

THE CLEAN AIR GUIDE



How to
Identify and Correct
Indoor Air Problems
□ in Your □
Home

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THE CLEAN AIR GUIDE

HOW TO IDENTIFY AND CORRECT INDOOR AIR PROBLEMS IN YOUR HOME

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Cette publication est aussi disponible en français sous le titre: *Guide d'assainissement de l'air : Comment cerner et régler les problèmes de qualité de l'air de votre habitation* LNH 6696

Acknowledgements

This booklet was written and illustrated by REIC Ltd. with the assistance of Ed Lowans and Alicia Conrad in collaboration with the Research staff at CMHC.

The project team would like to express their appreciation to the many individuals who reviewed the document and contributed to its development.

Project Authority: Virginia Salares, Research Division

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.

CANADIAN CATALOGUING IN PUBLICATION DATA

Main entry under title:

The clean air guide: how to identify and correct indoor air problems in your home

Issued also in French under title : Guide d'assainissement de l'air.

Includes bibliographical references.

ISBN 0-662-20299-6

DSS cat. no. NH15-83/1993E

1. Housing and health. 2. Indoor air pollution — Environmental aspects. 3. Environmental health. I. Canada Mortgage and Housing Corporation. II. Title: How to identify and correct indoor air problems in your home.

RA577.5B73 1993

613.5

C93-099459-0

© 1993, Canada Mortgage and Housing Corporation

ISBN 0-662-20299-6

Cat. NH15-83/1993E

Printed in Canada

Produced by the Public Affairs Centre, CMHC

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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 percent 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 the chemical vapours 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 infirm. 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

Almost everyone is 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 moulds. Moulds 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 moulds, dust mites, pollen, animal dander, and bacteria. Moulds are underrated contaminants in the home; they produce particulates (spores and residual matter) and gases (volatile compounds characterized as mouldy or musty odours). High moisture levels inside the home support the growth of moulds 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 furnaces, fireplaces, hot water heaters, woodstoves and oil furnaces;
- 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 15).

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 the outdoor air (pollution levels, temperature, and humidity) and radon and other soil gases which enter through leaks and cracks in the foundation.

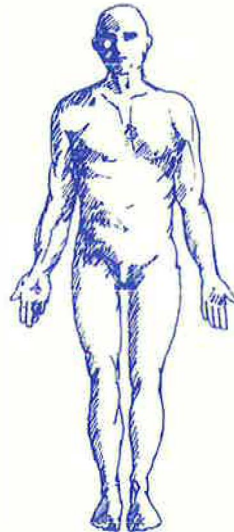
All of these agents and conditions affect the quality of the indoor environment, and pose potential dangers to your health. No matter what your health needs are, a clean air environment can improve the quality of your health and sense of well-being, and provide you with a nurturing, supportive environment.

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. Moulds, besides causing allergic reactions and acute infections, can cause chronic illnesses in humans (Significance of Fungi in Indoor Air: Report of a Working Group, Health and Welfare Canada, 1987).

The health care community is still in the process of determining the extent and range of housing-related health effects. The list that follows names just some of the ailments that may be related to poor indoor air quality. (For detailed information on health effects, refer to the Bibliography.)

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 is certainly not 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 personal blueprint 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 listening to your body and monitoring changes in 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 the 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. That is, they do not relate symptoms to health effects, or identify conditions such as 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.

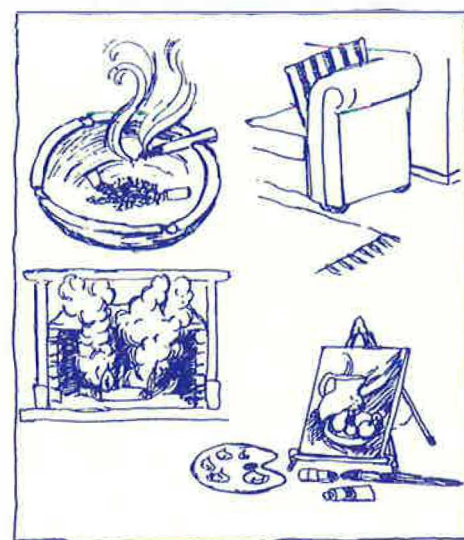
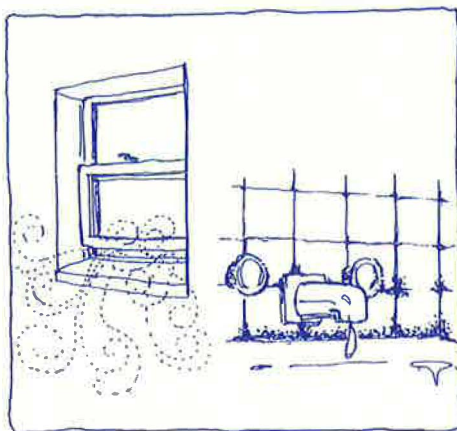
Filling out the Health Profile and the Air Quality Questionnaire in this section will give you a better idea of what problems to look for in your house.

