

The Air Inside: Understanding Indoor Air Quality

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Renewal of CEU # 7711

IAQ Agenda

- * What is it?
- * Different types of pollutants commonly found in homes
- * Highlighting lead, mold and radon
- * Health Problems; asthma
- * Solutions
- * Where to turn for additional help and information
- * Sick Building Syndrome and Building Related Illnesses
- * HVAC-Codes and Obstacles
- * Strategies for improving indoor air quality

Indoor Air Quality-Facts

- * The Environmental Protection Agency has identified indoor air quality as one of the top five most urgent environmental risks to public health

YET

- * Almost 25% percent of Americans are not concerned about the air quality in their homes and the impact it can have on their family's health



Indoor Air Quality

- * In the last several years, a growing body of scientific evidence has indicated:
 - * Air within homes and other buildings can be more seriously polluted than the outdoor air in even the largest and most industrialized cities



Indoor Air Quality

- * Other research indicates that people spend approximately 90 percent of their time indoors



Indoor Air Quality -Facts

- * Less than 20 percent of Americans believe that the air inside their homes is more polluted than the air outdoors
- * More than 70 percent of Americans have forced air heating and/or central air in their homes

Indoor Air Quality -Facts

- * Approximately 50% of people do not change the filter in their heating/air conditioning unit every 2 to 3 months as recommended
- * 10% of us have never changed their filters

Indoor Air Quality Facts

- * 50 % of Americans are not aware that forced air heating and air conditioning units should be inspected annually by a professional
- * More than 30 % of Americans have never had their forced air heating or air conditioning units inspected

Indoor Air Quality Facts

- * Nearly 75 percent of Americans live with someone who has:
 - * Allergies
 - * Asthma
 - * Emphysema or another respiratory illness.
- * Only 27 percent of Americans have carbon monoxide detectors in their homes
- * Estimated that 99% of Homes in US have indoor air quality issues.

Outside Air Quality Facts


- * Over half of the United States population lives in areas which have unhealthy levels of either ozone or particle pollution
- * 81 million Americans live in areas with unhealthy short-term levels of particle pollution
- * 66 million live in areas with chronically unhealthy levels of particle pollution

Outdoor Air Quality Facts

- * Air pollution found in large and midsize U.S. cities increases the risk of premature death from lung cancer and heart disease. (Source: *Journal of the American Medical Association*, 2002)
- * Air pollution contributes to lung disease, which claims close to 341,500 lives in America every year
 - * 3rd third-leading cause of death in the US
 - * (Source: *American Lung Association*, 2002)


Air Quality Facts

- * Approximately 160 million Americans are breathing unhealthy air
- * About one in 17 people in the United States lives in an area with unhealthy year-round levels of fine particle pollution
- * Children and seniors are the age groups most at risk:
 - * 29 million of these Americans are under the age of 14
 - * 15 million are over the age of 65




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An overview of LEED v3 and Indoor Air Quality



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Greenguard

- * Greenguard Indoor Air Quality Certified products have passed a series of rigorous emissions tests and undergo strict monitoring to ensure their low emitting status and compliance with the GREENGUARD standards
- * www.greenguard.org

What Contributes to Poor Indoor Air Quality?

- * New Homes today are built (energy efficient) to "hold" air inside
- * Goal is to reduce energy costs (avoid heat loss in the winter and heat gain in the summer)
- * However, it may not be the best answer for indoor air quality

What Contributes to Poor Indoor Air Quality?

- * This type of construction doesn't allow the home to breathe
- * Opening a window isn't always the answer
 - * That's when an air cleaner can help
 - * Especially if someone in your home suffers from allergies

What Contributes to Poor Indoor Air Quality?

- * Indoor pollution sources that release gases or particles into the air are the primary cause of indoor air quality problems in homes.
- * Inadequate ventilation can increase indoor pollutant levels by not bringing in enough outdoor air to dilute emissions from indoor sources and by not carrying indoor air pollutants out of the home.

What Causes Indoor Air Problems?

- * High temperature and humidity levels can also increase concentrations of some pollutants.
- * Signs that may indicate your home may not have enough ventilation include:
 - * Moisture condensation on windows or walls
 - * Smelly or stuffy air
 - * Dirty central heating and air cooling equipment
 - * Areas where books, shoes, or other items become moldy

What Causes Indoor Air Problems?

