

CLEAN AIR GUIDE

How to Identify and Correct Indoor Air Problems in your Home





CMHC—HOME TO CANADIANS

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The Clean Air Guide

HOW TO IDENTIFY AND CORRECT INDOOR AIR PROBLEMS IN YOUR HOME

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problèmes de qualité de l'air de votre habitation 61270*

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Disclaimer

This publication is based on current knowledge about the quality of indoor air in houses, and parts of it may be changed as new research findings become available. Neither the authors nor Canada Mortgage and Housing Corporation intend any of the suggestions in this publication to be construed as medical advice. For the prevention or treatment of specific conditions, please consult medical experts. The Corporation assumes no liability for any damage, injury or expense that may be incurred or suffered as a result of the use of this publication.

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INTRODUCTION

This Guide is about “clean air” housing. Inside you will find step-by-step instructions on how to create and maintain an indoor environment with low levels of potentially unhealthy airborne contaminants.

The need for clean air housing should not be underestimated. We spend, on average, 90 per cent of our time indoors, mostly in the home. Some of us spend virtually all of our time indoors. Unfortunately, the modern home has many substances that may be hazardous to our health. Those agents range from minor irritants, such as dust and animal dander, to major irritants, such as molds and the chemical vapours that may be emitted by modern building materials and furnishings.

Of course, not everyone is outwardly affected by these agents, or affected in the same way. In writing this guide, we separated people who have needs and concerns into three categories:

- 1. Comfort and Prevention:* This is the largest group and includes people who have no known reaction to low levels of contaminants. For this group, the need is to improve the comfort of the home and to prevent potential health problems from occurring.
- 2. Known Health Issue:* This group includes people with known sensitivities or people who are at elevated risk. Included under known sensitivities are allergies, respiratory ailments and chemical sensitivities. People

with elevated risk are those who spend a lot of time in the home, such as children, women and the elderly and persons with disabilities. For this group, the need is to alter the home to lessen the effects of any known irritants and to avert risk.

- 3. Serious Health Problem:* This is that small group of the population who are hypersensitive to numerous agents and who react adversely to extremely low levels of exposure. For this group, the need is to create an exceptionally clean home environment—a sanctuary from exposure to even the most minute levels of contaminants.

This Guide contains information and instructions relevant to people in any one of the three groups; how contaminants affect you, how to detect sources of potential health problems and how to decide on corrective measures. The information presented here will not cure the many health disorders affected by airborne contaminants. However, following the instructions will help you control the quality of your indoor environment and ultimately increase your sense of health and well-being.

YOUR HOUSE AND YOUR HEALTH

Many of us are concerned about outdoor air pollution. Few people, however, realize that the air they breathe inside their homes may actually be more hazardous to their health than outside air.

The link between human shelter and the healthfulness of the indoor environment is not new—even caves had indoor air quality problems. But as houses have become more complex, especially with the increased use of synthetic, chemical-based products, so too have the risks to human health. Today, depending on your level of sensitivity, you may be negatively affected by anything from furniture to fuel oil and from wax to wallpaper.

Another major source of trouble, especially for allergy sufferers, is molds. Molds grow wherever it is damp. They can be found outside the house, in the structure of the house and throughout the house; in obvious places like the kitchen and bathroom; and in not so obvious places like carpets and walls.

How Contaminants Enter Our Bodies

Contaminants can enter our bodies in three ways: through the water and food we consume (ingestion); through the materials and furnishings we come in contact with (touch); and through the air we breathe (inhalation). This Guide is primarily concerned with airborne contaminants and the improvement of air quality as the major step in creating a clean house. Airborne contaminants are generally divided into two different groups: biologicals and chemicals.

1. Biological contaminants can originate from outdoors or within the home. They include molds, dust mites, pollen, animal dander and bacteria. Molds are underrated contaminants in the home; they produce particulates (spores and residual matter) and gases (volatile compounds characterized as moldy or musty odours). High moisture levels inside the home support the growth of molds and dust mites.

2. Chemical contaminants include both gases and particulates. Gases can originate from numerous sources, including:

- gases released by occupant activity (body odour, carbon dioxide [CO₂], cigarette smoke);
- combustion gases generated by the burning of fossil fuels in gas and oil furnaces, fireplaces, hot water heaters, and woodstoves;
- gases released by building materials, furniture, fabrics, floor coverings, carpets, paints and caulking as they age, dry or cure;
- other gases, such as ammonia from cleaning products, chlorine from bleach, pesticides, vapours from personal care products and ozone produced by some electrical equipment;
- cooking and hobby activities; and
- gases from the soil and rocks, such as radon (see also note on page 16).

Chemical particulates may originate from a variety of sources, including dust and soils, combustion processes and cigarette smoke, as well as building materials and furnishings, such as concrete, lead paint, insulation, carpets and draperies.

The indoor environment is also affected by agents and conditions originating outside—for example, the quality of outdoor air (pollution levels, temperature and humidity) and radon and other soil gases which enter through leaks and cracks in the foundation.

All of these agents and conditions affect the quality of the indoor environment and may pose potential dangers to your health. Regardless of your health needs, clean indoor air can provide the basis for a nurturing environment. It can improve the quality of your health and your sense of well-being.

Health Effects and Indoor Air Quality

Many chemicals, such as formaldehyde, toluene and other volatile organic compounds (VOCs) found as contaminants in homes and offices, are known to have adverse effects on human health. Molds, besides causing allergic reactions and acute infections, can cause chronic illnesses in humans.

The health care community continues to determine the extent and range of housing-related health effects. Some of the ailments that may be related to poor indoor air quality are:

- allergic rhinitis
- anemia
- asthma
- asbestosis
- cancer
- cardiovascular stress
- coughing
- digestive problems
- dizziness
- dry, chapped or irritated skin
- emphysema
- eye, nose and throat irritation
- fatigue
- headaches



- impaired lung function/shortness of breath
- impaired vision
- impaired coordination
- influenza
- learning impairment
- liver and kidney damage
- loss of bone calcium
- nervous system depression
- nose bleeds
- pneumonia
- rashes
- respiratory distress
- respiratory infection
- sinus congestion

Exposure to contaminants can also have a number of indirect health effects, including increased susceptibility to disease from other causes, aggravation of existing disease and sensitization to the same and other environmental agents.

SIX STEPS TO A CLEAN AIR HOUSE

Adjusting your house to suit your health concerns may not be simple. Creating a clean air house will require some effort on your part. You will need to gain a greater understanding of the area in which you live, the house in which you live and the way in which you live. You will also need to learn to pay attention to what your eyes, ears, nose and brain are telling you about the environment that surrounds you.

Step 1: *Making Sense of the Situation*

Step 2: *Evaluating Your Location*

Step 3: *Assessing Your Home*

These steps will help you to understand the nature and number of polluting agents in your home, first through your own senses, and second by a closer inspection.

Once the type and location of agents have been determined, you will need to decide what to do about them, and how and who will carry out the work.

Step 4: *Deciding What To Do* outlines the basic strategy behind the creation of a clean air house and helps you draw up your own preliminary plan for action.

Step 5: *Taking Action* lists the criteria you should use when seeking help from professionals, such as architects, designers, contractors, and engineers.

Step 6: *Feedback and Evaluation* discusses the importance of monitoring your house and your health and well-being to determine the success of the work you undertake.

These six steps outline a comprehensive and thorough approach to clean air housing. This approach may take more time at the outset but it will be time well spent. Indoor air quality problems can be complex and there are many potential solutions. Without a thorough inspection of the home, time and money may be wasted on measures that don't address the major source of a problem.

STEP 1: MAKING SENSE OF THE SITUATION

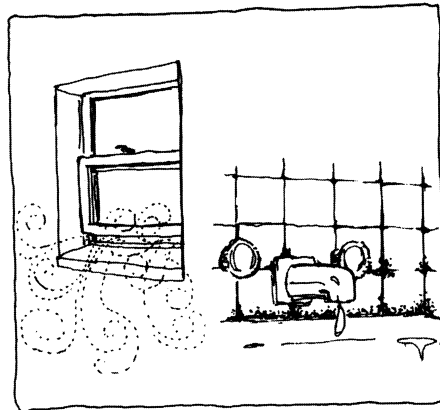
This section will help you review your health concerns and determine the nature of possible agents in your home through the use of your own senses—particularly, but not only, your sense of smell. It is important to note that the worksheet and questionnaire which follow are not diagnostic tools. They are not intended to identify allergies or chemical sensitivities.

This section will provide a quick overview of health concerns of members of your household. It will help determine whether the house has an indoor air quality problem and whether the air quality problem is likely to be associated with biological or chemical contaminants.

Filling out the Family Health Profile and the Air Quality Questionnaire in this section will give you a better idea of what problems to look for in your house.

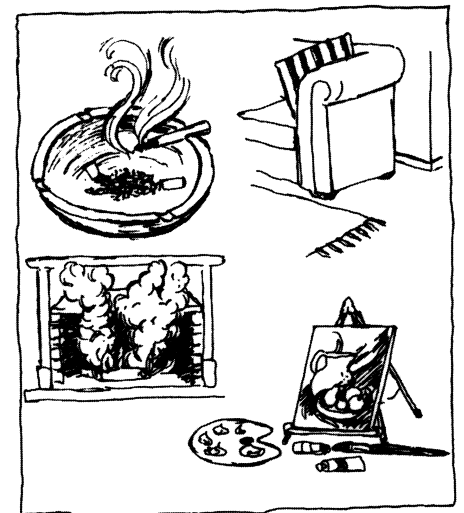
In addition, this exercise forces you to rely on your senses to interpret signals sent by the home environment. Learning to use your senses will allow you to detect changes to the indoor environment at an early stage.

The Family Health Profile provides a place to record your observations, as well as specific information on the medical history of household members, including suspected house-related ailments. Even when no health problem is apparent, fill out the questionnaires and the audits. You may be surprised at what you find.



Before beginning the Air Quality Questionnaire, we recommend that you close all windows and doors, and stay outside for at least 15 minutes. This will help clear your senses and provide a “shock reflex” to your system upon entering the house, making your sense of smell keener. This step can also be done after you have left your home for some time. It may be helpful to have more than one person in your household complete the questionnaire.