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 Health Profile provides a place to record your observations, as well as specific information on the medical history of household members, including house-related illnesses. 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? _____
- Do you feel better outdoors than inside your house? _____
- Do you feel better in other people's homes than in your own? _____
- Are there times when you feel sick inside your house? _____
- Do you associate specific symptoms with particular odours? _____
- Are they worse in certain areas of the house? _____
- Are they worse at a particular time of day or year? _____

If you answered 'Yes' to any one 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? _____
- Is the odour a "new smell" or a chemical odour
(similar to that of a new car, new house, new wood, gas, paint, fabric shop, carpet store, etc.)? _____
- Has a pest control company ever treated your house? _____
- Has the house been renovated recently? _____
- Are there new furniture or furnishings? _____

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

B

- Is your house old? _____
- Does your house have an "old smell" (stale, musty or earthy)? _____
- Does your house have a crawl space or basement? _____
- Does the crawl space or basement have a dirt floor? _____
- Do you sense that your basement is unhealthy for you
(feelings of dampness, aversion or discomfort, etc.)? _____
- Does water come into the basement at certain times? _____
- Is there flooding when it rains, or during the spring thaw? _____

If you answered 'Yes' to any one 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? (Large cities are notorious for air pollution.)	<input type="checkbox"/>	<input type="checkbox"/>
- Is it in a rural area? (Rural areas can be affected by agricultural activities, such as the application of chemical pesticides and fertilizers or raw animal manure.)	<input type="checkbox"/>	<input type="checkbox"/>
- Some areas have high radon concentration. Is your area one of them?	<input type="checkbox"/>	<input type="checkbox"/>
- Prevailing winds and seasonal considerations such as wind direction and 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"/>
- Is the house close to high voltage lines, or telecommunications towers (TV, microwave, radio or cellular)? (These are sources of electromagnetic fields.)	<input type="checkbox"/>	<input type="checkbox"/>
- Busy roads are a source of fumes, dust and noise. Rural routes are treated with roadside spraying, road salt and use of oil for dust control. Are nearby roads a likely problem?	<input type="checkbox"/>	<input type="checkbox"/>
- Are there any pollen bearing plants in the area which are known irritants?	<input type="checkbox"/>	<input type="checkbox"/>
- Railway lines or airports can be sources of air and noise pollution; is there one nearby?	<input type="checkbox"/>	<input type="checkbox"/>
- Some businesses create air quality problems, e.g., gas stations or dry cleaners. 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 will be 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 can purify the air but they also release pollen and can adversely reduce passive air change and light levels. Are the trees around the house likely to make a positive 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 near a golf course? They are 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 permanently affect the indoor air quality in an adverse way. 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 mould?	<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 15 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: chemicals and biologicals. Each worksheet is further divided into three columns: Sources, Symptoms or Problems, and Corrective Measures.

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 undertaken 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 several different rooms. Make a note of the rooms where each source is found as you go.)

Some Words of Advice

Before you begin the audit, assemble a clipboard to hold worksheets, a flashlight, and a face mask to use 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 mould. 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 they have an acute sense of smell. They 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 a 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 condensation indicate moulds	<input type="checkbox"/> Control sources of moisture (see Step 4, also CMHC's "Moisture and Air: Problems and Remedies") <input type="checkbox"/> Use a dehumidifier <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, insulation and drainage
<input type="checkbox"/> basement or crawl space with dirt floor	musty odours due to moulds	<input type="checkbox"/> Cover floor with 6 mil polyethylene, anchor with sand, gravel or bricks <input type="checkbox"/> Provide supply and exhaust air to crawl space
<input type="checkbox"/> cold cellar	likely place for moulds	<input type="checkbox"/> Ensure that foundation has good drainage <input type="checkbox"/> Insulate walls and ceiling, install air/vapour barrier and provide cold and warm air vents <input type="checkbox"/> Seal off cold cellar from the rest of the house <input type="checkbox"/> Control sources of moisture throughout the house
<input type="checkbox"/> wet windows	rotting, peeling paint, discolouration	<input type="checkbox"/> Control sources of moisture throughout the house
<input type="checkbox"/> carpets in basement	act as sinks for moisture and odours	<input type="checkbox"/> Remove carpets <input type="checkbox"/> Replace with smooth flooring
<input type="checkbox"/> carpets elsewhere	act as sinks, 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 mouldy	<input type="checkbox"/> Discard badly damaged materials, eliminate clutter and allow for air circulation
<input type="checkbox"/> open sump pit	source of moisture, moulds	<input type="checkbox"/> Provide sump pit with a tight-fitting cover (be sure the sump pit still works as intended or replace with a submersible pump)
<input type="checkbox"/> kitchen/bathroom sinks	unpleasant odours	<input type="checkbox"/> Unclog drain of debris <input type="checkbox"/> Pour baking soda and water, add vinegar, seal drain and allow to stand.
<input type="checkbox"/> floor drain	can be site for mould 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 airsealing type
<input type="checkbox"/> bathrooms	unvented moisture can lead to moulds	<input type="checkbox"/> Install a direct exhaust fan <input type="checkbox"/> Exhaust via a central ventilation system
<input type="checkbox"/> closets	cold walls can lead to condensation	<input type="checkbox"/> Exhaust closets via central ventilation system <input type="checkbox"/> Control sources of moisture in the house <input type="checkbox"/> Insulate outside wall and install an effective air barrier