- * The flexible polyurethane foam used in upholstered furniture, for example, can be up to 30% flame retardant by weight
- * We now know that brominated flame retardants escape from these products into our homes and the environment
 - * They are building up at alarming rates in our bodies

What Causes Indoor Air Problems?

New studies are showing serious health effects ranging from:

- * Interference with pre-natal brain development to disruption of hormone function and cancer

Types of Pollutants

- * Radon
- * Environmental Tobacco Smoke
- * Biological
- * Carbon Monoxide
- * Respirable Particles
- * Organic Gasses
- * Pesticides
- * Lead, Asbestos, Formaldehyde

Sources of Indoor Air Pollution

- * Building materials and furnishings such as
 - * Asbestos
 - * Insulation
 - * Wet or damp carpet
 - * Cabinetry or furniture made of certain pressed wood products (formaldehyde)
 - * Copy Machines

Sources of Indoor Air Pollution

Combustion Sources

- * Oil
- * Gas
- * Kerosene
- * Coal
- * Wood
- * Tobacco Products



* These all contain small quantities of formaldehyde

Carbon Monoxide

*Sources:

- * Non-vented kerosene & gas space heaters
- * Leaking chimneys and furnaces
- * Back-drafting from furnaces
- * Gas water heaters
- * Woodstoves, fireplaces & gas stoves
- * Automobile exhaust from attached garages

Carbon Monoxide-Health Effects

- * Low level exposure:
 - * Fatigue in healthy people
 - * Chest pain in people with heart disease
- * Higher level of exposure:
 - * Impaired vision and coordination
 - * Headaches
 - * Dizziness
 - * Confusion
 - * Nausea
- * At very high levels it can be fatal



ORGANIC GASSES Volatile Organic Compounds

- * Household products including:
 - * Paints, paint strippers, and other solvents
 - * Aerosol sprays; cleansers and disinfectants
 - * Air fresheners
 - * Stored gasoline
 - * Dry cleaned clothing
 - * Hobby supplies
- * Formaldehyde



Off Gassing

- * Off-gassing is the evaporation of chemicals from a material.
- * Furniture, plastics, vinyl products, paint, new cars, clothing, cosmetics, water bottles, carpet, and mattresses do it, to name just a few.
- * Off-gassing materials emit volatile organic compounds (VOCs) and small particulate substances throughout the life of the material.

Reducing Organic Gases

- * Use outside when ever possible
 - * At the very least, open windows
- * Don't buy them in bulk
- * Take dry cleaning out of plastic bags
- * Follow manufactures recommendations

Reducing Volatile Organic Gases

- * Buy used goods—the VOCs associated with their production have diminished over time, especially with cars and furniture- Antiques
- * Choose options like low-or no-VOC paint, which is now widely available
- * Always stay away from polyvinyl chloride, which is commonly found in linoleum, upholstery, and shower curtains.
- * If you have breathing problems, allergies, or environmental illness, take special care

Organic Gases –Health Effects

- * Eye, nose, and throat irritation
- * Headaches
- * Loss of coordination
- * Nausea
- * Damage to liver, kidney, and central nervous system

ORGANIC GASES VOC's



- * Studies have found that:
 - * Several organics average 2 to 5 times higher indoors than outdoors.
 - * Elevated concentrations can persist in the air long after the activity is completed
 - * Certain activities, such as paint stripping, may be 1,000 times the backyard outdoor levels

ORGANIC GASES VOC's

- * Manufacturers have reduced formaldehyde emissions from pressed wood products by 80-90% from the levels of the early 1980's
 - * As they age, the formaldehyde release decreases

Lead-Sources

- * Lead is found in:
 - * Lead-based paint
 - * Soil
 - * Dust
 - * Drinking water

Sources of Lead

- * High concentrations of airborne lead particles in homes can also result from lead dust from outdoor sources, including contaminated soil tracked inside
- * Indoor activities such as soldering and stained-glass making

Sources of Lead

- * Old lead-based paint is the most significant source of lead exposure in the U.S. today
- * Harmful exposures to lead can be created when lead-based paint is improperly removed from surfaces by:
 - * Dry scraping
 - * Sanding
 - * Open-flame burning

