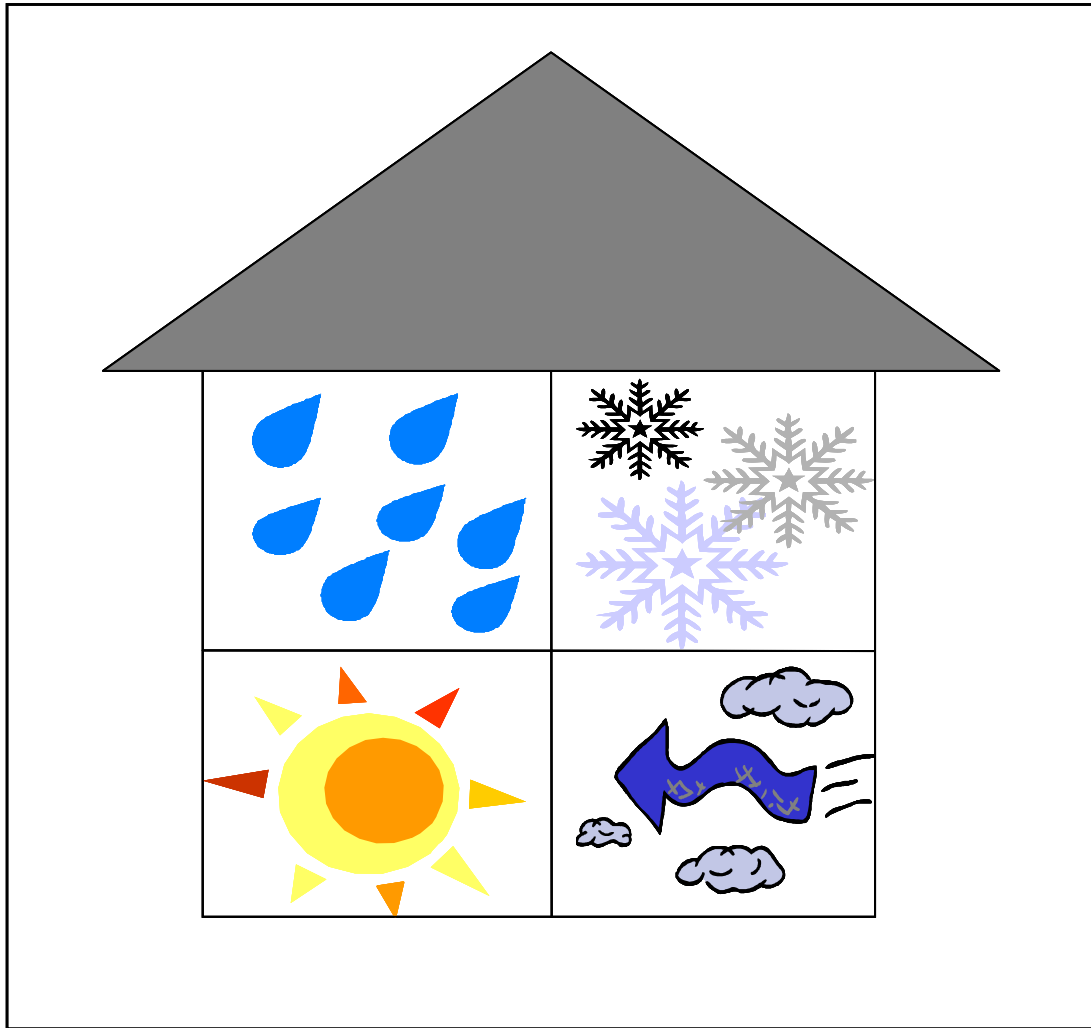


# How your house works!®



## An EZ guide & workbook to Home Health principles



## **Acknowledgements**

I would like to thank the wonderful staff at HUD for making a program like this a reality, the Opportunity Council for making this project happen, for all the great clients I have come to know in the Healthy Homes Program, Dave Finet for being a great Director and special thanks to Dave Blake for bringing me into the wonderful building science community!

Reproduction encouraged!

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## **What's Inside**

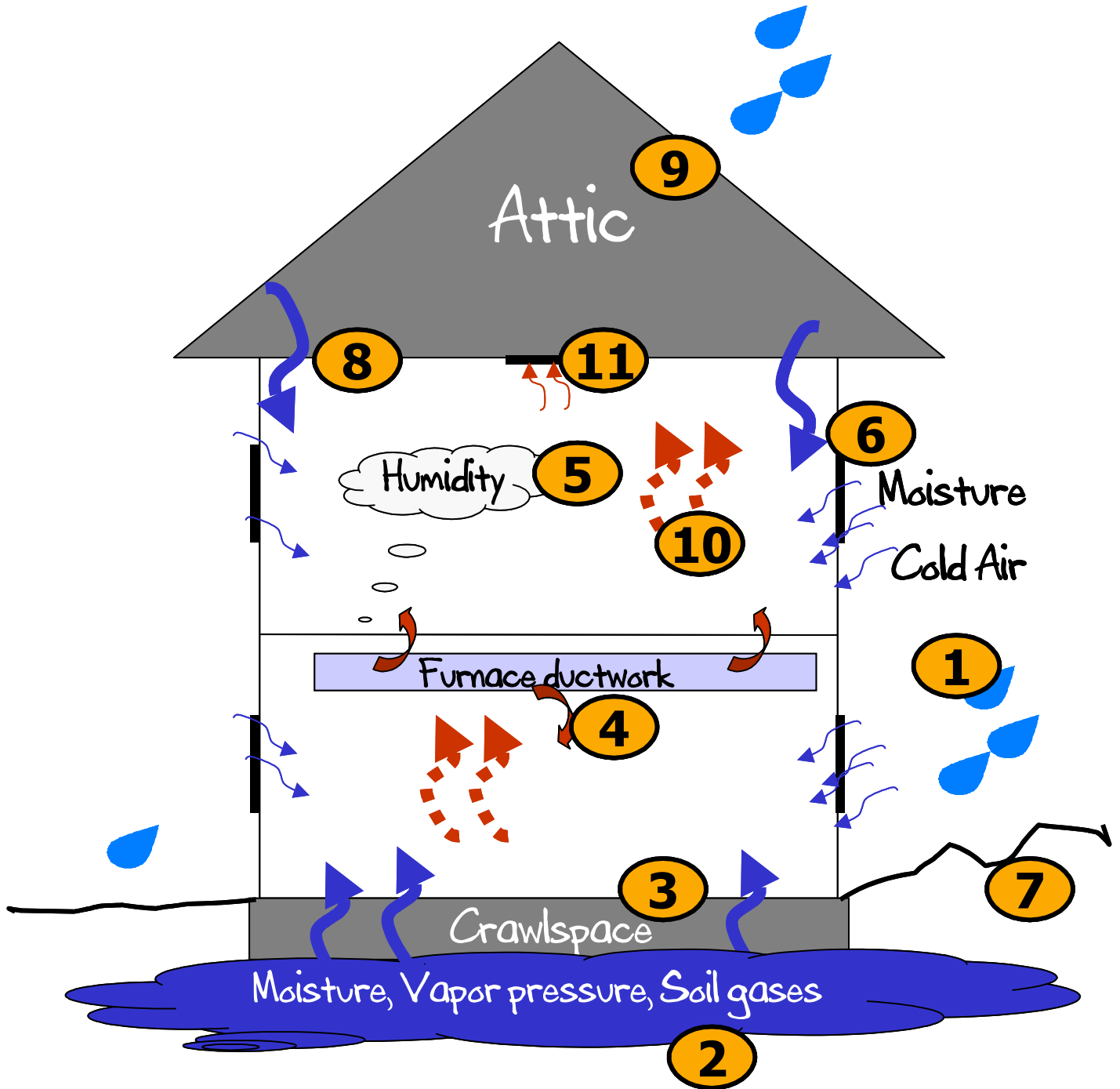
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This booklet highlights many important aspects of your home that relate to health.

