

Indoor Air Quality

- The best strategy for improving indoor air quality is through controlling the pollutants at their source
- Chemical emissions from building materials and furnishings represent a major pollutant source. Other sources include, but are not limited to, solvents, cleansers, tobacco smoke, and many, many more

Emissions from Building Materials

The majority of the document below was taken from:

Draft Technical Note

A Builder's Guide to Selecting Building Materials: Making Informed Choices to Improve Indoor Air Quality

- An area of particular concern is materials with large exposed surface areas, such as floorings, paints, finishes, and cabinetry
- Wet materials, such as paints or adhesives, release the vast majority of their emissions immediately after application. For this reason, adequate ventilation is extremely important.
- Dry materials, such as particleboard, vinyl flooring, etc., release their emissions at a slower rate and generally over a longer period of time (possibly several years)
- At higher temperatures and humidity levels, emissions tend to be much higher
- It should be noted that emission rates are very different between materials which have been sitting in a warehouse for several months and materials which are delivered straight from the manufacturer
- Porous, rough, or fleecy materials can act as "sinks" (absorbing pollutants from the air and then releasing them later). Two sinks of particular concern are carpet and drywall

Pollutants of Concern

Two pollutant groups most commonly found in residential homes are volatile organic compounds (VOC's) and formaldehyde

Volatile Organic Compounds

- VOC's normally exist as liquids or solids, but can vaporize to become gases
- Many VOC's cause irritation and some are cancer-causing [1]

- Total volatile organic compounds (TVOC's) is a term used to describe the most common VOC's within a structure
- Research has shown that there are signs of irritation and discomfort when the concentration of TVOC's exceeds 3 mg/m³ and no effects when the TVOC level is less than 0.2mg/m³ [2]
- The typical level in new Canadian homes is about 0.6mg/m³ [3]
- A level of 1.0mg/m³ is currently being discussed for office environments [4]

Formaldehyde

- Formaldehyde is a gas which is released from urea-formaldehyde glues (used in the manufacture of wood products) and urea-formaldehyde foam insulation. Other sources of formaldehyde include various household products, the human metabolism, and combustion.

Other Pollutants of Concern

- *Chlorinated hydrocarbons*: can irritate your eyes and lungs and damage your skin, liver, kidneys, and central nervous system. Sources can include solvents and cleansers
- *Polycyclic aromatic hydrocarbons* (PAH's): are primarily associated with tobacco smoke and combustion. PAH's are suspected to be cancer-causing, so exposure should be kept to a minimum.
- *Styrene*: is emitted from latex backings on carpets and also from a number of synthetic materials. Styrene is also suspected to be cancer-causing and can irritate various parts of the body.
- Material emissions are just one source of indoor air quality problems. Other sources include:
 - Combustion gases
 - Mould growing in walls and attics
 - Radon from the surrounding soil
 - Leaded paints and asbestos insulation (commonly found in older homes)

A Simplified Procedure for Predicting IAQ

1. Pick an emissions budget, based on health guidelines, material contributions, and ventilation
2. Identify material emission rates

3. Estimate emissions for each material selected
 4. Estimate total emissions
 5. Compare total emissions with the emissions budget and revise selection if needed
- Using this approach helps to identify the potential trade-offs between different materials

What Can Builders Do?

Select low-emission materials

- Builders should focus their efforts on priority areas such as floor coverings, cabinets, and paints (larger surface areas)
- Choose carpets that use latex-free backings i.e. needle-punched, fusion-bonded, etc.
- Jute, felt, polyethylene, and cork offer alternatives to latex under cushion
- Linoleum or composite vinyl tiles offer lower emissions than sheet vinyl
- Zero-VOC paints are available on the market
- Try to choose interior paints, wood finishes and other coatings that are water-based
- Cellulose wall paper is available and provides a healthy alternative to conventional products
- Look for sealers that are water-based, acrylic, or urethane
- Formaldehyde-free medium density fibreboard is currently available. This provides a good alternative to conventional particleboard
- Water-based contact cement, low-toxicity tile, and vinyl adhesives are available
- Purchase caulking that are acrylic latex, water-based, or neutral-cure