Lead Health Effects



- * Lead affects practically all systems within the body:
 - * High Levels can cause:
 - * Can cause convulsions, coma, and even death
 - * Lower levels of lead can cause:
 - * Adverse health effects on the central nervous system, kidney, and blood cells
 - * Blood lead levels as low as 10 micrograms per deciliter can impair mental and physical development

Children and Lead

- * Department of Health and Human Services called lead the "number one environmental threat to the health of children in the United States." **One million children today are affected by lead poisoning**

Children and Lead

- * Are more vulnerable to lead exposure than adults
 - * It is more easily absorbed into growing bodies
 - * The tissues of small children are more sensitive to the damaging effects of lead
- * Exposure
 - * Leads to delays in physical and mental development
 - * Lower IQ levels
 - * Shortened attention spans
 - * Increased behavioral problems
- * More likely to ingest lead from dust through play
 - * Been known to eat lead based paint

Lead-based Paint

- * Most homes built before 1960:
 - * Contain heavily leaded paint
- * Some homes built as recently as 1978:
 - * May also contain lead paint
 - * On window frames, walls, the outside of homes, or other surfaces
- * Lead paint in good condition is usually not a problem
 - * Except in places where painted surfaces rub against each other and create dust (for example, opening a window).
- * 2/2009 Consumer Product Safety Improvement Act (CPSIA) provides that paint and similar surface-coating materials for consumer use must be reduced from 600 ppm to 90 ppm

Children and Lead



- * A Disney-brand bracelet and other children's jewelry purchased at Disneyland resort contain dangerously high levels of lead — in one instance 275 times the legal limit for lead in paint ... according to an Oakland-based environmental group's report

In another instance, the coating on a Disney bracelet purchased at an Oakland retailer contained nearly 17 percent lead, or 166,000 parts-per-million lead.

Children and Lead

- * The [Consumer Product Safety Improvement Act \(CPSIA\)](#) was recently passed to establish safety standards and requirements for children's products.
- * This law went into effect on February 9, 2009, and establishes maximum amounts of lead that may be in products designed for children.
- * Products which exceed these levels may not be sold in the US
- * Feb 2009 The legal limit for lead in paint is 0.06 percent, or 600 ppm
- * After August 14, 2009, products designed or intended primarily for children 12 and younger cannot contain more than 300 ppm of lead
- * The limit went down to 100 ppm August 14, 2011

How to Reduce Exposure to Lead

- * Keep areas where children play as dust-free and clean as possible
- * Leave lead-based paint undisturbed if it is in good condition; do not sand or burn off paint that may contain lead; do not remove lead paint yourself
- * Do not bring lead dust into the home
- * If your work or hobby involves lead, change clothes and use doormats before entering your home
- * Eat a balanced diet, rich in calcium and iron

MOLD

- * Molds can be found almost anywhere
- * They can grow on virtually any substance, providing moisture is present.
- * Different molds can grow on:
 - * Wood
 - * Paper
 - * Carpet
 - * Foods

Mold

- * There is no practical way to eliminate all mold and mold spores in the indoor environment;
- * The way to control indoor mold growth is to control moisture



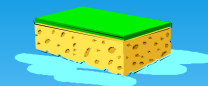


Magnified mold spores.

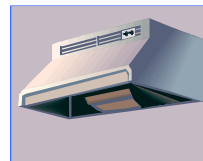
Molds can gradually destroy the things they grow on. You can prevent damage to your home and furnishings, save money, and avoid potential health problems by controlling moisture and eliminating mold growth.



Mold

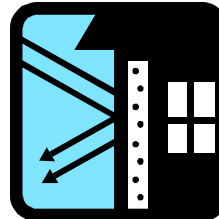


- * Reduce indoor humidity (to 30-60%) to maintain humidity between 30-50% by :
 - * Venting bathrooms, dryers, and other moisture-generating sources to the outside;
 - * Using air conditioners and de-humidifiers;
 - * Increase ventilation
 - * Using exhaust fans whenever
 - * Cooking
 - * Dishwashing
 - * Cleaning



Mold

- * Prevent condensation by adding insulation:
 - * Reduce the potential for condensation on cold surfaces such as:
 - * Windows
 - * Piping
 - * Exterior walls, roof or floors