If in filling out the questionnaire your answer is “don’t know” instead of a “yes” or “no”, **don’t stop**. You may be able to find the answer as you go along.



AIR QUALITY QUESTIONNAIRE

- | | Yes | No |
|--|--------------------------|--------------------------|
| Do you notice an odour as you enter the house? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Do you feel better outdoors than inside your house? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Do you feel better in other people's homes than in your own? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Are there times when you feel sick inside your house? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Do you associate specific symptoms with particular odours? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Are they worse in certain areas of the house? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Are they worse at a particular time of day or year? _____ | <input type="checkbox"/> | <input type="checkbox"/> |

If you answered "yes" to any of these questions, your house may have an indoor air quality problem.

If you experience symptoms but cannot detect any odour, you may consider asking a friend with a keen sense of smell to give you another opinion.

The two sets of questions below will establish the nature of the sources of contaminants in your house.

A

- | | | |
|---|--------------------------|--------------------------|
| Is the house new? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Is there a "new smell" (chemical odour similar to that of a new car, new house, new wood, gas, paint, fabric shop, carpet store, etc.)? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Has a pest control company ever treated your house? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Has the house been renovated recently? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Are there new furniture or furnishings? _____ | <input type="checkbox"/> | <input type="checkbox"/> |

If you answered "yes" to any of these questions, your house may have an indoor air quality problem associated with chemical contaminants.

B

- | | | |
|--|--------------------------|--------------------------|
| Is your house old? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Does your house have an "old smell" (stale, musty or earthy)? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Does your house have a crawl space or basement? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Does the crawl space or basement have a dirt floor? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Do you sense that your basement is unhealthy for you (feelings of dampness, aversion or discomfort, etc.)? _____ | <input type="checkbox"/> | <input type="checkbox"/> |
| Does water come into the basement at certain times? _____ | <input type="checkbox"/> | <input type="checkbox"/> |

If you answered "yes" to any of these questions, your house may have an indoor air quality problem associated with biological contaminants.

STEP 2: EVALUATING YOUR LOCATION

The next step is to examine the area in which you live and determine whether the location contributes to your health concerns. The worksheet on the following page walks you through a check of the wider geographical region in which you live, the district in which you live and your immediate neighbourhood. There is also a section which asks you some information about your house itself, such as the nature and extent of renovation work.

The worksheet notes many aspects of house location which can have a bearing on indoor air quality and health. Using the checklist as a guide, make note of any aspects of your house location which may be problematic. You may rely on your own knowledge of the immediate neighbourhood for most of the information, but a map of the city or district will also be helpful in locating major pollution sources which are upwind of your home.

Historical information about the house and its site are helpful in identifying problem sources. If you are relatively new to the neighbourhood and don't know the history of your home, contact the former owners or talk to some of the long-term residents on the street. They may be able to tell you, for example, if the previous owner routinely used pesticides, if the house ever experienced a fire, or if the lot was previously used as a gas station or dump site.

When filling out the worksheet, don't rely on just the factors that are listed. Let your ears, eyes and nose help decide whether there is a problem.

LOCATION AUDIT AND HOUSE HISTORY

	Yes	No
Geographical Area		
- Is the house in an urban area? (Air pollution may be a problem)	<input type="checkbox"/>	<input type="checkbox"/>
- Is it a rural area? (Rural areas can be affected by agricultural activities, such as the application of chemical pesticides and fertilizers or animal manure.)	<input type="checkbox"/>	<input type="checkbox"/>
- Prevailing winds and seasonal considerations, such as wind direction and temperature inversions, may affect local air quality. Is this likely to be a problem?	<input type="checkbox"/>	<input type="checkbox"/>
District		
- Is the house near a factory?	<input type="checkbox"/>	<input type="checkbox"/>
- Is the house near a landfill site?	<input type="checkbox"/>	<input type="checkbox"/>
- Busy roads are a source of fumes, dust and noise. Rural routes may be affected by roadside spraying, road salt and oil used for dust control. Are nearby roads a likely problem?	<input type="checkbox"/>	<input type="checkbox"/>
- Railway lines and airports can be sources of air and noise pollution. Is there one nearby?	<input type="checkbox"/>	<input type="checkbox"/>
- Some businesses, such as gas stations and dry cleaners can create air quality problems. Are there any nearby?	<input type="checkbox"/>	<input type="checkbox"/>
Immediate Neighbourhood		
- Neighbouring houses can be sources of wood smoke and combustion by-products from chimneys, dryer vents and kitchen ranges. Is this likely to be a problem?	<input type="checkbox"/>	<input type="checkbox"/>
- Indoor air quality is affected by the location of neighbouring driveways and exhaust vents. Is the house outdoor air intake located away from pollutant sources?	<input type="checkbox"/>	<input type="checkbox"/>
- Trees and shrubs may reduce air movement and reduce light levels. Are the trees around the house likely to make a negative contribution to indoor air quality?	<input type="checkbox"/>	<input type="checkbox"/>
- Is there a nearby swamp or pond that may cause excessive dampness or odours in the house?	<input type="checkbox"/>	<input type="checkbox"/>
- Is the house next to a golf course? (They may be routinely treated with pesticides.)	<input type="checkbox"/>	<input type="checkbox"/>
- Do the neighbours regularly use pesticides?	<input type="checkbox"/>	<input type="checkbox"/>
House History		
- Some hobbies or home businesses can negatively affect the indoor air quality. Is previous use of the house likely to present a problem?	<input type="checkbox"/>	<input type="checkbox"/>
- Were pesticides used in or around the house?	<input type="checkbox"/>	<input type="checkbox"/>
- Did the previous occupants keep pets? (A thorough cleaning may be necessary.)	<input type="checkbox"/>	<input type="checkbox"/>
- Some building materials are sources of pollutants. Was the house recently renovated?	<input type="checkbox"/>	<input type="checkbox"/>
- Has the house experienced a fire or flood? Is there a residue of smoke or mold?	<input type="checkbox"/>	<input type="checkbox"/>
- Drainage affects moisture levels in the house. Does the house have drainage problems?	<input type="checkbox"/>	<input type="checkbox"/>

STEP 3: ASSESSING YOUR HOUSE

The worksheets on pages 10 to 16 will help you to evaluate your house itself—structure, furnishings and products—as a contributing factor to your health concerns. The worksheets are divided into the two different groups of contaminants: biologicals and chemicals. Each worksheet is further divided into three columns: Sources, Symptoms or Problems, and Corrective Measures. If you believe you need professional assistance in assessing your house, you could consider hiring a trained Indoor Air Quality investigator (see page 20).

The Sources column provides a breakdown of the most common sources of air quality problems in homes. These are listed roughly in order of importance, with the most significant listed first. The Symptoms or Problems column briefly describes the specific contaminants that are associated with particular sources.

The third column, Corrective Measures, lists the actions that may be needed when dealing with an identified problem. This column will be filled out in **Step 4—Deciding What To Do.**

Using the worksheets as a guide, do a thorough inspection to identify the various sources that exist in your house. Start in the basement and work your way through the house in an organized fashion, ending with the attic. (Many sources, such as furnishings made of particle board, will be found in different rooms. As you go, make a note of the rooms where each source is found.)

Some Words of Advice

Before you begin the audit, assemble a clipboard to hold worksheets, a flashlight and wear a face mask if you are inspecting dusty places. Caution is advised when inspecting any area of the home that is a likely location for harmful substances such as lead dust, asbestos or mold. Try to disturb the area as little as possible to avoid generating high concentrations of airborne particles. Very sensitive people should avoid parts of the house that make them feel sick.

When carrying out the audit, it may be helpful to recruit a friend to assist you, especially if the friend has an acute sense of smell. He or she may notice items that you miss because of your long association with the home. The full audit will take several hours. If you don't have time to complete it in one session, complete one room or area of the house at a time. Be thorough: look at everything, look behind, beyond and inside.

BIOLOGICAL CONTAMINANTS

Sources	Symptoms or Problems	Corrective Measures
<input type="checkbox"/> Basement	Musty odour, black, white or multi-colour discolourations, dampness, moisture and condensation indicate molds	<input type="checkbox"/> Control sources of moisture (see Step 4; also refer to CMHC's <i>Moisture and Air: Problems and Remedies</i>) <input type="checkbox"/> Clean up mold. Refer to CMHC's <i>Clean-Up Procedures For Mold In Houses</i> <input type="checkbox"/> Use a dehumidifier; keep windows closed <input type="checkbox"/> Ventilate (see Step 4) <input type="checkbox"/> Relocate downspouts and grade soil to direct water away from house <input type="checkbox"/> Provide foundation with proper dampproofing, exterior insulation and drainage
<input type="checkbox"/> Basement or crawl space with dirt floor	Musty odours due to molds	<input type="checkbox"/> If the furnace and forced air ducts are in this space, install a sealed moisture barrier (6 mil polyethylene), anchored with concrete blocks or bricks. Ideally a concrete floor should be poured over the polyethylene. <input type="checkbox"/> If the furnace and forced air ducts are not in this space, install a sealed moisture barrier as above, isolate the crawl space from the rest of the house and vent to the outside with an exhaust fan.
<input type="checkbox"/> Cold cellar	Likely place for molds	<input type="checkbox"/> If the cold cellar is a framed room inside the basement, block the vents, remove moldy material, clean and use as a warm space. <input type="checkbox"/> For cold cellars under poured concrete porches, which are impractical to keep and operate as interior space, permanently seal access to the house. <input type="checkbox"/> Cold cellars are notoriously moldy. Use a refrigerator for cold storage or build a root cellar outside.
<input type="checkbox"/> Walls, ceilings	Stained, discoloured, mold growth	<input type="checkbox"/> Identify and correct water leaks, if any <input type="checkbox"/> Clean up mold. Refer to CMHC's <i>Clean-Up Procedures for Mold in Houses</i> <input type="checkbox"/> Look for sources of moisture in the basement or crawl space <input type="checkbox"/> Keep surfaces warm by providing heat and/or adding insulation <input type="checkbox"/> Allow air to circulate (e.g., behind furniture, curtains) <input type="checkbox"/> Install and/or use bathroom and kitchen exhaust fans <input type="checkbox"/> Consider installing whole house ventilation (refer to page 18 and CMHC's <i>This Clean House</i> video for a discussion of Heat Recovery Ventilators or HRVs)
<input type="checkbox"/> Wet windows	Rotting, peeling paint, discolouration	<input type="checkbox"/> Control sources of moisture throughout the house <input type="checkbox"/> Look for sources of moisture in the basement or crawl space <input type="checkbox"/> Use kitchen and bathroom exhaust fans <input type="checkbox"/> Consider installing whole house ventilation
<input type="checkbox"/> Carpets in basement	Collect moisture and odours; likely places for molds to grow	<input type="checkbox"/> Remove carpets <input type="checkbox"/> Use area rugs if desired
<input type="checkbox"/> Carpets elsewhere	Collect moisture and odours; older carpets cause stale, stuffy air	<input type="checkbox"/> Remove carpets, especially from areas of high humidity, such as kitchens and bathrooms <input type="checkbox"/> Replace with smooth flooring
<input type="checkbox"/> Clothes, paper, furnishings in basement	Materials absorb moisture and can become moldy	<input type="checkbox"/> Discard badly damaged materials, eliminate clutter and allow for air circulation <input type="checkbox"/> Store only washable items or non-washables in sealed plastic containers