BIOLOGICAL CONTAMINANTS

Sources	Symptoms or Problems	Corrective Measures
<input type="checkbox"/> water leaks <input type="checkbox"/> attics	visible stains moisture problems from inadequate ventilation in the attic and house air leakage into the attic space	<input type="checkbox"/> Ascertain source of moisture and correct <input type="checkbox"/> Ensure adequate ventilation in the attic <input type="checkbox"/> Seal all openings and leaks in the ceiling
<input type="checkbox"/> humidifier trays (also dehumidifiers, air conditioners, refrigerators, laundry equipment)	standing water supports microorganisms	<input type="checkbox"/> Discontinue use of humidifiers if there is a mould problem <input type="checkbox"/> Clean trays on a regular basis <input type="checkbox"/> Keep tubs and washing machine dry when not in use
<input type="checkbox"/> filters (furnace, air conditioner, HRV)	may be loaded with dust	<input type="checkbox"/> Clean and replace filters on a regular basis <input type="checkbox"/> Replace with a high-performance filter
<input type="checkbox"/> potted plants	soils can support fungal growth	<input type="checkbox"/> Remove from bedroom <input type="checkbox"/> Cover top of pot with foil, rigid plastic or a thick layer of pebbles <input type="checkbox"/> Remove plants from the house
<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, and vent clothes dryer to the outside <input type="checkbox"/> Don't store firewood indoors
<input type="checkbox"/> damp, dirty surfaces <input type="checkbox"/> house dust	support mould supports dust mites	<input type="checkbox"/> Keep wet surfaces very clean (e.g., tub and shower enclosures) <input type="checkbox"/> Remove shoes upon entering the house <input type="checkbox"/> Clean house regularly with a central vacuum or damp mop <input type="checkbox"/> Remove dust-collecting furnishings (e.g., loose shag carpets) <input type="checkbox"/> Have furnace ducts cleaned periodically <input type="checkbox"/> Add whole house vacuum system
<input type="checkbox"/> pollen and other particulates from outside	seasonal; cause allergies	<input type="checkbox"/> Caulk and weatherstrip house to prevent entry of dust, pollen, and other particulates from outdoors <input type="checkbox"/> Keep windows closed at night <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 air conditioners on page 17)
<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 <input type="checkbox"/> pesticides	gases and particulates pest control products are human poisons	<input type="checkbox"/> Smoking is inconsistent with clean air and good health <input type="checkbox"/> Discontinue pesticide use indoors and outdoors <input type="checkbox"/> Use traps, sealing insect entry points from the outside, and clean thoroughly.
<input type="checkbox"/> unvented kerosene or gas heater	combustion gases	<input type="checkbox"/> Do not use unvented heater indoors
<input type="checkbox"/> gas/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 <input type="checkbox"/> Replace with an electric stove
<input type="checkbox"/> gas water heater	combustion gases	<input type="checkbox"/> Check for combustion spillage <input type="checkbox"/> Replace with induced draft or sealed combustion water heater <input type="checkbox"/> Replace with electric water heater
<input type="checkbox"/> gas/oil furnace	unburned and combustion gases, odorous additives	<input type="checkbox"/> Check for combustion spillage and provide air using a supply air fan <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 <input type="checkbox"/> 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 <input type="checkbox"/> Install glass doors on fireplace <input type="checkbox"/> Upgrade woodstove to high-efficiency or catalytic type; install fresh air intake and burn only clean, dry wood
<input type="checkbox"/> electric furnace, baseboard heaters	odours can occur from dust frying on heating coils	<input type="checkbox"/> Vacuum ducts and heaters; have furnace cleaned by an electrician <input type="checkbox"/> Change, upgrade or clean filters <input type="checkbox"/> Have coils and extra heaters wired in series by an electrician; this will reduce surface temperatures
<input type="checkbox"/> electronic air cleaner	electric discharge can produce ozone, a respiratory and nervous system irritant	<input type="checkbox"/> Replace with bag or HEPA filter <input type="checkbox"/> Ensure smooth air flow and clean filters frequently (keeping filters clean minimizes ozone production)
<input type="checkbox"/> insulation/acoustical lining in ducts, furnace	fibres and chemical odours	<input type="checkbox"/> Remove lining and clean ducts