We hope that by understanding your home better, you will recognize the conditions that are within your power to control, leading to a healthier, happier place to live!

# The Basic Elements important to Home Health

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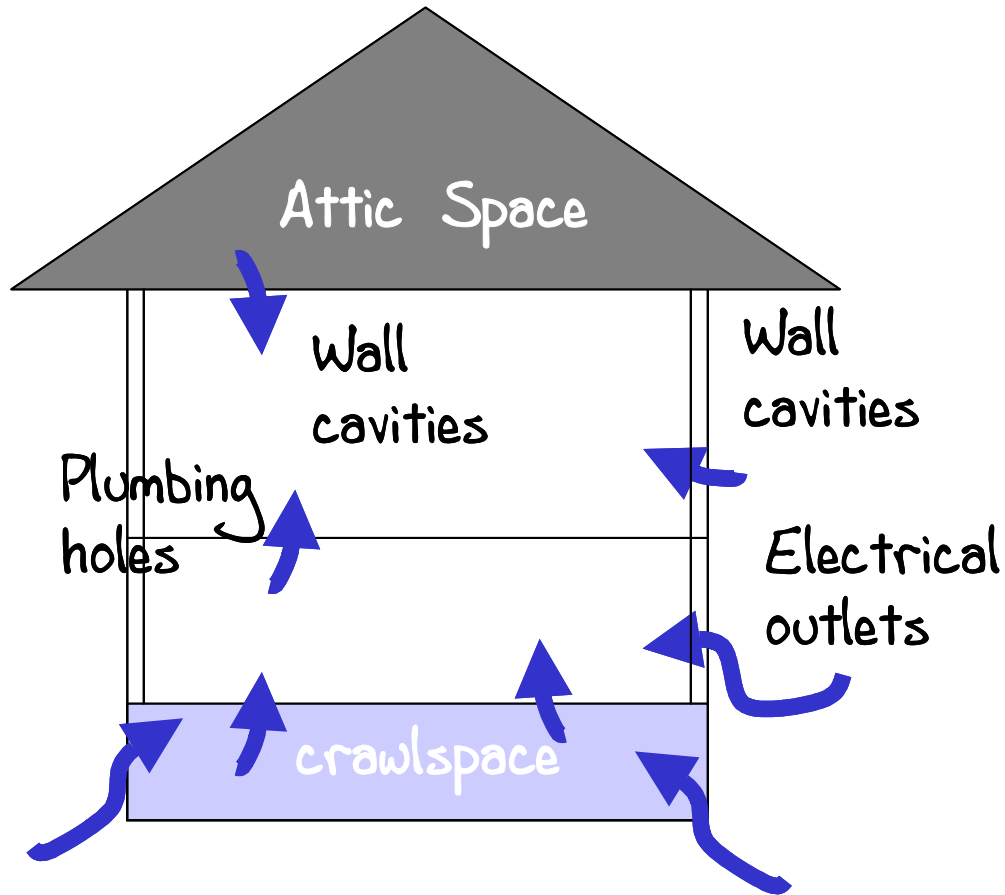


# The Basic Elements of Home Health – the details & solutions

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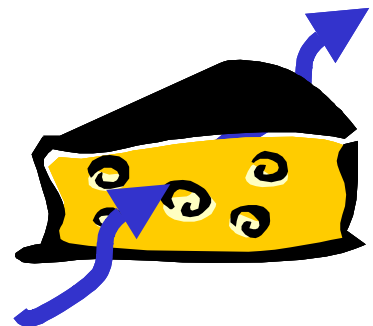
- 1** The weather in colder climates, particularly rain, provides moisture access on and around our homes. **S** Preventing moisture intrusion is top priority.
- 2** The moisture provided by rain & snow seeps into the ground. This moisture is then converted to vapor, creating a humidity increase in the ground. Other gases, known as soil gases, can also rise from the ground into our homes. Water close to the home causes structural damage. **S** Check gutters, create slope away from home, put in curtain drains.
- 3** The crawlspace may contain water, mold & pests. Unless specific measures are taken to isolate the crawlspace from the rest of your home, you are breathing air from your crawlspace. **S** Apply a 6 mil poly barrier to ground in crawl space. Air seal all penetrations to crawlspace.
- 4** Ductwork distributes the heat in your home, but also creates pressures that push and pull air from potentially undesirable places in your home. **S** All ductwork should be air sealed.
- 5** Indoor humidity may be created by showers, cooking, cleaning, and vapor pressures from the crawlspace and ground. **S** Humidity must be controlled.
- 6** Windows can leak (either cold air or water), or be of a low R-value, meaning they do not resist cold temperatures very well. This can lead to condensation and mold growth around your windows. **S** Windows should be updated to current energy efficiency standards, and be caulked and sealed in place.
- 7** The land around your home may be sloped or flat. It is best to have the ground slope away from your home at all times to allow water to move away from your home. Homes on slopes may encounter: springs or high amounts of surface water. **S** This water must be allowed to move around your home, not into it. Curtain drains, drain pipe.
- 8** Attics can leak air from the pressures of wind, heat or ductwork. **S** They should be air sealed to make sure insulation & other contaminants do not get in the living space. Attic access doors, light fixtures and furnace return grilles should be checked.
- 9** The roof is the most important structure of your home. It should not leak. Unattended roof leaks create exponential damage i.e. leaky roofs = leaky inside walls, ceilings etc.. **S** Maintain your roof, replace when necessary, plan your replacement, DO NOT WAIT!
- 10** Heat rises in the home. This is caused in part by Stack Effect. Stack Effect can push and pull air through your home, creating pressures. **S** Air sealing the attic can lessen the amount of heated air that leaves your home & limit flow of contaminants.
- 11** Exhaust fans ventilate bathrooms, ranges or your whole house. Make up air sources must be provided mechanically, through inlets or through opened windows. **S** Exhaust fans are necessary in the NW, run at least 45 min after the shower.