BIOLOGICAL CONTAMINANTS

Sources	Symptoms or Problems	Corrective Measures
<input type="checkbox"/> Open sump pit	Source of moisture and molds	<input type="checkbox"/> Provide sump pit with a tight-fitting cover (for example, plywood lined with 6 mil polyethylene)
<input type="checkbox"/> Kitchen, bathroom sinks	Unpleasant odours	<input type="checkbox"/> Clear debris that may be clogging the drain <input type="checkbox"/> Pour baking soda and water into drain, add vinegar, seal drain and allow to stand
<input type="checkbox"/> Floor drain	Can be site for mold growth; odours can back up into house	<input type="checkbox"/> Clean drain; ensure that trap is filled with water: add a layer of mineral oil to prevent trap from drying out <input type="checkbox"/> If problem persists, check whether street sewer or septic system is clogged <input type="checkbox"/> Replace the drain with an air-sealing type
<input type="checkbox"/> Bathrooms	Unvented moisture can lead to molds	<input type="checkbox"/> Install a direct exhaust fan <input type="checkbox"/> Alternatively, the bathrooms can be exhausted via a whole-house ventilation system
<input type="checkbox"/> Closets	Cold walls can lead to condensation	<input type="checkbox"/> Control sources of moisture in the house <input type="checkbox"/> Insulate outside wall and install an effective air barrier <input type="checkbox"/> Exhaust closets via a whole-house ventilation system
<input type="checkbox"/> Water leaks	Visible stains	<input type="checkbox"/> Find source of moisture and correct
<input type="checkbox"/> Attics	Moisture and mold problems from house air leakage into the attic space; also animal droppings	<input type="checkbox"/> Seal all openings and leaks in the ceiling. Refer to CMHC's About Your House <i>Attic Venting, Attic Moisture, and Ice Dams</i> . <input type="checkbox"/> Seal entry points for animals
<input type="checkbox"/> Humidifier trays (also dehumidifiers, air conditioners, refrigerators, laundry equipment)	Standing water supports micro-organisms	<input type="checkbox"/> Discontinue use of humidifiers if there is a mold problem <input type="checkbox"/> Clean trays regularly <input type="checkbox"/> Keep tubs and washing machine dry when not in use
<input type="checkbox"/> Filters (furnace, air conditioner, heat recovery ventilators)	May be loaded with dust	<input type="checkbox"/> Clean and replace filters regularly
<input type="checkbox"/> Potted plants	Soils can support fungal growth	<input type="checkbox"/> Reduce number of plants in the house <input type="checkbox"/> Cover top of pot with foil, rigid plastic or a thick layer of pebbles
<input type="checkbox"/> Other moisture-producing activities	Moisture, various biological contaminants	<input type="checkbox"/> Minimize water-producing activities <input type="checkbox"/> Don't dry laundry indoors; vent clothes dryer to the outside <input type="checkbox"/> Don't store firewood indoors
<input type="checkbox"/> Damp, dirty surfaces	Support mold	<input type="checkbox"/> Keep wet surfaces very clean (e.g., tub and shower enclosures)

BIOLOGICAL CONTAMINANTS

Sources	Symptoms or Problems	Corrective Measures
<input type="checkbox"/> House dust	Supports dust mites	<input type="checkbox"/> Remove shoes upon entering the house <input type="checkbox"/> Clean house regularly with a damp mop or by vacuuming <input type="checkbox"/> Remove dust-collecting furnishings (e.g., loose shag carpets, stored belongings) <input type="checkbox"/> Add whole-house vacuum system or use a vacuum cleaner with a HEPA (High Efficiency Particulate Air) filter
<input type="checkbox"/> Pollen and other particulates from outside	Seasonal; cause allergies	<input type="checkbox"/> Keep windows closed at night <input type="checkbox"/> Caulk and weather-strip house to prevent entry of dust, pollen, and other particulates from outdoors <input type="checkbox"/> Use a room air purifier (limited approach) <input type="checkbox"/> Install a mechanical ventilation system for the whole house with filters to clean the incoming air (see also page 18)
<input type="checkbox"/> Pet dander	Some individuals are allergic to some animals	<input type="checkbox"/> Wash and groom pet regularly <input type="checkbox"/> Confine the pet to one area of the house; keep the pet off furniture <input type="checkbox"/> Relocate pet

CHEMICAL CONTAMINANTS

Sources	Symptoms or Problems	Corrective Measures
<input type="checkbox"/> Smoking	Gases and particulates	<input type="checkbox"/> The only worthwhile measure is to eliminate smoke. Otherwise, most of the corrective measures will be less effective.
<input type="checkbox"/> Pesticides	Pest control products are human poisons	<input type="checkbox"/> Discontinue pesticide use indoors and outdoors <input type="checkbox"/> Use traps, seal insect entry points from the outside and clean thoroughly
<input type="checkbox"/> Unvented gas fireplace, kerosene or gas heater	Combustion gases	<input type="checkbox"/> Do not use unvented heater or gas fireplace indoors
<input type="checkbox"/> Gas or propane stove	Combustion gases	<input type="checkbox"/> Upgrade to a unit with electronic ignition and operate with an effective exhaust hood over the stove <input type="checkbox"/> Upgrade to a sealed combustion unit or replace with an electric stove
<input type="checkbox"/> Gas water heater	Combustion gases	<input type="checkbox"/> Check for combustion spillage (see page 29) <input type="checkbox"/> Replace with induced draft or sealed combustion water heater or replace with electric water heater
<input type="checkbox"/> Gas or oil furnace	Unburned gases and combustion gases, odorous additives	<input type="checkbox"/> Check for combustion spillage and provide air using a supply air fan (see page 29) <input type="checkbox"/> Have furnace serviced regularly <input type="checkbox"/> Check and repair leaks <input type="checkbox"/> Upgrade to a sealed combustion furnace with a dedicated (exterior) source of combustion air or convert to electric heating (radiant, hydronic or heat pump)
<input type="checkbox"/> Wood stove or furnace, fireplace	Unburned fuel, combustion gases	<input type="checkbox"/> Check for combustion spillage and provide air supply (see page 29) <input type="checkbox"/> Install glass doors on fireplace <input type="checkbox"/> Upgrade wood stove to high-efficiency or catalytic type; install fresh air intake and burn only clean, dry wood
<input type="checkbox"/> Electric furnace, baseboard heaters	Odours from dust on heating coils	<input type="checkbox"/> Vacuum heaters; have furnace cleaned by service person <input type="checkbox"/> Change filters on furnace
<input type="checkbox"/> Ozone generators	Sweetish smell of ozone, a harmful irritant	<input type="checkbox"/> Discontinue use <input type="checkbox"/> Identify sources of pollutants and correct the problems
<input type="checkbox"/> Electronic air cleaner	Electric discharge can produce ozone	<input type="checkbox"/> Ensure smooth air flow and clean filters frequently; keeping filters clean minimizes ozone production <input type="checkbox"/> Have the equipment checked by a mechanical contractor <input type="checkbox"/> If the smell of ozone persists, replace with a pleated paper filter <input type="checkbox"/> Reduce sources of particulates in the house
<input type="checkbox"/> Insulation, acoustical lining in ducts, furnace	Fibres and chemical odours	<input type="checkbox"/> Remove lining and clean ducts
<input type="checkbox"/> Urban outdoor air	Chemical pollutants	<input type="checkbox"/> Make house tight (e.g., caulk, weatherstrip) <input type="checkbox"/> Ventilate house but turn off ventilation during periods when pollutant levels are high, and filter the incoming air

CHEMICAL CONTAMINANTS

Sources	Symptoms or Problems	Corrective Measures
<input type="checkbox"/> Attached garage	CO, exhaust fumes and odours from stored chemicals can infiltrate house	<input type="checkbox"/> Seal or weatherstrip any major leakage points to the house <input type="checkbox"/> Do not store chemicals in the garage <input type="checkbox"/> Open the garage door before starting car and immediately drive outside <input type="checkbox"/> Install a carbon monoxide (CO) detector inside your house near the door to the garage <input type="checkbox"/> An exhaust fan in the garage may help reduce pollution entering the house <input type="checkbox"/> Park car outside
<input type="checkbox"/> Exposed fibre insulation	Particulates, chemical gases	<input type="checkbox"/> Cover with air barrier
<input type="checkbox"/> Loose, blown insulation in walls and attic	Dust (if there is no air barrier), chemical contaminants	<input type="checkbox"/> Seal walls and ceiling <input type="checkbox"/> Ensure that electric receptacles on walls are airtight
<input type="checkbox"/> Particle board/ hardwood veneer plywood in furnishings, shelves, paneling, etc.*	Formaldehyde and other gases from glues (urea-formaldehyde resins)	<input type="checkbox"/> Seal all surfaces with appropriate sealant. A sealant can be any one of the following: a) a high pressure laminate (e.g., melamine) installed at the time the furniture was built with a water-based contact cement covering all surfaces; b) poly or heavy duty aluminum foil with aluminum foil tape to cover surfaces and edges that are not visible; and c) a liquid sealant (e.g., acrylic coating, paint) applied as a thick film to encapsulate the surfaces. If a liquid sealant is used, ensure that the sealant is not in itself a source of odours and verify its effectiveness with a test material. Refer to CMHC's <i>Building Materials for the Environmentally Hypersensitive</i> on how to test materials. <input type="checkbox"/> Replace with materials or furnishings having lower emissions
<input type="checkbox"/> Oriented strand board construction (softwood) plywood in panels, underfloor, etc.*	Volatile organic compounds (gases) (phenol-formaldehyde resins)	<input type="checkbox"/> Remove non-structural materials <input type="checkbox"/> Seal with appropriate sealant <input type="checkbox"/> Combine with ventilation strategy