CHEMICAL CONTAMINANTS

Sources	Symptoms or Problems	Corrective Measures
<input type="checkbox"/> urban outdoor air	chemical pollutants	<input type="checkbox"/> Make house tight <input type="checkbox"/> Ventilate house, but filter the incoming air (and house air) with adsorbent media and particulate filters
<input type="checkbox"/> attached garage	exhaust fumes can infiltrate house	<input type="checkbox"/> Seal garage from main residence <input type="checkbox"/> Do not store chemicals in garage <input type="checkbox"/> Park car outside
<input type="checkbox"/> exposed fiberglass 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"/> particleboard/indoor plywood in furnishings, shelves, panelling, etc.*	formaldehyde and other gases from glues (urea-formaldehyde resins)	<input type="checkbox"/> Seal all surfaces with appropriate sealant <input type="checkbox"/> Replace with safer, alternative materials or furnishings
<input type="checkbox"/> waferboard, exterior plywood in panels, underfloor, etc.*	formaldehyde and other gases from glues (phenol-formaldehyde resins)	<input type="checkbox"/> Remove non-structural materials <input type="checkbox"/> Seal with appropriate sealant <input type="checkbox"/> Combine with ventilation strategy
<input type="checkbox"/> new paints	chemical smells (decrease with time)	<input type="checkbox"/> Choose low-toxicity paints <input type="checkbox"/> Paint only when windows can be opened, in the summer; never 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 .

* 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 particleboard and interior-grade plywood than from waferboard and exterior-grade plywood.

CHEMICAL CONTAMINANTS

Sources	Symptoms or Problems	Corrective Measures
<input type="checkbox"/> carpets and underpads	chemical emissions (especially new carpets), dust, dust mites and moulds	<input type="checkbox"/> Remove loose carpets and replace with cotton or untreated wool rugs <input type="checkbox"/> Replace with hard flooring (particleboard and waferboard underfloor must be dealt with as outlined above)
<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 mould growth, electromagnetic field effects	<input type="checkbox"/> Use conventional beds
<input type="checkbox"/> wallcoverings made of vinyl, plastics or other synthetics	odours (especially strong when new)	<input type="checkbox"/> Remove wallpaper and adhesive and replace with natural materials using adhesives without fungicide <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"/> Exhaust the closets <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"/> 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 and keep in a vented cupboard or closet <input type="checkbox"/> Use bathroom exhaust fan regularly
<input type="checkbox"/> pine, cedar furniture or panelling	odours from terpenes in woods	<input type="checkbox"/> Seal with appropriate sealants (see Guide to Healthy Building Materials) <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
<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	<input type="checkbox"/> Store outside house or in closet equipped with exhaust fan
<input type="checkbox"/> cracked basement floor	possible radon contamination, sewer and soil gases, moisture problems	<input type="checkbox"/> Test for radon <input type="checkbox"/> Seal cracks <input type="checkbox"/> Ventilate the basement <input type="checkbox"/> Use subfloor ventilation in extreme cases
<input type="checkbox"/> lead-based paint	lead dust (during and after renovation)	<input type="checkbox"/> Consult specialists on lead removal <input type="checkbox"/> See CMHC publication on lead
<input type="checkbox"/> asbestos	particulates are lung hazards	<input type="checkbox"/> Have professionals seal or remove
<input type="checkbox"/> asphalt roofing, vinyl siding	chemical odours	<input type="checkbox"/> Seal the house and provide a balanced ventilation system

Radon, lead and asbestos cause long-term problems, not the shorter-term problems common to other pollutants.

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, moulds and chemical contaminants laid up all summer but now newly stirred.

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

STEP 4: DECIDING WHAT TO DO

The worksheets on pages 10 to 15 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; the basic strategies that underlie corrective measures for clean air housing; and 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** 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 gas furnace range from having the furnace serviced on a regular basis, to upgrading the furnace, to replacing the furnace altogether.

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, as opinions are more common 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, 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 mould or dust mites should be eliminated.

Separate: If it isn't feasible to eliminate an offending substance, then the next best strategy is to separate it from the living space. This involves two approaches. The first is sealing the material itself to prevent it from releasing gases into the air (outgassing). The second involves air-sealing the building envelope (to prevent outdoor pollutants from entering the house) or creating a cleaner oasis, such as a bedroom, within the house (to prevent pollutants elsewhere in the house from entering the bedroom).

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. Only balanced ventilation systems (those which bring in enough air to replace exhausted air) are recommended. To conserve energy, heat recovery may be combined with central ventilation — complete units are called heat recovery ventilators (HRV) or air-to-air heat exchangers. HRV's can work with forced air heating systems and air conditioners.

Forced air heating and cooling systems can include air purification using particulate filters or chemical adsorbent filters (e.g., activated charcoal or activated alumina) to remove gaseous contaminants.

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 moulds, 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 (avoiding prolonged showers, minimizing open boiling of foods, eliminating line drying of clothes indoors, humidi-

fying in the winter only if and when needed) and local ventilation (use of exhaust fans during cooking or showering).

Air conditioners can reduce humidity levels in summer and keep mould growth at bay. It should be noted that air conditioning does not kill moulds. While the flow of outdoor pollutants such as pollens is slowed, the indoor-generated pollutants (moulds, in particular, as well as chemical contaminants) are confined and recirculated.

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 some homes may require complete drainage and dampproofing of the foundation. This could involve excavation around the exterior of the foundation.

Dirt floors in basements and crawl spaces provide a continuous source of moisture, microorganisms and soil gases and must be sealed with an air barrier. Crawl spaces should be isolated and provided with their own supply and exhaust air.