# Houses are holey...kinda like Swiss cheese

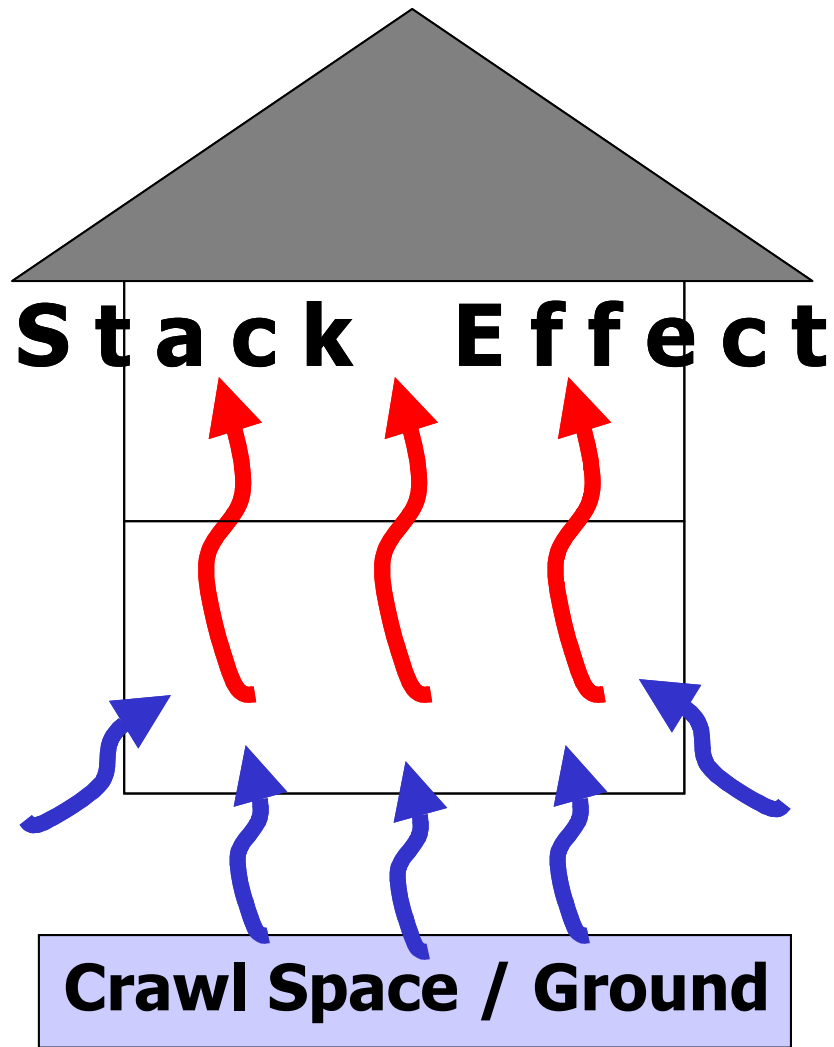


Air moves through holes, cracks and other penetrations within your home. The forces of wind, mechanical ventilation, & stack effect pull and push air around.

That means air from your crawlspace can move into your home for example.