Hidden Mold

- * **Mold may be hidden in places such as:**
 - * The back side of dry wall wallpaper, or paneling
 - * Top side of ceiling tiles
 - * Underside of carpets and pads, etc.
 - * Other possible locations of hidden mold include areas inside walls around pipes (with leaking or condensing pipes)



Hidden Mold

- * Mold may be hidden in places such as:
 - * Surface of walls behind furniture (where condensation forms),
 - * Inside ductwork,
 - * Roof materials above ceiling tiles (due to roof leaks or insufficient insulation)



Caution with Hidden Molds

- * Removal of wallpaper can lead to a massive release of spores if there is mold growing on the underside of the paper.
- * Dead mold may still cause allergic reactions in some people, so it is not enough to simply kill the mold, it also be removed

What are Mold and Mildew?

Generic terms that are used to describe the same thing

- Fungi that are a natural part of both the indoor and outdoor environments.

Mold is often used to describe fungi growing on surfaces

Mildew to describe fungi growing on fabrics.

What causes mold to grow?

- * A nutrient source
- * Appropriate temperature
- * Moisture

Solution is remove the one element that is possible to remove -- MOISTURE

Are all Molds Harmful?

- * No
 - * Many types of mold are essential to everyday life and are beneficial to health.
 - * We are all exposed to many types of mold everyday, even *Stachbotrys chartarum*.
 - * Mold, for example can be commonly found on grocery shelves, such as button mushrooms, etc.
 - * Molds are used in baking and for some types of fermentation, including alcohol beverages and for making commonly used medicines

Where does mold grow?

- * Mold can grown inside buildings near leaky windows and door openings, roofs, HVAC equipment and in floors and walls
 - * In short, wherever conditions are right and especially where moisture becomes trapped

Why is there moisture?

- * Building tightness, which does not allow moisture to escape to the outdoors
- * Liquid water infiltration from outside as a result of leaky building envelope
- * Moisture condensation on cold surfaces or building materials, which originate from water vapor inside or outside
- * Moisture generated within the building

Proper Installation of Wallpaper

- * Keep work area and the wallcoverings clean
 - * Remove old wallcovering and residual glue
 - * Wash areas with visible mold with a water and detergent solution
 - * Allow to dry
 - * Be sure surface is dry and free of grease, staining markers and mold
 - * Make sure the wall is structural sound with no excessive moisture or condensation

Proper Installation of Wallpaper

- * If a wall area is not dry or structurally sound for installation, do not install
- * Small stained areas should be treated with a stain killing/blocking primer to prevent stains from coming through the wallcovering at a later time

What if you aren't sure?

- * In unusual cases where moisture or moisture infiltration from the wall cavity cannot be eliminated or sufficiently reduced, you should consider using a more permeable (or breathable) wallcovering
- * Use a wallcovering primer with a biocide
- * Apply primer from sealed containers and use new rollers and trays
- * Use an adhesive that contains biocides

Mold

* Potential health effects and symptoms associated with exposures include:

- * Allergic reactions
- * Asthma
- * Other respiratory complaints



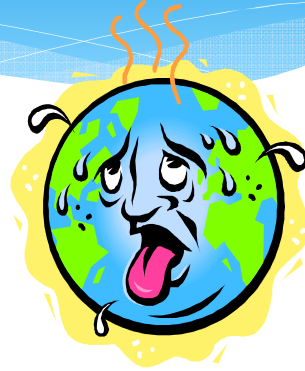
Biological Pollutants

- * Animal Dander (minute scales from hair, feathers, or skin)
- * Dust Mite and Cockroach parts
- * Fungi (Molds)
- * Infectious agents (bacteria or viruses)
- * Pollen



Biological Pollutants

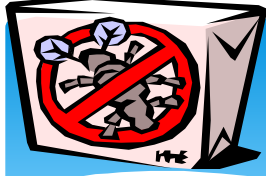
- * 30% to 50% of all structures have damp conditions which may encourage the growth and buildup of biological pollutants
- * Warm and moist climates are likely to have a higher % of these pollutants



Other Ailments from Pollutants

- * **Primarily allergies**
 - * Watery eyes
 - * Runny nose and sneezing
 - * Nasal congestion
 - * Itching
 - * Coughing
 - * Wheezing and difficulty breathing
 - * Headache
 - * Fatigue