Improperly finished basements (inadequate or no insulation, no air barrier, lacking drainage, etc.) may have moisture trapped in the walls which provides conditions for mould growth. The source of the moisture has to be controlled and the walls and woodwork cleaned (limewashed) and allowed to dry.

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

Ventilation may be either local ventilation (vented exhausts in bathrooms, kitchen, attic, crawl space) or a whole house ventilation system.

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. Sufficient evidence has accumulated on the negative impact on health of using open flame gas stoves. There are three options: eliminate the pilot light with electronic ignition and use an effective exhaust hood, upgrade to a sealed combustion unit, and replace the gas stove with an electric stove. Those with sensitivities will find the last option 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. 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 emit equally strongly whether new or old (e.g., rubber). 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 particleboard — can be used. When the furniture is built in, sealing with an appropriate, non-polluting coating can reduce further outgassing (Refer to Guide to Healthy Building Materials).

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 would result from the ventilation if source control is done first.

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

Many hobbies use solvents, glues, or other chemicals which 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

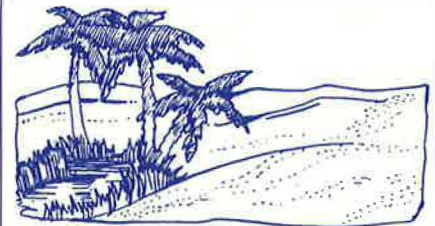
Which measures you choose will be based on a number of factors, including whether you own or rent, available funding, and, most importantly, the degree or nature of your health concern. In general, the more serious your health concerns, the more extensive the measures you should undertake.

Use the worksheet on page 20 to record the measures you intend to undertake; this is your personal action plan. After filling out the form, ask yourself the following questions and make revisions to your action plan as required.

- Have I identified the major contaminants?
- Do the action items deal with the major sources in the home?
- Is the level of effort appropriate to the level of health concern?
- Are all the measures necessary? Do some overlap?
- Do these items represent a comprehensive action plan?

Spend time reviewing your list. It is important to prioritize the steps for major problems, listing the most effective solutions first, and to get some idea of the costs involved. You may need to talk to contractors or architects, or to contact your local CMHC office for publications.

Oasis versus Whole House

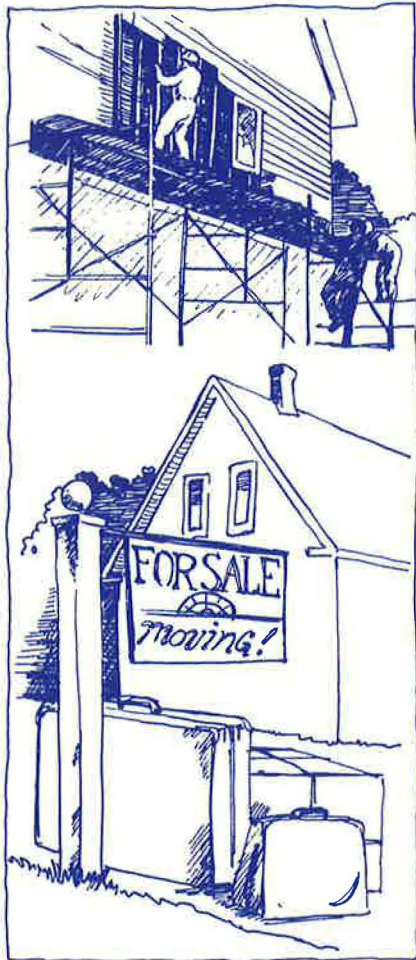


If you cannot put into action every measure you identify due to cost or other considerations, you may want to phase certain measures in over time using the 'oasis' approach.

Under the oasis approach, a single room, usually the bedroom, is made cleaner than the rest of the house. The degree of attention paid to the oasis and the degree of separation between it and the rest of the house will depend on the health requirements of the individual.

The whole house approach, on the other hand, improves comfort for all members of the family and makes the whole house accessible to the affected individual.

A combination of the whole house and oasis approaches may be most practical.



Renovate or Relocate

Having completed the action plan, you should review its implications. In some cases it may make more sense to relocate than to undertake major renovations. It is extremely important to estimate the whole cost and implications of the alterations before committing yourself to large expenditures. You should consider moving under the following conditions:

- The house location is a major problem.
- Major renovations such as carpet replacement throughout the house, heating system replacement, or basement moisture proofing 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.
- Alterations to the house could reduce its resale value to an unacceptable degree.
- 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**.

STEP 5: TAKING ACTION

Remodelling, 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 problems in the house, determining the appropriate solutions, and carrying out remedial measures properly. Decisions on the materials to use will have a major effect on the result.

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.

It will help to find the right person — someone with the right blend of experience, professionalism and willingness to execute your plan.

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 really only 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 be willing to research and learn, and ask suppliers and subcontractors to make an extra effort on your behalf. (Note: 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 you to ensure that the bids you receive are competitive. (Note: 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.

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 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 are more effective.