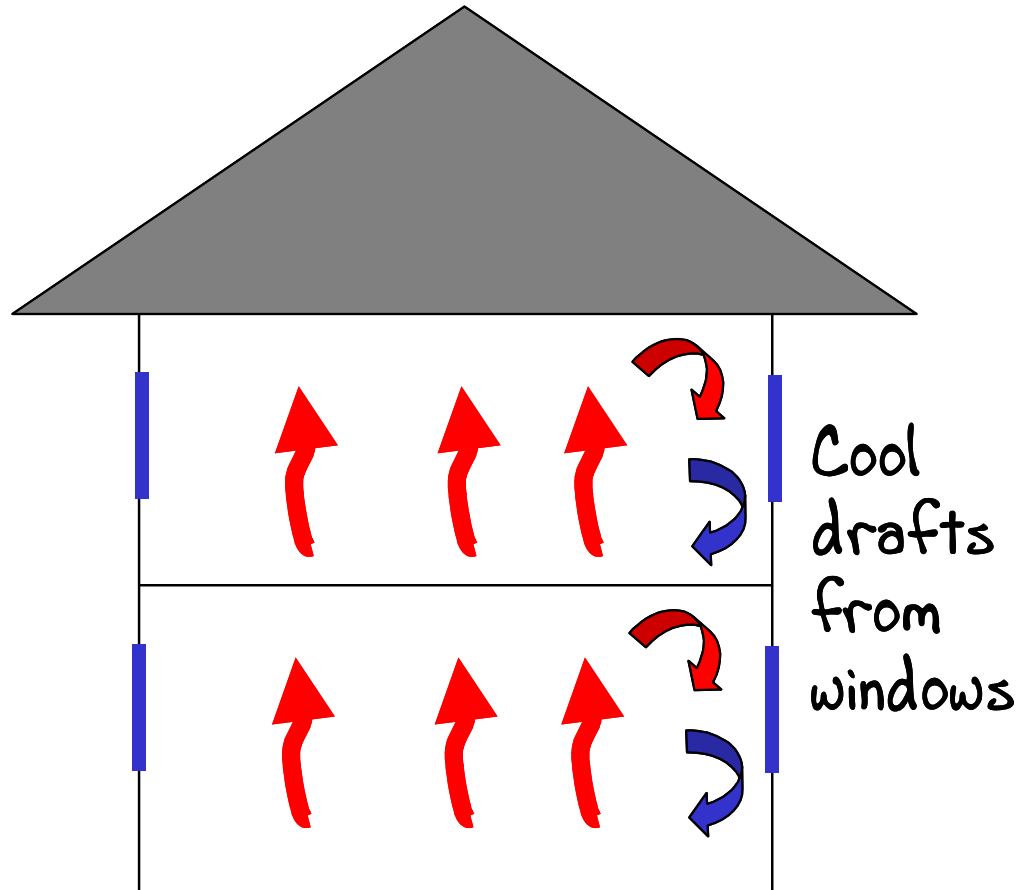


# Warm air rises



# Temperature and Convection

Temperature differences cause convection & air flow movement

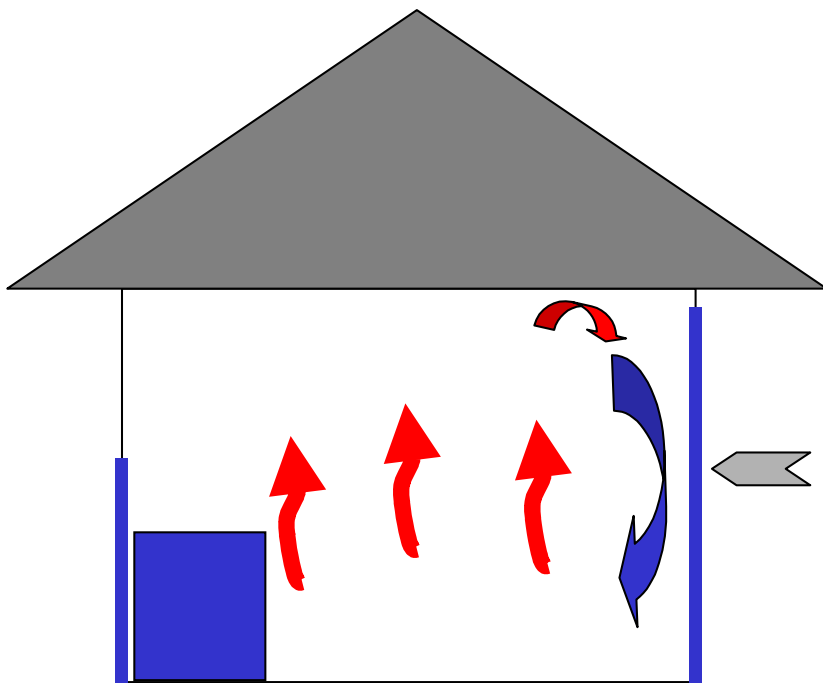




# Temperature throughout the home

What happens in cool/un-ventilated areas of the house?

**General rules:** Keep areas against outside walls clear,  
Be sure each room has adequate heat, ventilation  
& air flow.



Furniture placed tight against outside walls does not allow air flow, creates a cool, high relative humidity area for moisture to condense, often resulting in mold growth. Leaving an air space of even an inch can help!

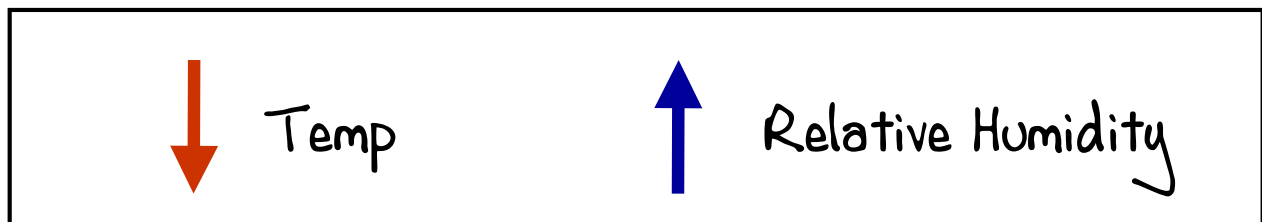
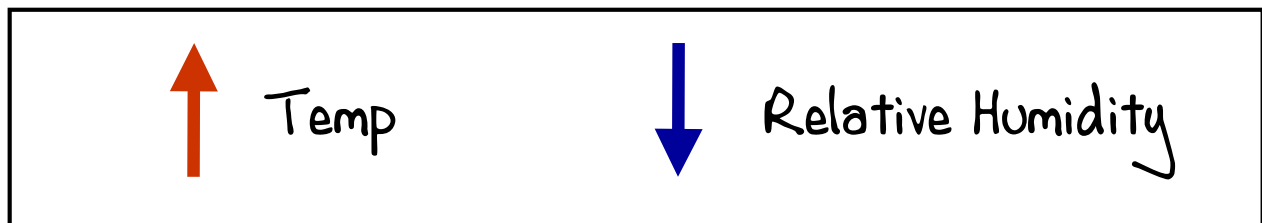
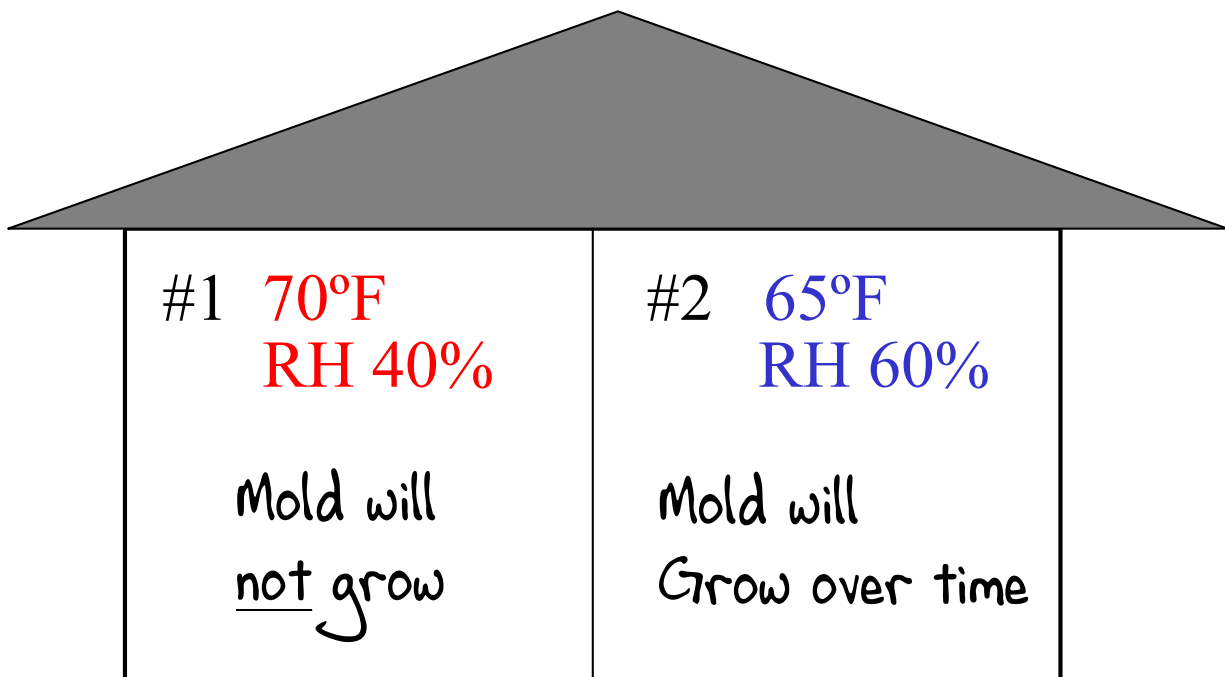
Outside walls/ windows tend to be cooler, creating a surface cool enough to condense moisture from the air like a glass of ice water. This happens especially if the room itself is always cool or higher in humidity or both.