* *Note: Two kinds of resin binders are used in the manufacture of composite wood products: urea-formaldehyde and phenol-formaldehyde resins. The former are more soluble in water than the latter and therefore are more likely to be affected by moisture in the air. The free formaldehyde concentration and emission rate are much higher from particle board, medium-density fibreboard (MDF) and finishing plywood (hardwood plywood) than from oriented strand board and construction plywood (softwood plywood) which use phenol-formaldehyde. Older materials may have given off their chemicals over time. A "sniff test" can help determine if there is still a problem.*

CHEMICAL CONTAMINANTS

Sources	Symptoms or Problems	Corrective Measures
<input type="checkbox"/> New paints	Chemical smells (decrease with time)	<input type="checkbox"/> Choose low-odour, low-toxicity paints <input type="checkbox"/> Paint only when windows can be opened and in the summer; don't paint when weather is damp or humid <input type="checkbox"/> Cover all exposed furnishings in the room with plastic and ventilate during and after painting to prevent odours from being absorbed by the furnishings
<input type="checkbox"/> Carpets and underpads	Chemical emissions (especially new carpets), dust, dust mites and molds	<input type="checkbox"/> Remove synthetic rugs and/or underpads and replace with area rugs of natural fabrics (e.g. cotton, wool) <input type="checkbox"/> Replace with hard flooring
<input type="checkbox"/> Rubber mats	Rubber odours	<input type="checkbox"/> Remove and replace with non-odorous mats
<input type="checkbox"/> Waterbed	Chemical odours from the rubber, possible mold growth	<input type="checkbox"/> Use conventional bed
<input type="checkbox"/> Wallcoverings made of vinyl, plastics or other synthetics	Odours (especially strong when new), possible mold growth	<input type="checkbox"/> Remove wallpaper and adhesive <input type="checkbox"/> Finish with low-odour paint
<input type="checkbox"/> Synthetic window coverings	Chemical off-gassing is intensified by exposure to sun	<input type="checkbox"/> Replace with natural materials
<input type="checkbox"/> Other furnishings	Various chemical contaminants	<input type="checkbox"/> Replace furniture containing synthetic foam upholstery <input type="checkbox"/> Replace foam mattresses and pillows with untreated cotton <input type="checkbox"/> Replace vinyl covers with cotton
<input type="checkbox"/> Office clothes, dry-cleaned clothing	Office smell, smoke, dry-cleaning solvents	<input type="checkbox"/> Air out dry-cleaned clothes thoroughly <input type="checkbox"/> Minimize dry-cleaning by selecting washable clothes <input type="checkbox"/> Don't keep office or dry-cleaned clothes in bedroom <input type="checkbox"/> Exhaust the closets
<input type="checkbox"/> Personal care products	Odours and various chemical products	<input type="checkbox"/> Substitute with unscented and non-irritating products <input type="checkbox"/> Remove all toiletries and cosmetics from the bedroom <input type="checkbox"/> Use bathroom exhaust fan regularly
<input type="checkbox"/> Pine, cedar furniture or paneling	Odours from terpenes in wood	<input type="checkbox"/> Seal with appropriate sealants (refer to CMHC's <i>Building Materials for the Environmentally Hypersensitive</i>) <input type="checkbox"/> Use woods that do not contain aromatic resins

CHEMICAL CONTAMINANTS

Sources	Symptoms or Problems	Corrective Measures
<input type="checkbox"/> Cleaning and household maintenance products	Chemical odours	<input type="checkbox"/> Substitute with unscented and non-toxic products (e.g., baking soda); avoid cleaning agents containing organic solvents <input type="checkbox"/> Do not use room deodorizers, mothballs or fabric softeners <input type="checkbox"/> Use steam cleaning rather than chemical cleaning but make sure drying is rapid
<input type="checkbox"/> Hobby materials (glues, solvents, etc.)	Gases, particulates	<input type="checkbox"/> Substitute non-toxic materials <input type="checkbox"/> Install a separate exhaust fan in the hobby area
<input type="checkbox"/> Paint supplies	Chemical gases; old water-based paints can become sources of microbial contaminants (e.g., bacteria, yeasts, molds)	<input type="checkbox"/> Buy only enough paint to use each time <input type="checkbox"/> Do not store oil-based paints inside house <input type="checkbox"/> If some water-based paint is retained for touch-ups, ensure that the can is tightly sealed. Inspect the can periodically and dispose of old paints. Check that the paint is not spoiled before using.
<input type="checkbox"/> Candles	Produce soot	<input type="checkbox"/> If candles are being burned to hide cigarette smoke stop smoking <input type="checkbox"/> Discontinue using candles
<input type="checkbox"/> Cracked basement floor	Possible radon contamination, sewer and soil gases, moisture problems	<input type="checkbox"/> Seal cracks <input type="checkbox"/> Ventilate the basement <input type="checkbox"/> Use subfloor ventilation in extreme cases <input type="checkbox"/> Determine if radon is a concern (refer to CMHC's <i>Radon: A Guide for Canadian Homeowners</i>)
<input type="checkbox"/> Lead-based paint	Lead dust (during and after renovation)	<input type="checkbox"/> Consult specialist on lead removal <input type="checkbox"/> Refer to CMHC's <i>Lead in Your Home</i>
<input type="checkbox"/> Asbestos	Only a lung hazard when fibres are in the air	<input type="checkbox"/> Have professionals seal or remove

Radon, lead and asbestos may cause problems after long-term exposure. The other pollutants dealt with in this Guide can exert their effects after short-term exposure.

Some Further Words of Advice

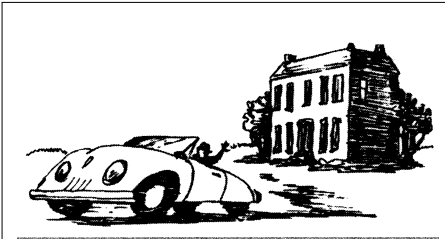
It is not possible to make a complete list of pollution sources in your home since there may be some things unique to your own house or lifestyle. The above list should be used as a starting point.

Cause and effect may not be as simple as it seems. For example, the furnace is often blamed as the source of discomfort since the onset of symptoms can coincide with turning on the furnace in the fall. It may not be the furnace but dusts, molds and chemical contaminants laid up all summer but now newly stirred-up.

As you observe what goes on around you, be open to other pollution sources as well as possible interaction between components of the house, conditions or activities. Refer to books and publications (see **Bibliography**, page 35) and seek professional help.

STEP 4: DECIDING WHAT TO DO

The worksheets on pages 10 to 16 list a number of corrective measures that you can take to remedy the problems identified in Step 3. The discussion that follows will tell you why the corrective measures are listed in a particular order. It will also outline the basic strategies that underlie corrective measures for clean air housing and show you how to choose which corrective measures are right for your circumstances.



If the house inspection pointed to some serious problems with the location (**Step 2**) and you have decided that moving is a must, turn to the section on **Relocating** (page 25) for a discussion of considerations relating to renting, buying an older home, or building or buying a custom home to suit your needs.

Reading the Corrective Measures

As you will note on the worksheets, sometimes just one corrective measure is identified. For many problems, however, several measures are suggested. These are listed according to level of effort, from low-cost, easy-to-implement measures to measures which may require extensive and expensive renovations. For example, measures that may be implemented when dealing with the unburned combustion gases from a furnace range from having the furnace serviced on a regular basis, to upgrading the furnace, to replacing it.

The worksheets do not offer an exhaustive list of measures but list those that are most commonly undertaken. The description of each measure is not intended as a how-to but as an overview of what is involved. Readers are advised to consult several of the reference books listed in the bibliography for further information on materials and methods involved in developing clean air housing. Use judgment in choosing between recommended options—opinions are worth less than proven facts.

Basic Strategies

While each corrective measure requires a different level of effort and expense, the underlying actions taken to deal with the sources of potential problems are the same—*eliminate, seal/separate* and *ventilate*.

Eliminate: Whenever possible, deal with problems at the source. This may mean eliminating the use of products or materials that are a potential concern or which cause an adverse health reaction. It may involve removing problematic furnishings, equipment or building components. As well, conditions which support the accumulation of harmful substances, such as mold or dust mites, should be eliminated.

Seal/Separate: If it isn't feasible to eliminate an offending substance, the next best strategy is to separate it from the living space. This involves two approaches. The first is sealing the surfaces of the material itself to prevent it from releasing gases into the air (out-gassing) or keeping it in a sealed container when not in use. The second involves isolating the area temporarily until a more permanent solution is found. This may mean closing off a room that appears to be contaminated. A bedroom can be rendered cleaner by providing it with a source of heating separate from the rest of the house.

Ventilate: Ventilation comes last, but it is certainly not least. No matter what else you do, ventilation should always be part of any clean air strategy. Ventilation helps to lower concentrations of indoor air pollutants by supplying fresh air from the outdoors (provided that the air intake is not located near an outdoor contaminant source). Ventilation is not a substitute for reducing sources of offending agents, but it is necessary for maintaining good air quality.

A whole-house (central) ventilation system has a central exhaust to remove stale air from the house. In contrast, local ventilation consists of exhaust fans that remove pollutants at their source, such as kitchens and bathrooms. Balanced ventilation systems bring in enough air to replace exhausted air. To conserve energy, heat recovery may be combined with central ventilation (recovering heat from stale air before it is exhausted)—complete units are called heat recovery ventilators (HRV) or air-to-air heat exchangers. HRVs can work with forced-air heating systems and air conditioners.