In order to evaluate the effects of any measures you undertake, keep a health record as you set your personal action plan into motion. 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. Make sure you record the date and nature of the corrective measures you take.

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. When taking note of 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 an improved sense of well-being, improved tolerance to food, or better reaction to other therapies.

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 you have now?
- Did you overlook a major source of agents?
- Are you 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 personal action plan accordingly.

RELOCATING

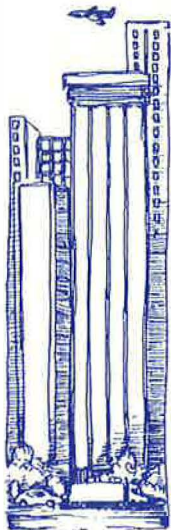
Until now, we've dealt with what to look for and what to do about making your present home a clean air home. After assessing your present home and reviewing the corrective measures, you may decide that the best course of action is to move. If that's the case, there are a number of other factors you need 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

Generally speaking, apartment complexes are not a preferred option. As a tenant, you have little control over most of the factors that can affect you. However, if you have no choice, apartments in converted homes are often better than apartment buildings. Use the worksheets on pages 10 to 15 as you walk through the apartment. Factors to consider include the following:

- Some older buildings that have not been renovated may be preferable to newer structures. Older buildings are more likely to have hardwood floors and plaster walls, and less likely to have synthetic wood products. Older buildings often have hydronic (hot water) heating systems (a preferred method). However, it may be expensive to introduce controlled ventilation in these buildings. Watch for signs of mould in older buildings, especially in the basement.
- Check out your neighbours. Make sure none of their habits (e.g., barbeque, smoking) will interfere with your health.
- Check out the ventilation. Will your air supply be affected by your neighbours? Is there cross-ventilation? Are exhaust fans working in the kitchen and the bathroom?
- Identify remedies required and the landlord's responsibility.
- Is the entrance shared? What is the condition of common areas, such as stairs, corridors, and elevators?
- Has the apartment been newly renovated — kitchen cabinets, carpeting, etc.?
- Will the apartment require painting before you move in?
- What is the building policy regarding pets?
- Has the building been infested with insects or rodents? Has it been treated with pesticides?
- Did previous tenants have pets or were they smokers?
- Do other tenants smoke or have pets?
- Where are parking facilities, laundry exhaust, 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 15 as you walk through any house you are considering for purchase. Other factors to consider include the following:

- Avoid houses with damp basements or finished basements lacking an air barrier.
- Look for houses without carpeting, combustion appliances, and composite wood products. All of these things can be removed or replaced, but that's an added expense.
- Older houses are 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 synthetic wood products. In addition, questionable products will have had a number of years to outgas.
- A house that hasn't been remodelled or renovated is preferable. The remodelling may have used materials that affect

the indoor air quality. Any remodelling that needs to be done can be carried out using non-toxic products. See the next page for a list of features common to homes which have undergone major renovations for health considerations.



Building a Home

Building from the ground up is the surest route to creating a clean air house. Wider options enable the use of optimum materials. However, the costs will depend on the choices made, the most ideal (e.g., ceramic tiles, plaster walls) being usually the most expensive. Building a clean house involves decisions on materials choices, which are 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.

A CMHC survey of families who have built new homes or undertaken extensive renovations for health reasons yielded a list of common characteristics of clean-air housing. You may wish to consider these features in your plans.

- Hard-finish flooring, such as ceramic tiles or hardwood, was chosen; tiles were laid with cement mortar rather than adhesives; concrete without admixtures, water reduction oils, and curing agents was used for the foundation.
- Building materials with no formaldehyde or minimum emission of volatile organic compounds were used; woods used were not treated with preservatives.
- Wall and ceiling surfaces were used that did not require paints (such as plaster); when they were painted, non-toxic paints were used.
- A heating system with an electric source rather than petroleum fuels, and a low-temperature heating system were found to be preferable.
- Draft-free building techniques were used to reduce the infiltration of contaminants from the outdoors, or from materials in the building envelope.
- Sites were chosen for good outdoor ambient air quality and location away from heavy traffic, industrial pollution, and power lines.
- A ventilation system was used to bring in fresh air and exhaust stale air from local sources of pollution within the house.
- Clothes closets were equipped with exhaust fans and located outside of bedrooms.
- An air purification system was used to remove airborne contaminants such as dusts, mould spores, pollens, and chemical pollutants.
- A central vacuum system, which exhausts to the outside, or other suitable means of removing dust from the home, was included.
- Furniture, furnishings, and household products were selected for minimum emission of volatile chemical contaminants.
- Sufficient natural lighting was an important part of the design.
- Houses with no basement were preferred. Where there were basements or crawl spaces, they were properly drained, insulated and ventilated.

CONCLUSION

Achieving clean air housing is not simple. It requires an understanding of the potential problems in 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 to take corrective measures.