# Temperature & Humidity

Warmer air holds more moisture

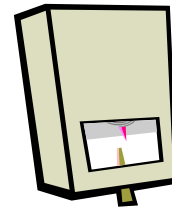
**Example:** Say we have air with a certain amount of moisture.

Now put that air in a 70° room and a 65° room. Look how the Relative Humidity changes.



# Humidity

Too high - 50% RH and above

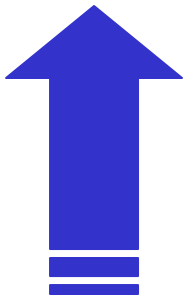


Just right – 40-50%



How do you know?  
Check your humidity gauge.  
(hygrometer)

## When Relative humidity is too high

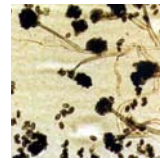


Molds

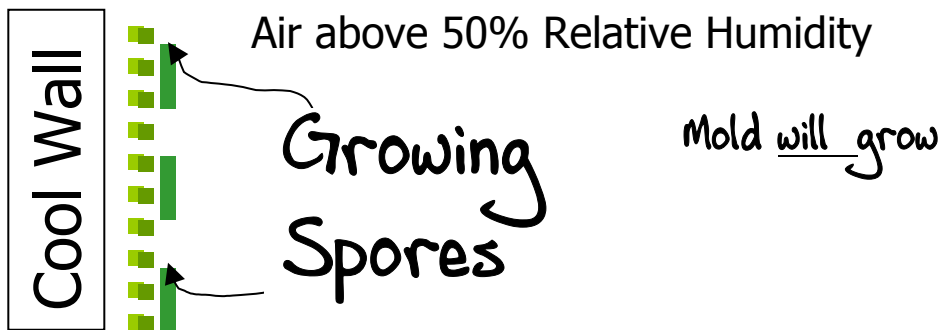
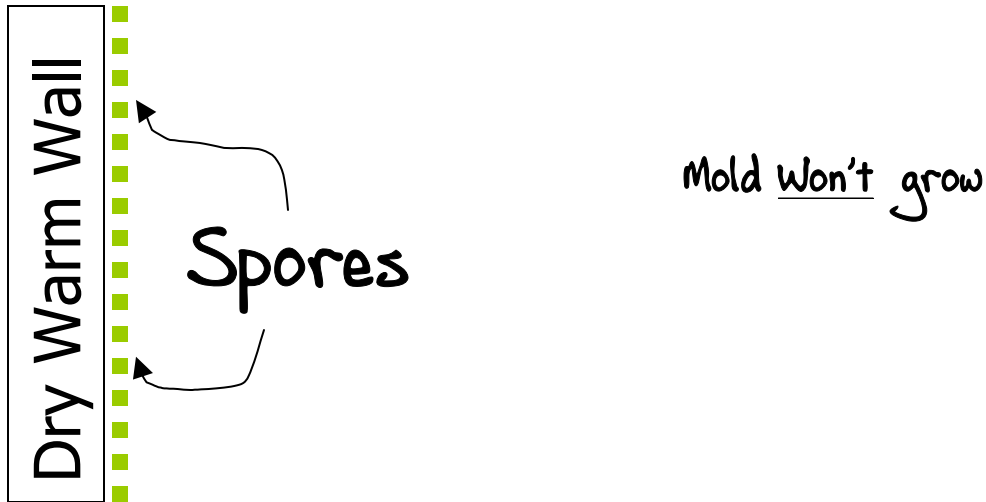
Dust mites