Forced air-heating and cooling systems can include air purification using particulate filters. Chemical adsorbent filters (e.g., activated charcoal or activated alumina) to remove gaseous contaminants are expensive and not practical.

Readers are advised to seek professional advice in designing and installing ventilation systems and other complex house components. (For guidance on locating professionals, see **Step 5—Taking Action.**)

The following notes will illustrate how these three strategies work together to effectively deal with chemical or biological contaminants.

Biological Contaminants

Biological contaminants, such as molds, dust mites and bacteria, thrive in moist conditions. Control is achieved by eliminating unnecessary sources of excess moisture from the home.

Some of the moisture generated inside can be reduced by changes in lifestyle and local ventilation (use of exhaust fans during cooking or showering). Changes in lifestyle may include avoiding prolonged showers, minimizing open boiling of foods, eliminating line drying of clothes indoors, humidifying in the winter only if and when needed.

It is helpful to measure the relative humidity inside your home. This can guide you in determining whether to humidify or not, and when you should be dehumidifying your basement.

Keep the relative humidity (RH) low enough to prevent condensation on windows. The RH should be about 25 to 35% in the winter. (Refer to CMHC's About Your House *Measuring Humidity in Your Home*).

Air conditioners can reduce humidity levels in summer and keep mold growth at bay. It should be noted that air conditioning does not kill molds. While it inhibits the flow of outdoor pollutants, such as pollens, it confines and recirculates indoor-generated pollutants (molds, in particular, as well as chemical contaminants).

Moisture problems caused by water entering the house from the outside through the walls and floor in basements or crawl spaces are challenging, and the solutions can be complex. How the water comes in has to be identified. In some cases, the solution may be as simple as redirecting exterior downspouts and eliminating depressions next to the home, or sealing a cracked wall that leaks only when it rains. But in some homes, complete drainage and dampproofing of the foundation may be required. This could involve excavation around the exterior of the foundation. Exterior insulation should be applied at the same time.

Dirt floors in basements and crawl spaces provide a continuous source of moisture, micro-organisms and soil gases. There are two ways to fix this problem: isolate the space or treat it like a lived-in space. If the height is very limited and ducts and a furnace are not present in the crawl space or basement, the dirt floor can be covered with polyethylene and the air exhausted to the outside from the area. If a forced air distribution system, ducts and a furnace are present in the crawl space or basement, sealed polyethylene *must* cover floor. A concrete covering is desirable to prevent damage to this moisture barrier.

Moisture trapped in the walls of improperly finished basements (inadequate or no insulation, no air barrier, lacking drainage, etc.) may provide conditions for mold growth. The source of the moisture has to be controlled, moldy materials discarded and the surfaces cleaned with unscented detergent and water and allowed to dry. (Refer to CMHC's *Clean Up Procedures for Mold in Houses*).

Immediate measures include eliminating carpets and furnishings that can hold moisture, using an air conditioner and/or dehumidifier in hot weather, and providing enough heat and air circulation in cold weather to prevent condensation on the walls. (Note: an effective dehumidifier should have a defroster.)

Chemical Contaminants

There are numerous sources of chemical contaminants in the home—the heating system, building materials, furnishings and occupant activities. The contribution of each source may be pronounced or insignificant. Since the total contaminant load is the sum of large and small contributions, all the sources have to be addressed.

Combustion gases and unburned fuel (including the additives) from fossil fuel appliances can be a major source of contaminants in the home. Evidence has accumulated on the negative impact on health of using unvented gas appliances. Unvented space heaters or gas fireplaces are not recommended. Older gas stoves have a pilot light which releases some gases. Newer gas stoves have electronic ignition. When using the gas stove, operate the exhaust hood. Those with asthma and sensitivities will find replacing a gas stove with an electric stove to be the most satisfactory.

Furnaces and water heaters are available with electronic ignition and with a sealed combustion unit which separates the appliance from the house air supply. For health and safety reasons, these appliances should be serviced regularly and checked for spillage of combustion products. Individuals with extreme sensitivities may need to replace gas or oil with electricity for hot water and space heating.

Many building materials and furnishings outgas chemicals. Some materials such as paints and finishes have strong chemical emissions when new, but these decrease with time. Others, such as rubber, emit equally strongly whether new or old. The emissions from surface treatments on furniture can be reduced by allowing the material to outgas outside the house, preferably in a dry place. Materials with lower emissions—hard flooring rather than wall-to-wall synthetic broadloom, or solid wood instead of veneer-coated particle board—can be used. When the furniture is built in, sealing with an appropriate, non-polluting coating can reduce further outgassing. (Refer to CMHC's *Building Materials for the Environmentally Hypersensitive*).

In many instances, it may not be feasible to remove or replace these materials or apply a sealant. The practical solution is to install a whole-house ventilation system to dilute the level of the contaminants in the air. It should be recognized that better air quality results from the ventilation if source control is done first.

Careful selection of non-toxic, unscented household cleaning compounds and personal cosmetics will reduce the occupant-generated chemical pollutants in the house. This is one of the easiest measures to implement.

Many hobbies use solvents, glues or other chemicals that temporarily release large quantities of pollutants. Carefully ventilating to the outdoors and limiting circulation to other areas of the house can significantly reduce exposure and risks.

Choosing Measures

Which measures you choose will be based on a number of factors, including whether you own or rent, the available funding and, most importantly, the degree or nature of your health concern. In general, the more serious the problems and your health concerns, the more extensive the measures you should undertake.

Use the worksheet on page 21 to record the measures you have identified. This is your preliminary action plan. On the right hand side of the worksheet, mark the columns for no-cost/low-cost, medium-cost and higher-cost measures. This should give you an idea of the work and associated costs involved. Note measures that require immediate attention, such as those dealing with combustion spillage.

If your list is extensive or includes major renovation, consider engaging the services of a professionally trained residential IAQ investigator to investigate your home for indoor air problems. An IAQ investigator is trained to find the problem(s), determine the causes and advise you on the most appropriate solutions. Before you

proceed with the renovation, you may avoid costly mistakes of undertaking work which are not effective or do not deal with the problem. Trained investigators can prioritize the steps into a final action plan which you can implement depending on your budget.

If you need to phase some of the work you should begin by making a specific area cleaner than the rest of the house. The bedroom of an affected person is an important place to begin. The whole house approach is recommended, however, since it makes the whole house accessible and it improves comfort for all members of the family.

Who are trained residential IAQ investigators?

They are private consultants or consulting companies who have been trained in IAQ investigation and provide this service to residential consumers.

Find out what procedure they are using and what you will receive from the investigation.

A number of individuals across Canada have completed training using CMHC's Residential IAQ Investigation Procedure. They conduct an investigation of the residence and provide a written report that identifies problems with indoor air quality, pinpoints their sources and recommends

Review your list. Deal with urgent safety issues without delay. Implement as many no-cost/low-cost or medium-cost measures you can do even before you get professional help. A good starting point is getting a dehumidifier, if you don't have one, to reduce moisture in a damp basement. You can remove moldy carpets and clear the basement of unused belongings, but make sure you protect yourself and other family members during the process. This may give some improvement, but the problem can come back unless the cause is corrected.

solutions. A trained IAQ investigator can help you assess the extent and costs of renovation. To find someone who uses the CMHC Residential IAQ Investigation Procedure, contact CMHC at 1 800 668-2642.

Note that IAQ investigators who use the CMHC Residential IAQ Investigation Procedure are neither employees, representatives nor agents of CMHC. Prospective clients for investigation services should perform due diligence before entering into a purchase agreement for IAQ investigation services. Any contract you enter into is between yourself and the investigator. The investigators are solely responsible for their inspections and reports.



Renovate or Relocate

It is extremely important to estimate the total cost and implications of alterations before committing yourself to large expenditures. In some cases, it may make more sense to relocate than to undertake major renovations. Relocating may become the option if:

- The house location is a major problem.
- Major renovations, such as replacement of carpet with hard flooring throughout the house, heating system replacement or major work in the basement, are required.
- The house has such serious problems that it will be almost impossible to obtain the required indoor air quality even after extensive renovations.
- You don't have sufficient control over the premises to make the required changes.
- You don't have access to sufficient financial resources, materials or talent to undertake the required work.
- The disruption and time required for major renovations would be too stressful for you or other family members.
- You are not planning long-term occupancy in this house.

For more information on relocating or on building from the ground up, refer to the section on **Relocating**, (page 25).

STEP 5: TAKING ACTION

Remodeling, renovating and building from the ground up all have one thing in common—construction. And, unless you or your family can do the work alone, you're going to need the help of professionals, such as designers, architects, engineers and builders.

The responsibility for ending up with a house with clean air rests with you. This depends on several factors: correctly identifying factors in the house which may be causing problems; determining the appropriate solutions; and carrying out remedial measures properly. Choices for new materials will have a major influence on the air you will breathe.

The renovation or building process itself introduces pollutants to the indoor air. It may be necessary to leave the home during construction to avoid high, but temporary, exposure to contaminants.

It will help to find the right contractor with the right blend of experience, professionalism and willingness to carry out the work.

There are several general rules to follow when looking for a professional, and special considerations to take into account when looking for a professional who will satisfactorily perform the work required by a person with sensitivities. General rules include:

- Seek out recommendations before looking through the phone book. Talk to self-help organizations, friends and neighbours.
- For each person you're considering:
 - ask for client references and take the time to check them out;
 - investigate their business record; and
 - ask to see any requisite licenses and proof of registration under any relevant consumer protection acts.

There is one special consideration—does the person have any experience or familiarity with non-toxic construction materials and clean house building techniques? This is a new field, and few professionals have had experience with such a specialized type of project. Almost anyone you hire will have to research and learn and ask suppliers and subcontractors to make an extra effort on your behalf. Professionals with energy-efficient building experience may be better able to understand and appreciate the need for an uncommon level of construction quality and control of air flow.

Once you have found several professionals whose work you like and whom you believe to be trustworthy, you're ready to ask for price estimates. A good practice is to get three quotes. This will help to ensure that the bids you receive are competitive. The lowest bid isn't necessarily the best. Familiarity with the work, the quality of workmanship and, above all, how you feel about each bidder as an individual must all be part of the equation.

One final note: when drawing up a written contract, make sure that every one of your specifications is clearly spelled out.