As the steps in this guide show, it is not a one-time activity. Family health needs or lifestyle may change over time, making it necessary to take additional measures in the home. Or there may be changes to the house or the neighbourhood that 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 outlined in the booklet provide a method 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 (temperature and humidity).
- 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.**

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 the national housing agency. It provides information on housing technology and health-related housing issues, and sponsors research and demonstration projects. CMHC operates regional offices in every province and territory.

Provincial housing agencies are typically involved in housing codes and standards and in providing social housing. Many of the provincial housing organizations listed administer federal housing programs for the hyper-sensitive. 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

Advocacy Group for the Environmentally Sensitive (AGES)
1887 Chaine Court
Orleans, Ontario K1C 2W6
(613) 830-5722
Contact: Marie Laurin

Allergy and Environmental Health Association of Canada
3463 Yonge Street
Toronto, Ontario M4N 2N3
1-800-695-9271
Chapters: British Columbia, New Brunswick, Nova Scotia and Ontario.

Allergy Foundation of Canada / Fondation du Canada des allergies (1974)
P.O. Box 1904
Saskatoon, Saskatchewan S7K 2S5
(306) 373-7591
Contact: Sandy Woynarski, President

Allergy / Asthma Information Association
#10, 65 Tromley Drive
Etobicoke, Ontario M9B 5Y7
(416) 244-8585
Chapters: British Columbia, Manitoba, New Brunswick, Ontario, Quebec and Yukon Territory.
Contact: Susan Daghish

Asthma Society of Canada
P.O. Box 213, Station K
Toronto, Ontario M4P 2G5
(416) 977-9684
Contact: Elizabeth Kovac

Canada Housing Information Centre*
Canada Mortgage and Housing Corporation
700 Montreal Road
Ottawa, Ontario K1A 0P7
(613) 748-2367
(CMHC operates regional offices in every province and in the territories)

Canadian Lung Association
75 Albert Street, #908
Ottawa, Ontario K1P 5E7
(613) 747-6776
Chapters: Alberta, British Columbia,
Manitoba, New Brunswick, Nova Scotia,
Ontario, Prince Edward Island, Quebec,
Saskatchewan and Yukon.
Contact: Bob Mech, Executive Director

Canadian Society of Allergy and Clinical
Immunology
c/o Dr. Don Stark, President
207 – 3195 Granville Street,
Vancouver, B.C. V6H 3K2
(604) 734-4848

Canadian Society for Environmental
Medicine
RR #6
6901 2nd Line West
Mississauga, Ontario L5M 2B5
(416) 564-0122

Canadian Centre for Occupational Health
and Safety
250 Main St. E.
Hamilton, Ontario L8N 1H6
1-800-263-8276

Resources Listed by Province

ALBERTA

Alberta Association for Environmental
Health
16 McKerrell Close South East
Calgary, Alberta T2Z 1M7
(403) 257-1102
Contact: Linda Seifert

Alberta Municipal Affairs*
Housing Division, Special Programs
10155 – 102 Street, 16th Floor
Edmonton, Alberta T5J 4L4
(403) 427-8161

Society for Environmental Health
and Housing
Box 74, Site 22, RR #12
Calgary, Alberta T3E 6W3
(403) 240-2494
Contact: Ethel Patrick

BRITISH COLUMBIA

Allergy and Environmental Health
Association
1091 Gordon Drive
Kelowna, B.C. V1Y 3Z3
(604) 861-8301
Contact: David Hughes

Allergy / Asthma Information Association
1620 West 8th Avenue, #202
Vancouver, B.C. V6J 1V4
(604) 731-9884
Contact: Lynda Kerr

B.C. Housing Management Commission*
#1701, 4330 Kingsway
Burnaby, B.C. V5H 4G7
(604) 433-2218
Contact: Client Services

MANITOBA

Allergy / Asthma Information Association
Prairies / NWT Regional Office
600 Better Street, #106
Winnipeg, Manitoba R2Y 2H7
(204) 837-2137
Contact: Margaret Irvine, Coordinator

Manitoba Housing and Renewal
Corporation*
287 Broadway
Winnipeg, Manitoba R3C 0R8
(204) 945-4748
Contact: Planning Department

NEW BRUNSWICK

Allergy and Environmental Health
Association, New Brunswick Branch
P. O. Box 4073
Dieppe, New Brunswick E1A 6E7
(506) 382-3696
Contact: Marilyn Shaw-Guisset
or Margaret Kelly

Allergy / Asthma Information Association
20 South Road
Doaktown, New Brunswick E0C 1G0
(506) 365-4501
Contact: Gloria J. Shanks, Coordinator

Dept. of Municipalities, Culture &
Housing*
P.O. Box 6000
Fredericton, New Brunswick E3B 5H1
(506) 453-7132
Contact: Blair Gardner, Program Officer

NOVA SCOTIA

Allergy and Environmental Health
Association, Nova Scotia Branch
P. O. Box 8212, Station A
Halifax, Nova Scotia B3K 5L9
(902) 463-4760
Contact: Myrtle Gillis

Nova Scotia Department of Housing
and Consumer Affairs*
1496 Bedford Hwy, #304
Bedford, Nova Scotia B4A 1E5
(902) 424-5110
Contact: Joe Amyoony