Bacteria & Virus

Materials in/of home begin to break down

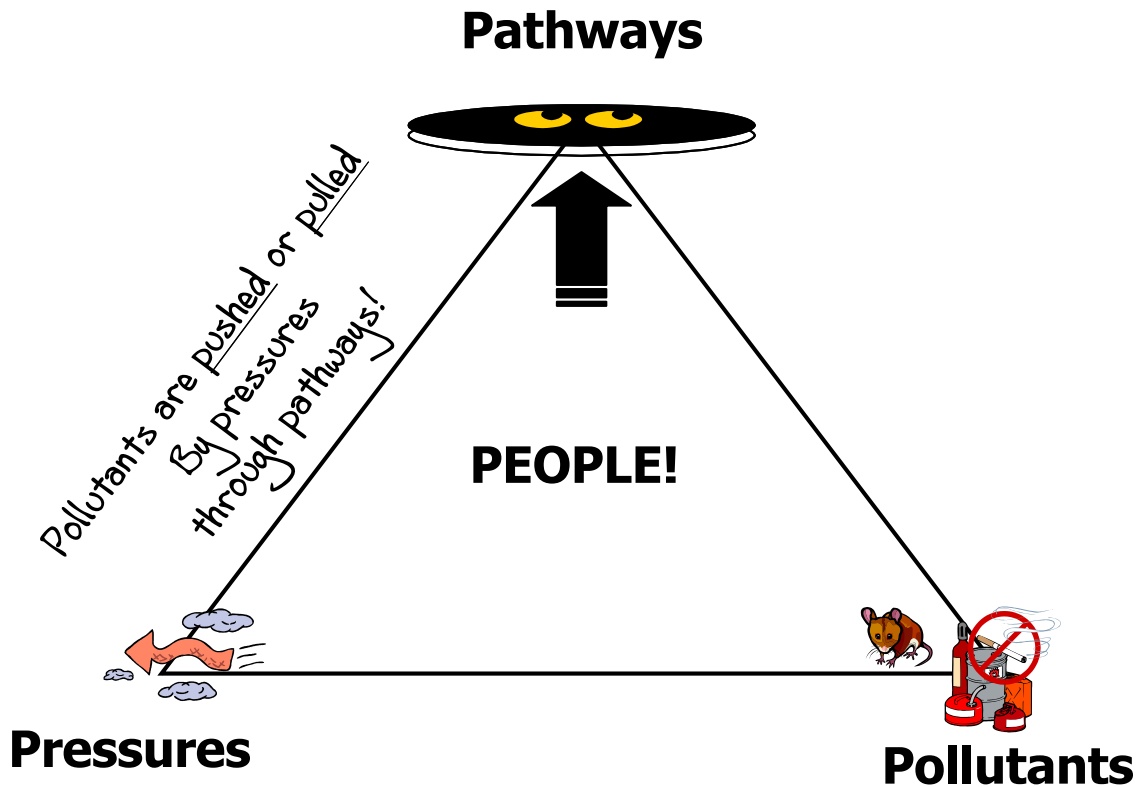


# Mold Spores are everywhere... that's OK



It's the conditions that count !

# Pressures move Pollutants through Pathways

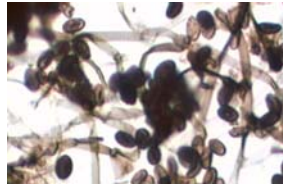


People can be in direct contact with pollutants.  
*EXAMPLE: moldy wall surface*

People can be indirectly in contact with pollutants via  
pathways.  
*EXAMPLE: moldy crawlspace, air moves through  
plumbing holes to you*

## Pollutants (what are the sources)

Molds/Mildews



Toxic chemicals

Rodents



Smoke



CO

## Pathways (where is air getting through)

Holes



Cracks

Crevices

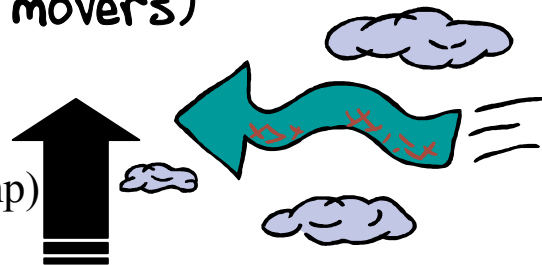
Plumbing/Electrical Penetrations

## Pressures (what are the movers)

Home Temperature

Air Movement (fans, heater, temp)

Weather Outside (wind, temp)



# Worksheet – Pressures & Pathways

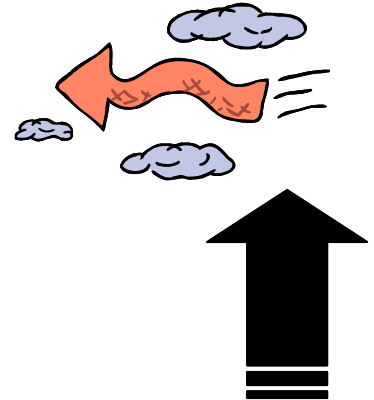
## Pressures

Home Humidity  
(Identify RH in each room)

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## Pathways in your home

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Plumbing/Electrical Penetrations

## Pollutants in your home

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# Where do you spend your time?

- 1.Name all the rooms in your house
- 2.How they are used
- 3.How often they are used
4. Doors routinely open or closed? Why?

Room: \_\_\_\_\_

How is it used: \_\_\_\_\_

How often (put hours) \_\_\_\_\_

Doors routinely open or closed? Why? \_\_\_\_\_

Room: \_\_\_\_\_

How is it used: \_\_\_\_\_

How often (put hours) \_\_\_\_\_

Doors routinely open or closed? Why? \_\_\_\_\_

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How is it used: \_\_\_\_\_

How often (put hours) \_\_\_\_\_

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How is it used: \_\_\_\_\_

How often (put hours) \_\_\_\_\_

Doors routinely open or closed? Why? \_\_\_\_\_



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How often (put hours) \_\_\_\_\_