CHMC's About Your House information such as *Hiring a Contractor* or *Before You Start Your Renovation*, may be helpful.

STEP 6: FEEDBACK AND EVALUATION

How will you know whether the measures you have taken in the home were the right ones? Evaluating your success will be a purely subjective judgment based on your own observations of how the house is performing or changes in your health and well-being. If your health concern is not pressing, one way of proceeding is by undertaking the measures bit by bit. For example, start with low-cost measures. If they don't have the desired result, move to measures that require more time and expense and may be more effective.

In order to evaluate the effects of any change you make to your home, keep a record of your observations about your house and any discomfort or symptoms you notice in your house. Unless you or other household members have serious health problems, a weekly entry will do, as long as it summarizes notable health-related incidents and your general condition during the week.

Document the changes you made in your home and the date these were implemented.

When the measures are complete, the information can be used to evaluate their effectiveness and help you decide whether you've gone far enough or whether you need to do more to adapt your home to your health needs. Observe changes in your home. Do you still notice as much moisture in the windows as before? Have odours that were bothering you disappeared? Do you still struggle with cleaning stains in the bathroom? When taking note of health effects, remember that an improvement in health may not be immediate. Also, for someone with multiple health problems, it may not be obvious. The first signs may simply be less discomfort in the house.

Making Adjustments

Keeping track of what was done and the results will provide the necessary information for you to plan any further work that may be needed. When reviewing the results of your evaluation, ask yourself these questions:

- What new information do I have now?
- Did I overlook a major source of contamination?
- Am I experiencing some relief from symptoms? Is more work needed?

In your review, it is helpful to do the Air Quality Questionnaire again. After you have eliminated a major problem in the house, another problem that was masked by more serious problems, such as stronger odours, may become apparent. It is not unusual, as you clean the air in the house, for other sources of pollutants to become more noticeable. Based on your observations, prepare a revised action plan accordingly.

RELOCATING

Until now, we've dealt with what to look for and what to do about making your present home a clean air home. After assessing your present home and reviewing the corrective measures, you may decide that the best course of action is to move. If that's the case, there are a number of other factors you need to consider. This section will give you some guidance on how to assess an apartment, another home or a custom-built house.

NOTE: in all three cases, evaluate the location using the worksheet on page 8.

Apartment Complexes

As a tenant, you may have little control over most of the factors that can affect you. It is important, therefore, when looking for an apartment to be informed of what you should be looking for. Study the checklists on pages 10 to 16 to familiarize yourself with typical sources of problems. Use the information to avoid potential sources of contaminants.

If you are looking at a unit on the ground or second floor, ask to see the basement. Chances are you will be breathing air that comes from the basement.

In many regions of the country, basements of homes are being converted into apartments.

It is quite common to find higher humidity levels in the basement, and some basements have chronic moisture and mold problems. This is well worth checking before moving in.

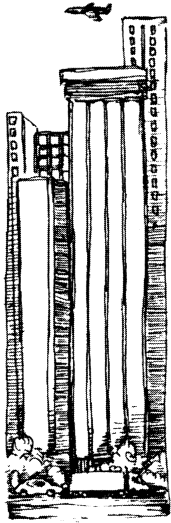
One question often asked is whether a new building is better than an older building. Hardwood floors are more likely to be found in older buildings. Older buildings often have hydronic (hot water) heating. Hot water heating has advantages—less dust, and it is easier to isolate the apartment from other units in the building. On the other hand, the apartment may be lacking in ventilation. Watch out for signs of mold in older buildings, especially in the basement. An important consideration is that older buildings generally have lower insulation levels. Cold surfaces may be prone to mold.

New or newly renovated buildings may have more pressed wood products, carpets and underpads. Emissions may be a concern when these are newly installed and ventilation is limited. With time, the emissions decrease but whether new or old, pay attention to the types of paints or finishes used. Odours from oil-based paints or coatings can linger for extended periods of time. Such odours can affect people, even those with no known allergies.

Other factors to consider include the following:

- Does the apartment have an exhaust fan in the bathroom and kitchen? Are these working?

- Check out the ventilation. In newer buildings, fresh air is brought into the corridor. Older buildings rely on air coming in through natural openings. One can tell if the building breathes by the presence of odours, e.g., cooking odours especially at supper time, and odours of cleaning chemicals used in common areas.
- Is the landlord approachable? What is likely the response if concerns are voiced?
- Is the entrance shared? Are the common areas (e.g., stairs, elevators, corridors) in good condition?
- Has the apartment been newly renovated—kitchen cabinets, carpeting, etc.?
- Will the apartment require painting before you move in?
- What is building policy regarding pets and smoking? Tenants sometimes complain of cigarette smoke from neighbours living next door or one floor below.
- Were previous tenants of the unit smokers? Surfaces exposed to cigarette smoke tenaciously retain the smoke odour.
- Did previous tenants have pets? Allergens from animal dander may take months to disappear.
- Has the building been infested with insects or rodents? Is the building regularly treated with pesticides?
- Where are parking facilities, laundry facilities, garbage chute, etc.?



Which Floor

When it comes to apartment buildings, the most important factor may be which floor you live on. Lower floors may have the best access to outside air. But, at the same time, they are also closer to roadways and parking garages. In some buildings, upper floors may breathe almost exclusively from plumbing, electrical and heating chases, so that your fresh air is actually someone else's exhaust. In addition, pests move through apartment buildings via service chases (plumbing, electrical, communication, etc.). The choice of floor should be evaluated on the basis of accessibility of outside air, the quality of the air being brought in, and local characteristics of the building which can affect the indoor air.



Buying a Home

Use the worksheets on pages 10 to 16 as you walk through any house you are considering for purchase. Other factors to consider include the following:

- Avoid houses with damp basements. Moisture or mold problems may be hidden behind finished walls in the basement. Look for houses with sealed combustion appliances and without carpeting and composite (pressed) wood products. These can be removed or replaced, but that's an added expense.
- Older houses may be preferable to newer houses, provided that they don't have moisture problems. Older houses are more likely to have hardwood floors and plaster walls, and less likely to have pressed wood products. In addition, questionable products will have had a number of years to 'outgas.' However, check the level of insulation which will affect your comfort and the

house's energy consumption.

- A house that has been remodeled or renovated may have used materials that affect the indoor air quality. Any remodeling that needs to be done can be carried out using low-emission products. See the next page for a list of other features to consider.



Building a Clean-Air Home

Building from the ground up is the surest route to creating a clean air house. This wider option enables the optimum use of materials. However, the costs will depend on the choices made, the most ideal (e.g., ceramic tiles, natural wood) being usually the most expensive. Building a clean air house involves making decisions on materials, which is not a critical part of normal construction. A considerable commitment in time and energy is therefore required from start to finish. It is very important to enlist the services of a competent and cooperative architect and contractor.

Some of the features described below may apply only to building a new home. However, these features are worth considering when renovating or looking to buy another home. Consult the **Resources** section for more detailed information.

- A house on a slab-on grade foundation is less likely to have the moisture problems commonly found in basements and crawlspaces. A moisture barrier under the slab and proper drainage and insulation of the foundation are very important.
- If building a new house and your plans include a basement, or if you are doing a major renovation of your house, ensure that building techniques that exclude moisture entry through the foundation are followed. Exterior insulation is preferred.
- A basement suspected of being moldy may need to have all interior finishes and contaminated furnishings removed or cleaned and the moisture sources corrected. Refer to CMHC's *Clean-Up Procedures for Mold in Houses*.
- Airtight construction with ample insulation will enable you to control the air quality inside the house and make the occupants more comfortable.
- High efficiency or sealed combustion heating appliances are preferable.
- Specify metal ducts and plenums for forced air distribution systems, instead of ducts made of plastic or enclosed wood joists and subfloor used as return plenum.
- Radiant heating of ceramic tile, terazzo or concrete floors eliminates dusts inherent in forced air systems. Emissions would be released from certain coverings over heated floors.
- Select low-emission building materials, paying particular attention to materials inside the building envelope. Refer to CMHC's *Building Materials for the Environmentally*

Hypersensitive for general descriptions of materials and how to test materials.

- Hard-finish flooring, such as ceramic tiles and solid hardwood, are easier to clean and do not act as dust reservoirs or mold breeding sites.
- Use low-odour water-based paints on walls and ceilings.
- Minimize furnishings made of pressed wood. If these are used, encapsulate (seal) all surfaces.
- Bathroom and kitchen exhaust fans (and a dehumidifier if there is a basement) are the minimum equipment needed to control moisture in the house. The next step is a properly installed heat recovery ventilator that brings in fresh air and at the same time exhausts stale air from local sources of pollution.
- A central vacuum system, which exhausts to the outside, prevents the redistribution of fine particles that are not retained by the vacuum filter. Alternatively, use a vacuum cleaner with a HEPA (High Efficiency Particulate Air) filter.

Families with asthma or environmental sensitivities may require more stringent features than the above. Some may need to exclude combustion fuel appliances completely. Alternatively, the gas or oil furnace/boiler may need to be separated from the house. Paints can be avoided by using old-fashioned plaster or the newer veneer plaster walls. Refer to CMHC's *Building Materials for the Environmentally Hypersensitive*, *Research House for the Environmentally Hypersensitive: Description and Technical Details*, *This Clean House* video and *A Guide to Mechanical Equipment for Healthy Environments*.

The house features alone do not ensure clean air in the home. How you operate and maintain your house, what you bring inside, your hobbies and lifestyle have a significant contribution to the indoor air quality of your home.

CONCLUSION

The six steps to achieving clean air housing may not be obvious. Required is an understanding of the potential problems with indoor environments, of your own health needs and the condition of your home. And it requires effort on your part to identify problem sources in the home and take corrective measures.

As the steps in this Guide show, it is not a one-time activity. Family health needs or lifestyle may change and make it necessary to take additional measures in the home. Or changes to the house or the neighbourhood may affect your home's air quality.

This booklet is not the last word on clean air housing. Rather, the overview presented here provides a starting point for your involvement. The six steps provide a way for you to deal with the issue. The audit forms and questionnaires are self-help tools which you may use to assess and reassess your situation as circumstances change.

The list of **Resources** and the **Bibliography** will guide you to other sources of information and assistance.