The Environmental Medicine Clinic
Victoria General Hospital
Bethune Building, Room 519
Halifax, Nova Scotia B3H 2Y9
(902) 428-7089
Contact: Dr. Gerald Ross

ONTARIO

Allergy and Environmental Health Assoc.
P. O. Box 40604
Burlington, Ontario L7P 0N0
1-800-695-9271
Contact: Ed Lowans

Ontario Ministry of Housing*
777 Bay Street
Toronto, Ontario M5G 2E5
(416) 585-7041

Patient Information on Chronic Illness
(P.I.C.I.)
41 Green Valley Court
Kleinburg, Ontario L0J 1C0
(416) 832-5340
Contact: Maggie Burston, Director

Sunnyhill Research Centre
2269 Concession 4, R.R. #1
Goodwood, Ontario L0C 1A0
(416) 649-1356
Contact: Bruce Small

PRINCE EDWARD ISLAND

Allergy and Environmental Illness
Group Inc.
P.O. Box 1482
Charlottetown, P.E.I., C1A 3X5
(902) 628-1524
Contact: Sandra Boswell

P.E.I. Council of the Disabled Inc.
P.O. Box 2128, 164 Richmond Street
Charlottetown, P.E.I. C1A 7N7

P.E.I. Housing Corporation*
P.O. Box 2000, 3 Queen Street
Charlottetown, P.E.I., C1A 7N8
(902) 368-5769
Contact: Don Pridmore

QUEBEC

Allergy / Asthma Information Association
177 Andover Road
Beaconsfield, Quebec H9W 2Z8
(514) 694-3965
Contact: Mary Allen

Société d'habitation du Québec*
1054 Conroy
Édifice G, Aile St. Amable, 4e étage
Quebec, Quebec G1R 5E7
(418) 644-2618
Contact: René Bergeron

SASKATCHEWAN

Allergy Foundation of Canada
Moose Jaw Chapter
P. O. Box 451
Moose Jaw, Saskatchewan S6H 4P1

Saskatchewan Community Services*
Housing Division
2500 Victoria Avenue, #900
Regina, Saskatchewan S4P 3V7
(306) 787-4177

YUKON

Allergy / Asthma Information Association
Yukon Chapter
4 Liard Road
Whitehorse, Yukon Y1R 3L4
(403) 667-2063
Contact: Joyce Peschke

Yukon Housing Corporation*
P.O. Box 2703
Whitehorse, Yukon Y1A 2C6
(403) 667-5759
Contact: Mike O'Connor

Financial Assistance

There are two programs available from CMHC which are relevant: Homeowner RRAP and RRAP for Disabled Persons.

Homeowner RRAP

The Homeowner Residential Rehabilitation Assistance Program (RRAP) provides loans to low income households 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.

The Homeowner RRAP is delivered by CMHC or a "RRAP delivery agent," who may be from the municipality or other agency. In Newfoundland, New Brunswick, Quebec and the Yukon, funding for RRAP is provided jointly by the federal and provincial governments and is delivered by the provincial housing agency.

RRAP for Disabled Persons

The Residential Rehabilitation Assistance Program (RRAP) for Disabled Persons assists in the modification of existing homeowner or rental housing to improve the accessibility of these dwellings for disabled persons. Under this program, individuals can apply for assistance to undertake modifications that will improve the accessibility of their dwelling.

RRAP for Disabled Persons is available in Nova Scotia, Prince Edward Island, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia and the Northwest Territories. In those provinces, funding comes entirely from the federal government through CMHC. Similar programs, serving the same purpose and funded jointly by federal and provincial governments, operate in other provinces.

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

Other Provincial Assistance

In Ontario, the Ontario Home Renewal Program for Disabled Persons (OHRP-D) offers assistance to disabled homeowners, or homeowners with permanently disabled resident dependents, for modifications or additions that make a home more suitable for a disabled occupant. Interest-free loans of up to \$15,000 are available. Contact the Ontario Ministry of Housing's nearest regional office.

In other provinces, inquire from your provincial housing agency about other programs that may be available.

BIBLIOGRAPHY

The titles listed below represent a small sample of available works on the subject of housing and health. Additional titles may be found through the Canadian Housing Information Service 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

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- Drerup, Oliver, Mattock, Chris, et al. *Housing for the Environmentally Hypersensitive (Survey and Examples of Clean Air Housing)*. 1990.
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- Canadian Wood Frame House Construction*. 1988 (2nd Metric Edition).
- Guide to Healthy Building Materials*. Expected date of publication: early 1993.
- Homeowners and Homebuyers Inspection Checklist for Maintenance and Repair*. 1984.
- How to Hire a Contractor*. 1988.
- How to Improve the Quality of Air in Your Home*. Consumer Series. 1989.
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Other Publications

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- Bower, John. *Healthy House: How to Buy One, How to Build One, How to Cure a "Sick" One*. New York: Carol Communications, 1989.
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- Zamm, Alfred. *Why Your House May Endanger Your Health*. New York: Simon and Schuster, 1982.

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