (formaldehyde, etc.). Are there any electronic air cleaners that do not produce ozone — a respiratory and C.N.S. irritant? *Diane Berry, Kingston ON*

Comments on Ecologo

I would like to see much, much more stringent testing regulating all products that have toxic emissions of any kind. A lot should be outright banned (e.g. toxic carpets). Re: Qualifying for the "Ecologo" by manufacturers: an independent body should conduct all testing for VOCs in order to obtain fair, consistent and credible results. Leaving this up to the manufacturer is irresponsible — we all know their track records. I, for one, do not trust their in-house reporting. With this standard in practice, I, as an interior designer (and one with severe chemical sensitivities), cannot, in good conscience, specify the "Ecologo" materials as healthy and low in emissions. All in all I find the Ecologo misleading without full disclosure of toxicity. *Rita Eames, Lela Interiors, Surrey BC*

COMING EVENTS

Calendar for 1995

Sept 11-14 **Healthy Buildings '95**. 4th International Conference on Healthy Buildings. Milan, Italy. Contact: Professor Marco Maroni, Universita de Milano, Via S. Barnaba 8, 20122 Milano, Italy, tel: +39 2 5518 1723, fax: +39 2 5518 7172.

week of Oct 16-20 (TBD) **Task Force on Material Emissions**. 5th Meeting. Ottawa ON. Hosted by Canada Mortgage and Housing Corporation. Contact: Jim White, Chair, CMHC, 700 Montreal Road, Ottawa ON K1A 0P7, tel: (613) 748-2309, fax: (613) 748-2402; or Terry Robinson, Secretariat, Scanada Consultants Ltd., 436 MacLaren Street, Ottawa, ON K2P 0M8, tel: (613) 236-7179, fax: (613) 236-7202.

Oct 21-24 **IAQ '95 Conference on Indoor Air Quality**. Denver, Colorado. Contact ASHRAE, 1791 Tullie Circle NE, Atlanta GA 30329, tel: (404) 636-8400, fax: (404) 321-5478.

Nov 8 **IAQ Update 1995**. Parkway Sheraton Hotel, Toronto ON. Sponsored by ASHRAE Toronto Chapter. Contact John Cowan, tel: (416) 322-6423, fax: (416) 322-6036.

Calendar for 1996

Feb 17-21 **ASHRAE Winter Meeting**. Georgia World Congress Center, Atlanta GA. Contact: ASHRAE, 1791 Tullie Circle NE, Atlanta GA 30329, tel: (404) 636-8400, fax: (404) 321-5478.

June 22-26 **ASHRAE Annual Meeting**. San Antonio Marriott River Center, San Antonio TX. Contact: ASHRAE, 1791 Tullie Circle NE, Atlanta GA 30329, tel: (404) 636-8400, fax: (404) 321-5478.

July 17-19 **RoomVent '96**. 5th International Conference on Air Distribution in Rooms. Yokohama, Japan. Abstracts are due November 1, 1995. Contact: Dr. S. Kato, Institute of Industrial Science, University of Tokyo, 7-22-1 Roppongi, Minato-ku, Tokyo 106, Japan, tel: +81 3 3402 6231 ext.2575, fax: +81 3 3746 1449.

July 21-26 **Indoor Air '96**. 7th International Conference on Indoor Air Quality and Climate. Official Conference of International Academy of Indoor Air Sciences. Abstracts are due November 30, 1995 and should be sent to Dr. Koichi Ikeda, Institute of Public Health, 6-1, Shirokanedai 4-chome, Minato-ku, Tokyo 108, Japan, tel: +81 3 3441 7111 ext.275, fax: +81 3 3446 4723, email: indair@kimura.arch.waseda.ac.jp. For registration information: Mr. M. Kato, Japan Convention Services Inc., Zebura Building, 4F, 11-22, Aoi 2-chome, Higashi-ku, Nagoya-shi 461, tel: +81 52 933 1970, fax: +81 52 933 0644.

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