As the section on **Feedback and Evaluation** explained, measuring progress towards a clean air home is not a simple matter. You will need to take into account the general well-being of family members as well as specific health conditions. There is no absolute test for indoor air quality, but the following general criteria can serve as benchmarks.

- The air is fresh, clean and odour-free.
- Toxins and irritants are eliminated or minimized.
- The house provides a high level of comfort and promotes a feeling of well being.
- The house does not make anyone sick and it provides a supportive environment to those who want to rebuild their health.

The ultimate test, of course, is that your home allows you to **BREATHE EASY**.

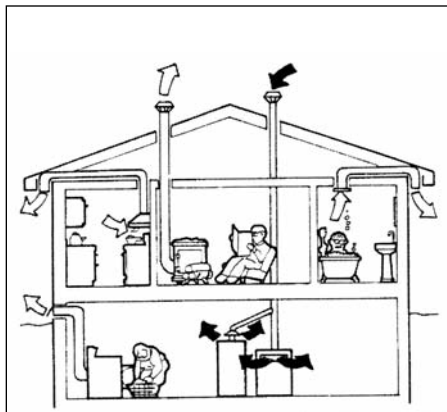
COMBUSTION, SPILLAGE AND BACKDRAFTING

Combustion is the process of burning fuel, such as oil, gas or wood. The primary products of combustion are carbon dioxide and water. Under perfect conditions (right amount of oxygen, right temperature), these are the gases that should be produced. However, incomplete combustion due to insufficient oxygen or low burning temperature can produce carbon monoxide and, in severe depletion of oxygen, soot. An improper air-to-fuel ratio can also lead to nitrogen oxides. All the combustion products should be expelled out of the chimney or flue.

Combustion air is the air used in the process of burning fuel. In almost all houses, there is sufficient air for normal size combustion appliances. Appliances that are located in small, well-enclosed utility rooms may have difficulty obtaining combustion air from the house. Ensure that the appliances have access to house air through grilles or louvres in the walls enclosing the room. Most high-efficiency appliances no longer require combustion air from the house or the chimney. They are said to be ‘sealed,’ ‘directly vented’ or ‘spillage resistant.’ Air supply and exhaust are handled by pipes through the wall.

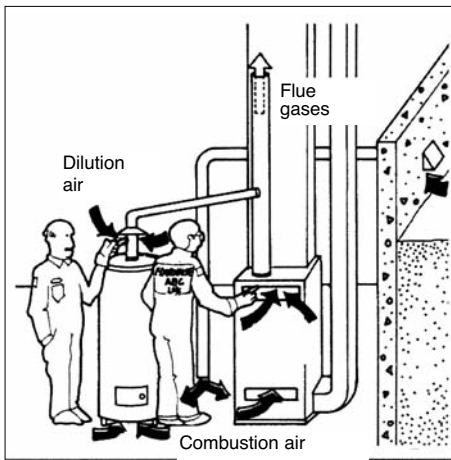
A combustion appliance is said to “spill” if combustion products escape into the house rather than up the chimney. A reversal of the continuous flow of flue gases and outdoor air—pulling them down the chimney instead of up—is known as backdrafting. Evidence of spillage or backdrafting includes soot, scorched surfaces and melted fittings near the vent.

Spillage and backdrafting is most often caused by improperly designed or maintained venting systems. Sometimes, it is caused by excessive house depressurization, which may be produced by large exhaust fans or open fireplaces.



Exhaust fans or clothes dryers may overpower the chimney draft of the heating system and cause exhaust gases to spill into the house.

Every house heated with a combustion appliance should have a carbon monoxide detector which should warn homeowners when the carbon monoxide concentration reaches a very high level. A smoke detector located above the barometric damper of an oil furnace will indicate if the oil furnace is having problems venting.



Testing for spillage of flue gases

Combustion backdraft test

An experienced Heating, Ventilation and Air Conditioning (HVAC) contractor can conduct a backdraft test for you. You can also carry out the quick test described here.

- Select a calm day in spring or fall with cool weather.
- Find something that can show the direction of air flow by the smoke it emits—a commercial smoke pencil or even an incense stick.
- Turn down the thermostats on the furnace and hot water heaters and leave them off for about half an hour.
- Hold the smoke indicator near the draft hood of a gas furnace or near the barometric damper of an oil furnace and watch for air movement into the house as opposed to up the chimney.
- Switch on all exhausting equipment that you could be running at the same time, such as the kitchen fan, clothes dryer or central vacuum cleaner. Check for air movement at the draft hood or damper. If air is coming down the chimney at this point, you have a problem.
- Now, have someone turn up the furnace thermostat. If your smoke indicator shows that hot exhaust comes out of the furnace draft hood (rather than house air being sucked into it), then combustion gases are spilling into the house.
- After completing the test, return all exhaust devices and heating equipment to normal operating conditions.

If gases spill (either naturally or during the test described in “Combustion backdraft test”) for a period of less than 30 seconds, it is generally not cause for concern since the flue usually establishes a good draft once it heats up. Spillage and backdrafting for longer periods should be investigated. The cause is usually a constricted or poorly functioning chimney, or suction created at the appliance by other equipment—for example:

- A return air grille sharing a small room with the combustion equipment.

- Another exhausting appliance, such as a clothes dryer, sharing a small room with the combustion appliance.
- High-capacity exhausting appliances operating in the home (this could include other combustion equipment).

If spillage occurs only during unusual or improbable circumstances, keep monitoring the situation to see whether further action is required. If drastic spillage occurs under normal conditions, contact your HVAC contractor immediately.

RESOURCES

There are two types of organizations involved with housing and health issues: non-governmental organizations (NGOs), such as the Allergy and Environmental Health Association or the Lung Association, and government housing agencies. The non-governmental organizations provide information. Some may also run self-help and support groups and act as advocates in presenting issues to government. Some NGOs operate only nationally or locally. Others maintain both national offices and chapters in provinces and major urban centres.

Canada Mortgage and Housing Corporation (CMHC) is Canada's national housing agency. It provides information on housing technology and health-related housing issues, and sponsors research and demonstration projects. CMHC has offices in every province and territory.

Provincial housing agencies are typically involved in housing codes and standards, and in providing social housing. The provincial housing organizations listed below may administer federal housing rehabilitation programs. They may also handle such cases on an individual basis under the existing provincial programs for social housing or housing for the disabled.

Government organizations are indicated with an asterisk.

National Organizations

Allergy/Asthma Information Association
National Office
Box 100
Etobicoke, Ontario M9W 5K9
416-679-9521 or 1-800-611-7011
www.aaia.ca
e-mail: national@aaia.ca
Chapters: British Columbia, Manitoba, New Brunswick, Ontario, Quebec and Yukon Territory
Contact: Andrea Kenney

Asthma Society of Canada
130 Bridgeland Avenue
Suite 425
Toronto, Ontario M6A 1Z4
416-787-4050 or 1-800-787-3880
www.asthma.ca
info@asthma.ca

Canada Housing Information Centre*
Canada Mortgage and Housing Corporation
700 Montreal Road
Ottawa, Ontario K1A 0P7
1-800-668-2642

Canadian Lung Association
1900 City Park Drive, Suite 508
Gloucester, Ontario K1J 1A3
613-747-6776
Chapters: Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, Quebec, Saskatchewan and Yukon

Canadian Society of Allergy and Clinical Immunology
774 Echo Drive
Ottawa, Ontario K1S 5N8
613-730-8177
www.csaci.medical.org
csaci@rcpsc.edu

Canadian Society for Environmental
Medicine
2197 Riverside Drive
#506
Ottawa, Ontario K1H 7X3
Fax: 613-523-0108

Canadian Centre for Occupational Health
and Safety
250 Main St. E.
Hamilton, Ontario L8N 1H6
1-800-263-8466
www.ccohs.ca

Resources Listed by Province

ALBERTA

Allergy/Asthma Information Association
Prairies/NWT
16531 - 114 Street
Edmonton, Alberta T5X 3V6
780-456-6651
e-mail: prairies@aaia.ca

Alberta Lung Association
P.O. Box 4500, Station South
Edmonton, Alberta T6E 6K2
780-407-6819
1-800-931-9111
www.ab.lung.ca
e-mail: info@ab.lung.ca

Housing Field Services*
4th Floor, Stand Life Centre
10405 Jasper Avenue
Edmonton, Alberta T5J 4R7
780-427-3919
www.seniors.gov.ab.ca

BRITISH COLUMBIA

Allergy/Asthma Information Association
B.C. and Yukon Chapter
113 – 445 Yates Road
Kelowna, British Columbia V1V 1Y4
250-861-6590 or toll-free
1-877-500-2242
Fax: 250-861-6597
e-mail: bc@aaia.ca

B.C. Housing*
Suite 601
4555 Kingsway, # 1701
Burnaby, British Columbia V5H 4V8
604-433-1711
www.bchousing.org

British Columbia Lung Association
2675 Oak Street
Vancouver, British Columbia V6H 2K2
604-731-5864
1-800-665-5864
www.bc.lung.ca
e-mail: info@bc.lung.ca

MANITOBA

Manitoba Lung Association
629 McDermot Avenue, 2nd Floor
Winnipeg, Manitoba R3A 1P6
204-774-5501
1-888-566-LUNG
www.mb.lung.ca
e-mail: reception@manitobalung.org

Allergy and Environmental Health
Association
Manitoba Branch
77 Meadowcrest Bay
Winnipeg, Manitoba R2V 4G9
204-339-1609

Manitoba Family Services and Housing*
219 - 114 Garry Street
Winnipeg, Manitoba R3C 4V6
204-945-3242
www.gov.mb.ca
e-mail: fadmin@gov.mb.ca

NEW BRUNSWICK

Allergy and Environmental Health
Association
New Brunswick Branch
P.O. Box 4073
Dieppe, New Brunswick E1A 6E7
506-384-2178
e-mail: aehant@nb.sympatico.ca

Allergy/Asthma Information Association
Atlantic Branch
20 South Road
Doaktown, New Brunswick E9C 1G1
506-365-4501
atlantic@aaia.ca

Family and Community Services*
P.O. Box 6000
Fredericton, New Brunswick E3B 5H1
506-453-2001
www.gnb.ca