Doors routinely open or closed? Why? \_\_\_\_\_

Room: \_\_\_\_\_

How is it used: \_\_\_\_\_

How often (put hours) \_\_\_\_\_

Doors routinely open or closed? Why? \_\_\_\_\_

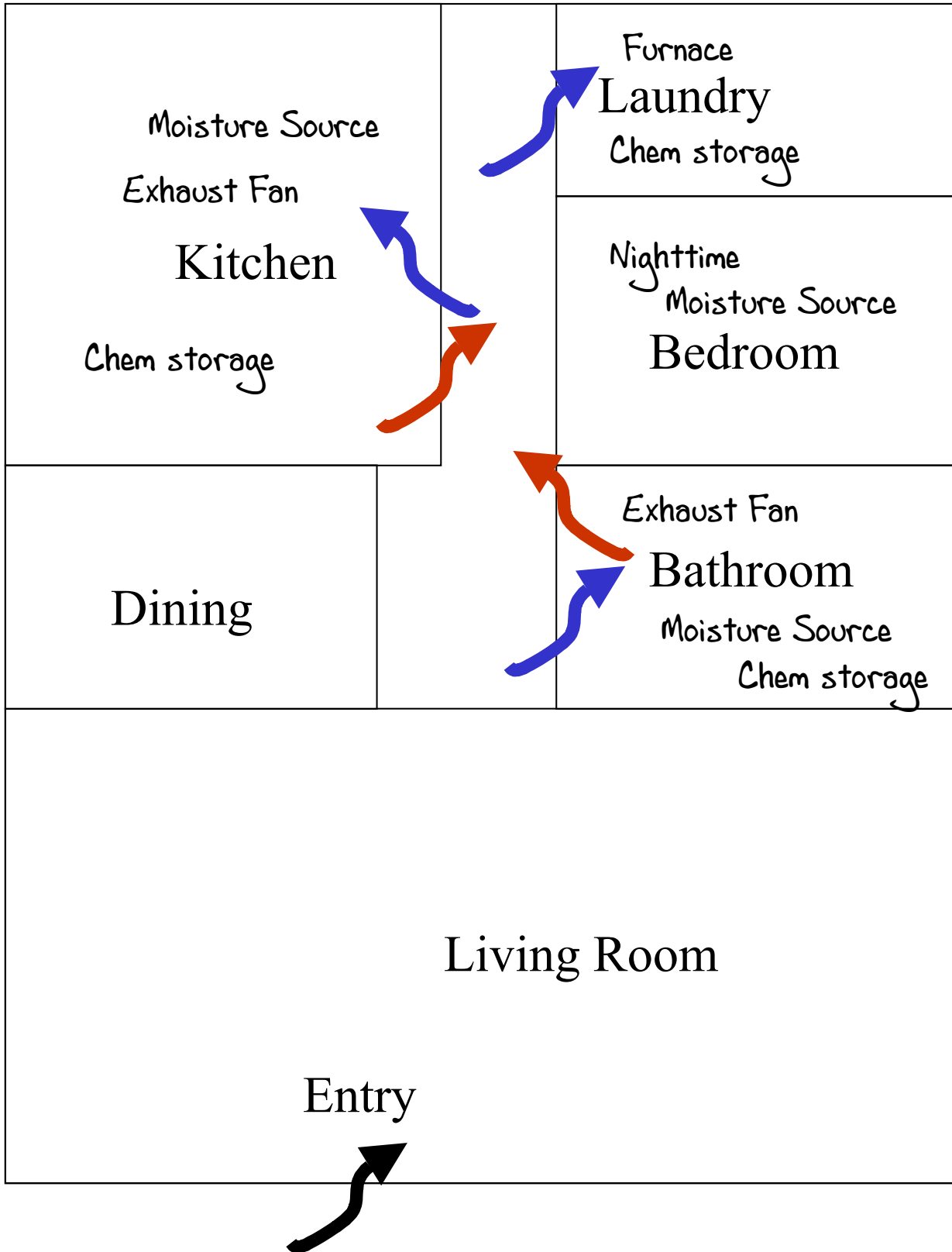
Room: \_\_\_\_\_

How is it used: \_\_\_\_\_

How often (put hours) \_\_\_\_\_

Doors routinely open or closed? Why? \_\_\_\_\_

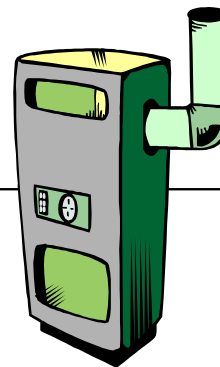
# Worksheet – Floor Plan - Example



# Worksheet – Floor Plan (draw your own!)



# Heating System Types



## Forced Air – has built in circulation

Electric or Gas

- |  |  |
|--|--|
| <p><b>+</b> Moves air<br/>Can filter air<br/>Heats air<br/>Can include fresh air ventilation</p> | <p><b>-</b> Must have filter (HEPA)<br/>Filter must be changed<br/>Vents must be cleared<br/>Duct work</p> |
|--|--|



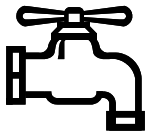
## Radiant – relies on convection & conduction

Wood stove  
In floor  
Baseboard  
Hot Water/Steam wall units

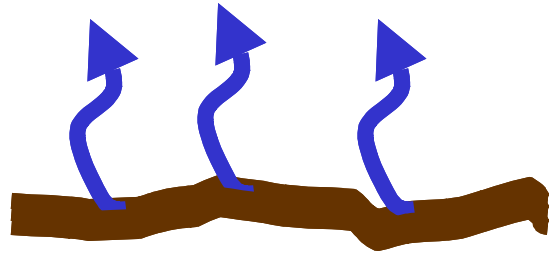
- |  |   |
|--|---|
| <p><b>+</b> Heats materials<br/>Can be more quiet<br/>No ducts</p> | <p><b>-</b> Can create cold spots if<br/>only one source i.e. woodstoves<br/>&amp; baseboard heaters<br/>Requires ventilation/circulation</p> |
|--|---|

# #1 Problem of homes & Occupants.....

Unattended Leaks



Soil gases & Moisture  
from the ground  
(under the house)



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**MOISTURE!!!!**

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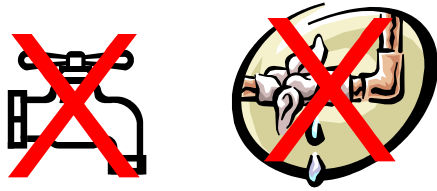


Humidity from people,  
showers & cooking

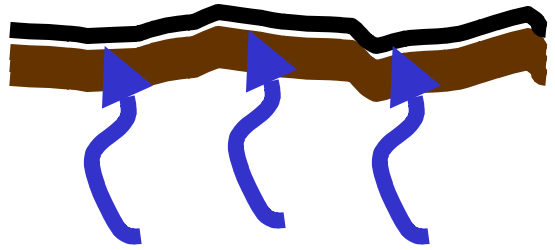


# How to control moisture

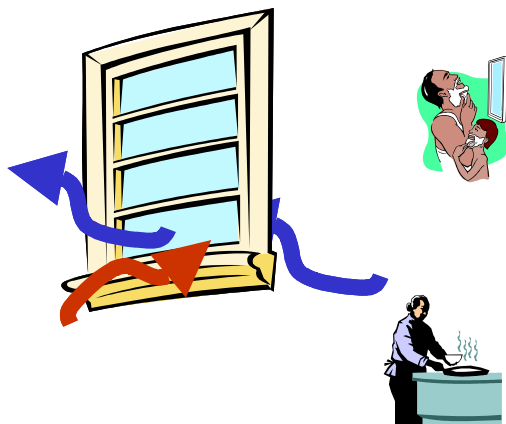
Fix Leaks Promptly



Install vapor barrier/  
ventilate



**MOISTURE!!!!**



Open Windows

Bath fan on  
during and after  
shower for 45  
minutes!