Construction strategies which will help to lower emissions

- Protect carpeting and other materials from spills during construction or remodeling
- Make sure that suppliers are aware of the importance of protecting products from becoming contaminated during storage and transportation
- Properly seal exposed surfaces of emitting materials
- Prior to installation, air out materials that have high initial emission rates (2-3 days)
- Ensure that the building has adequate ventilation during construction or renovation

Educate homeowners on how they can help control emissions

- If purchasing new furniture, ask about low-emission alternatives. Remember to air out the product prior to installation, or ask the supplier to leave the products in a well ventilated area for a few days before delivering it
- Provide sufficient ventilation in areas where fax machines, printers, and photocopiers are located, as these can be a major source of chemical emissions
- When choosing products such as cleaners, paint, sealers, carpet, flooring, etc., become educated in the alternative, low-emission products that are currently available

Plants as Environmental Air Cleaners

- Common house and office plants remove harmful pollutants from indoor air, according to NASA. The findings of a two year study indicate that plants provide a natural and cost effective way to combat “sick building syndrome” [5]
- The study focused on three of the most common indoor air pollutants: formaldehyde, benzene, and trichloroethylene

<i>Pollutant</i>	<i>Source</i>	<i>Solutions</i>
Formaldehyde	-foam insulation -plywood -particleboard -clothes -carpeting -furniture -paper goods -cleaners	-Azalea -Dieffenbachia -Philodendron -Spider plant -Golden Pothos -Bamboo Palm -Corn Plant -Chrysanthemum -Poinsettia
Benzene	-tobacco smoke -gasoline -synthetic fibers -plastics -inks -oils -detergents	-English ivy -Marginata -Janet Craig -Chrysanthemum -Peace Lily -Gerbera Daisy -Warneckeii
Trichloroethylene	-dry cleaning -inks -paints -varnishes -lacquers -adhesives	-Gerbera Daisy -Chrysanthemum -Peace Lily -Warneckeii -Marginata

Plants that effectively remove pollutants from the indoor air (NASA Study) [6]

- According to scientists at Washington State University, placing plants around all types of office equipment reduces the amount of dust in these corresponding areas
- Dr. Virginia Lohr has proved that by using foliage plants, the accumulation of dust in interiors can be reduced by as much as 20% [7]

Where to Get Information on Low-Emissions Materials

Canadian Publications

1. Building Materials for the Environmentally Hypersensitive. Available for \$29.99 from: CMHC Publications
P.O. Box 3077
Markham, Ontario
L3R 6G4
2. Environmental By Design: Volume 1: Interiors. Available for \$24.95 from Environment By Design
P.O. Box 95016
South Van C.S.C.,
Vancouver, B.C.
V6P 6V4
3. R-2000 Procurement List. Available from John Broniek, Canadian Home Builders' Association
Tel: (613) 230-3060 Fax: (613)23

References:

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2. CANMET Energy Technology Centre, **Draft Technical Note A Builder's Guide to Selecting Building Materials: Making Informed Choices to Improve Indoor Air Quality.** Natural Resources Canada, Ottawa, 1996. Pg. 4
3. CANMET Energy Technology Centre, **Draft Technical Note A Builder's Guide to Selecting Building Materials: Making Informed Choices to Improve Indoor Air Quality.** Natural Resources Canada, Ottawa, 1996. Pg. 4

4. CANMET Energy Technology Centre, **Draft Technical Note A Builder's Guide to Selecting Building Materials: Making Informed Choices to Improve Indoor Air Quality.** Natural Resources Canada, Ottawa, 1996. Pg. 4
5. Plants for Clean Air Council
<http://www.plants4cleanair.org>
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