New Brunswick Lung Association
65 Brunswick Street
Fredericton, New Brunswick E3B 1G5
506-455-8961
www.nb.lung.ca
e-mail: info@nb.lung.ca

NEWFOUNDLAND AND LABRADOR

Newfoundland and Labrador Lung
Association
292 LeMarchant Road
P.O. Box 5250
St. John's, Newfoundland A1C 5W1
709-726-4664
1-888-566-5864
www.nf.lung.ca
e-mail: info@nf.lung.ca

Newfoundland and Labrador Housing
Corporation*
Sir Brian Dunfield Building
2 Canada Drive
P.O. Box 220
St. John's, Newfoundland A1C 5J2
709-724-3000
www.nlhc.nf.ca

NOVA SCOTIA

Allergy and Environmental Health
Association
Nova Scotia Branch
P.O. Box 31323
Halifax, Nova Scotia B3K 5Y5
1-800-449-1995 (NS only)
info@environmentalhealth.ca
www.environmentalhealth.ca

Nova Scotia Department of Community Services*
Housing Department
P.O. Box 696
Halifax, Nova Scotia B3J 2T7
902-424-3280
www.gov.ns.ca/coms/hous

Nova Scotia Environmental Health Centre
Dalhousie University
P.O. Box 2130
Fall River, Nova Scotia B2T 1K6
902-860-0057

ONTARIO

Allergy And Environmental Health Association
Kitchener Branch
513 Quiet Place #2
Waterloo, Ontario N2L 5L6
519-885-2803

Allergy And Environmental Health Association
Ottawa Branch
Ottawa RPO Shoppers City West
Box 33023
Nepean, Ontario K2C 3Y9
613-860-2342
www.aeha.ca

Environmental Health Clinic
Women's College Hospital
76 Grenville Street
Toronto, Ontario M5S 1B6
416-351-3764

Ontario Lung Association
573 King Street East, Suite 201
Toronto, Ontario M5A 4L3
416-864-9911
1-800-972-2636
www.on.lung.ca
e-mail: olalung@on.lung.ca

Ontario Ministry of Municipal Affairs and Housing*
777 Bay Street
Toronto, Ontario M5G 2E5
416-585-7041
www.mah.gov.on.ca

Allergy/Asthma Information Association
Ontario Region
P.O. Box 2371
St. Mary's, Ontario N4X 1A2
519-284-4222
1-888-250-2298
e-mail: ontario@aaia.ca

PRINCE EDWARD ISLAND

Allergy and Environmental Illness Group Inc.
P.O. Box 1482
Charlottetown, P.E.I. C1A 7N1
902-368-2730
e-mail: que@isn.net

PEI Health and Social Services*
17 Knights Lane
P.O. Box 640
Souris, P.E.I. C0A 2B0
902-687-7150
www.gov.pe.ca

PEI Lung Association
1 Rochford Street, Suite 2
Charlottetown, P.E.I. C1A 9L2
902-892-5957
1-888-566-LUNG
www.pei.lung.ca
e-mail: info@pei.lung.ca

QUEBEC

Allergy/Asthma Information Association
172 Andover Road
Beaconsfield, Quebec H9W 2Z8
514-694-0679
e-mail: quebec@aaia.ca

Association pulmonaire du Québec
800, boul. de Maisonneuve Est,
bureau 800
Montréal, Quebec H2L 4L8
514-287-7400
1-800-295-8111
www.pq.lung.ca
asspulm@cam.org

Société d'habitation du Québec*
1054, rue Louis-Alexandre-Taschereau
Aile St-Amable, 3^e étage
Québec, Quebec G1R 5E7
418-643-7676
www.shq.gouv.qc.ca
e-mail: infoshq@shq.gouv.qc.ca

SASKATCHEWAN

Allergy and Environmental Health Association
Prairie Regional Contact:
204-339-1609

Saskatchewan Lung Association
1231 - 8th Street East
Saskatoon, Saskatchewan S7H 0S5
306-343-9511 or
1-888-566-LUNG
www.sk.lung.ca
e-mail: info@sk.lung.ca

Saskatchewan Municipal Affairs and Housing*
Housing and Inspection Services
1855 Victoria Avenue, #900
Regina, Saskatchewan S4P 3V7
306-787-4177
www.municipal.gov.sk.ca
e-mail: infohousing@mah.gov.sk.ca

YUKON

Allergy/Asthma Information Association
BC/Yukon
113 - 445 Yates Road
Kelowna, British Columbia V1V 1Y4
250-861-6590 or
1-877-500-2242
e-mail: bc@aiaa.ca

Yukon Housing Corporation*
P.O. Box 2703
Whitehorse, Yukon Y1A 2C6
403-667-5759
www.housing.yk.ca
e-mail: ykhouse@housing.yk.ca

Financial Assistance

There are two programs available from CMHC which are relevant: Homeowner Residential Rehabilitation Assistance Program (RRAP) and RRAP for Persons with Disabilities.

Homeowner RRAP

The Homeowner RRAP offers financial assistance to low-income homeowners for major repairs or work needed to bring your residence to the minimum standard of safety and health. Depending on your income and where you live, part of the loan may not need to be paid back.

RRAP for Persons with Disabilities

RRAP for Persons with Disabilities assists in the modification of existing homeowner or rental housing to improve the accessibility of these dwellings for disabled persons. Under this program, homeowners and landlords can apply for assistance to undertake modifications that will improve the accessibility of their dwelling.

In some areas of the country, funding for these or similar programs is provided jointly by the Government of Canada and the provincial or territorial government. In these areas, the provincial or territorial housing agency may be responsible for delivery of the programs. Program variations may also exist in these jurisdictions.

For more information about Homeowner RRAP or RRAP for the Disabled, contact your local CMHC office or your provincial housing agency.

BIBLIOGRAPHY

The titles listed here represent a small sample of available works on the subject of housing and health. Additional titles may be found through the Canadian Housing Information Centre and from CMHC's annual list of publications. Many provincial housing agencies and electric utilities also provide booklets on housing technology. In particular, texts on energy-efficient housing include information on controlling moisture and ventilation.

CMHC Publications

Call 1 800 668-2642 to order!

A Guide to Mechanical Equipment for Healthy Indoor Environments. 2001 (order #62015)

Building Materials For The Environmentally Hypersensitive. \$29.95 (order #61089)

Canadian Wood-Frame House Construction. \$25.95 (order #61010)

Clean-Up Procedures for Mold in Houses. \$14.95 (order #61091)

Farewell to Cockroaches: Controlling Cockroaches the Least-Toxic Way. (order #60948)

Healthy Housing Renovation Planner. \$34.95. (order #60957)

Homebuying Step by Step. A Consumer Guide and Workbook. Free (order #60946)

Homeowner's Inspection Checklist. \$19.95 (order #62114)

Investigating, Diagnosing & Treating Your Damp Basement. \$9.95 (order #61065)

Lead in Your Home. Free (order #61941)

Moisture and Air Householder's Guide: Problems and Remedies. (order #61033)

Radon: A Guide for Canadian Homeowners. Free (order #61945)

Prices do not include applicable taxes, shipping and handling.
Prices are subject to change.

About Your House series (Free)

Moisture and Mold

Attic Venting, Attic Moisture, and Ice Dams. (order #62034)

Choosing a Dehumidifier. (order #62045)

Measuring Humidity in Your Home. (order #62027)

Importance of Bathroom and Kitchen Fans. (order #62037)

Healthy and Safety

Asbestos (order #62029)

Carbon Monoxide. (order #62046)

Combustion Gases in Your Home. (order #62028)

How to Read a Material Safety Data Sheet (MSDS). (order #62038)

Urea-Formaldehyde Foam Insulation (order #62032)

Energy Efficiency and Cost Savings

Insulating Your House. (order #62039)

Hydronic Radiant Floor Heating. (order #62030)

Maintenance and Repair

Soot Staining on Carpets (order #62035)

Garbage Bag Airflow Test (order #62288)

Maintaining Your Heat Recovery Ventilator (HRV). (order #62043)

Removing Ice on Roofs. (order #62036)

Should You Get Your Heating Ducts Cleaned? (order #62044)

Your Furnace Filter (order #62041)

Construction and Renovation

Before You Start Renovating Your Basement - Structural Issues and Soil Conditions (order #62248)

Emergencies

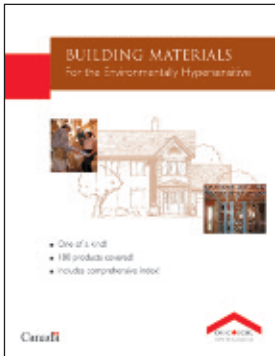
After the Flood: A Homeowner's checklist (order #60515)

When You Must Leave Your House Due to Prolonged Winter Power Outage. (order #60356)

Wood Heat Safety in an Emergency (order #60339)

CLEAN AIR GUIDE

How to Identify and Correct Indoor Air Problems in your Home

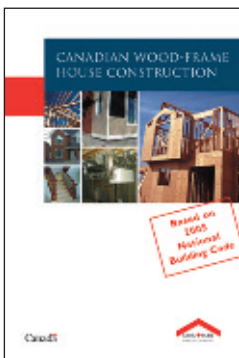


Building Materials for the Environmentally Hypersensitive

For people who are environmentally hypersensitive, even low levels of contaminants in the air can cause problems ranging from discomfort to debilitating illness. This book provides information on pollutant emissions and other considerations for more than 180 building materials and finishes commonly used in residential construction.

\$25.95

61089



Canadian Wood-Frame House Construction

This national bestseller contains illustrations, sizing tables, planning notes and other practical information on wood-frame house construction. Tips on Healthy Housing™ are also provided to improve indoor air quality and reduce environmental impact. Topics include: footings and foundations; framing and roof sheathings; exterior and interior finishes; plumbing, heating and wiring; insulation, fire and sound control; ventilation; and much more.

\$25.95

61010



Moisture and Air: Homeowner's Guide—Problems and Remedies

Use the information in this Guide to identify the typical signs of moisture and air quality problems in your home, to identify the probable causes and to consider practical solutions.

FREE

61033

61082 15-06-10



www.cmhc.ca

ISBN 978-0-660-96630-4