**VENTILATE!!!**

Properly ventilate through Spot fans & whole house ventilation fans, and open windows

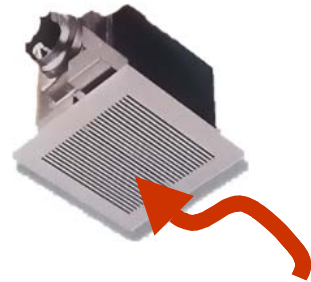
# Ventilation....the moisture mover!

Always run the bath fan during shower

Run for at least 45 minutes

Use range fan while cooking

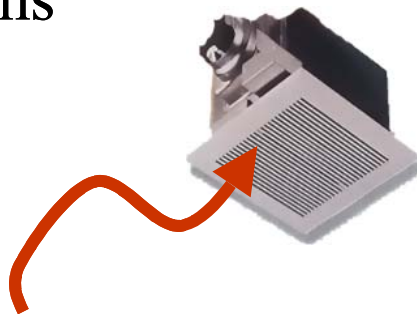
Install fresh air make up when necessary  
(air ports when necessary)



## Why?

Spot ventilation such as bathroom fans  
remove moisture at the source

Moist air created from showers, baths,  
cooking and dryers venting into the home  
create high humidity leading to mold and  
dust mite problems



# #1 Killer of Occupants.....

You can't see it.....

Sometimes you can't smell it  
(unless the gas is scented).....

**CO**

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## **Carbon Monoxide!!!!**

### **Sources**

Poorly vented combustion appliances

Gas leaks to those appliances

Fires that die out and smolder without adequate ventilation.

Gas water heaters, furnaces, ranges, dryers,  
wall heaters back-drafting and spilling

Starting cars in attached garages, letting them warm up



# **What you can do about CO**

**Install a CO detector**

**Have all combustion appliances tested by qualified technicians for back drafting and spillage, worst case tests**

**Have all gas appliances installed by a professional**

**Have your appliances regularly serviced by a professional**

**Be aware of the signs of CO poisoning which include:**

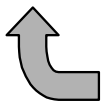
**Headaches  
Drowsiness  
Flu like symptoms  
Memory loss**

**(Whole families may get these symptoms at once!)**

**When starting car in attached garage, be sure to have doors to home closed. Air seal those doors. Open garage door first, before starting car. Be sure to leave garage door Open for sometime after you leave when possible.**

# Contaminants in the home...

- Environmental Tobacco Smoke
- Mold
- Dust mites
- Laundry Detergent
- Fabric Softener
- Cleaning Agents
- Paints
- Insecticides
- Pets
- New carpet/furniture
- Lead ( if home built before 1978)
- CO (if you have combustion appliances)



Check off what you have...  
Write down on the following page  
Specifically each one and its location

## **Contaminants in the home... where**

Environmental Tobacco Smoke -

Mold -

Dust mites -

Laundry Detergent -

Fabric Softener -

Cleaning Agents -

Paints -

Insecticides -

Pets -

New carpet/furniture –

Lead – (peeling paint)

CO (if you have combustion appliances) -

# Take control of the contaminants in your home



1. Don't smoke.
2. Don't bring toxic items into your home.
3. Keep relative humidity levels in your home within 40-50%
4. Clean often with non-toxic cleaners (less dust = better health)
5. Get furniture that is free of formaldehydes. Be sure to ventilate your home at a much higher rate during & after installation.
6. Use low VOC paints, provide adequate ventilation and drying heat to expedite off-gassing.
7. Where possible replace carpet with hard surface flooring.
8. Be sure your combustion appliances have regular maintenance by a qualified technician.
9. Make sure all painted surfaces are kept in good condition.
10. Install a CO detector if you have a combustion appliances, woodstove, or fireplace.

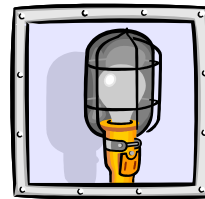


# Top 10 Preventive Maintenance list



Where	What to look for	How often
<b>1. Roof &amp; Gutters</b>	Leaks Condensation on surface in attic Missing shingles Disconnected downspouts, disconnect from roof, drainage toward foundation, splatter against house	During Rainy season After wind storms
<b>2. Plumbing</b>	Faucet leaks, pipe leaks, sink leaks, under sinks	Monthly, be aware with use
<b>3. Combustion appliances</b>	Regular Maintenance Install CO detector	Be aware of alarm
<b>4. Appliances</b>	Leaks from piped appliances, washing machine, dishwasher, refrigerator( if water dispense)	Monthly,be aware with use
<b>5. Humidity</b>	Levels above 50% Relative Humidity in home	Daily, read gauge, get sense of level of humidity in home.
<b>6. Pests</b>	Feces, frass, chewed materials, check corners, noises	Always ; when cleaning
<b>7. Crawlspace</b>	Moisture, pooling of water, dripping sounds, smells, droppings, change of smells. Take a peek with flashlight through access door.	Monthly during winter
<b>8. Windows</b>	Check for leaks, drafts, mold, condensation	Be aware, mostly in winter
<b>9. Exterior walls</b>	Check inside wall surfaces baseboards, corners, especially if stuff is crammed next to wall	Monthly during winter
<b>10. Home</b>	Changes in noises, smells and temperatures	Be aware, mostly in winter.

# Importance of maintenance



Big problems usually grow from small problems

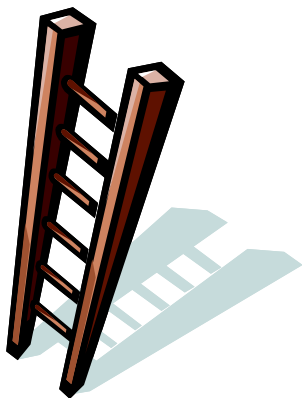
- + Maintenance catches things before they get too big
- + Smaller problems are solved more easily than big ones...
- + And are less expensive

Consistent maintenance = Healthy Home

## Maintenance, the Occupant & Health

As a home owner or occupant, the space you live in affects your health.

By being proactive and caring for your home through maintenance you are caring for your health & your families health!



# Effects of Preventive Maintenance

1. Overall health improvement, especially asthma, respiratory ailments.
2. Your home is less expensive to take care of.
3. Problems that do arise are usually smaller when you find them.
4. Usually avert big damages.
5. You are in more control of your environment.
6. Your home is a nicer place to live!



# **Pulling it all together**

There are many things you can do to create a Healthy Home. This booklet outlines most of the concepts you need to understand your home.

By understanding how your home works and following the ideas listed in this book you are taking charge of your own health!