Pesticides

- * 75 percent of U.S. households used at least one pesticide product indoors during the past year
- * Products used most often are insecticides and disinfectants
- * Another study suggests that most exposure to pesticides (80 %) occurs indoors



Sources of Pesticides

- * Measurable levels of up to a dozen pesticides have been found in the air inside homes
 - * This amount of pesticides found in homes appears to be greater than can be explained by recent pesticide use in those households
- * Products used to kill household pests (insecticides, termiticides and disinfectants)
- * Products used on lawns and gardens
- * Danger is that they drift or are tracked inside the house

Sources of Pesticides

- * In addition to the active ingredient, pesticides are also made up of ingredients that are used to carry the active agent
 - * These carrier agents are called "inerts" in pesticides because they are not toxic to the targeted pest
 - * Some inerts are capable of causing health problems

Pesticides

- * Keep exposure to a minimum
- * Do not store unneeded pesticides inside home
- * Dispose of unwanted containers safely
- * Store clothes with moth repellents in separately ventilated areas, if possible

Pesticides- Keep exposure to a minimum

- * Keep indoor spaces clean, dry, and well ventilated to avoid pest and odor problems
- * By appropriately fertilizing, watering, and aerating lawns
 - * The need for chemical pesticide treatments of lawns can be dramatically reduced

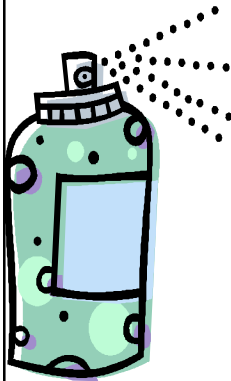
Pesticides-Health Effects

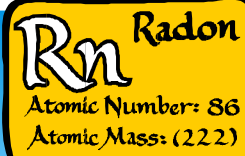
- * Irritation to eye, nose, and throat
- * Damage to central nervous system and kidney
- * Increased risk of cancer



Pesticides-Health Effects

- * Moth Repellants (paradichlorobenzene)
 - * Cause cancer in animals
 - * Potential short term toxic effects in humans although threat and risk is unknown
 - * Key active ingredient in Room Deodorizers
 - * In fact many moth repellent products recommend these products be used as a room deodorizer





Radon

- * Radon is a naturally occurring radioactive gas without color, odor, or taste
- * Found all over the U.S.-It can get into any type of building — homes, offices, and schools — and result in a high indoor radon level. But you and your family are most likely to get your greatest exposure at home, where you spend most of your time
- * Radon comes from the natural (radioactive) breakdown of uranium in soil, rock and water and gets into the air you breathe.

Radon

- * Radon gets into the indoor air primarily from soil under homes and other buildings
- * Most inhaled radon is rapidly exhaled
 - * The inhaled decay products readily deposit in the lung
 - * They irradiate sensitive cells in the airways increasing the risk of lung cancer

Radon

- * Nearly one in 15 homes in the U.S. has a high level of indoor radon
- * The U.S. Surgeon General and EPA recommend all homes be tested for radon
- * It is a fixable problem

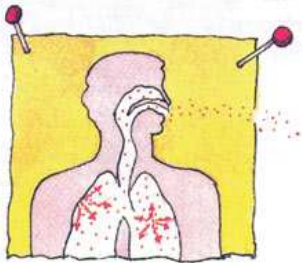
Radon

- * **Levels in Homes:**
 - * Based on a national residential radon survey completed in 1991, the average indoor radon level is 1.3 picocuries per liter (pCi/L)
 - * The average outdoor level is about 0.4 pCi/L
- * Fix your home if your radon level is 4 picocuries per liter (pCi/L) or higher
- * Additional info: 800-SOS-RADON

Radon

- * Radon is the second leading cause of lung cancer
- * It is a serious public health problem
- * Smokers are at higher risk of developing radon-induced lung cancer
- * The National Academy of Sciences (NAS) estimated that radon causes about 20,000 lung cancer deaths each year

Radon

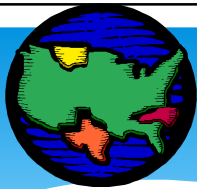
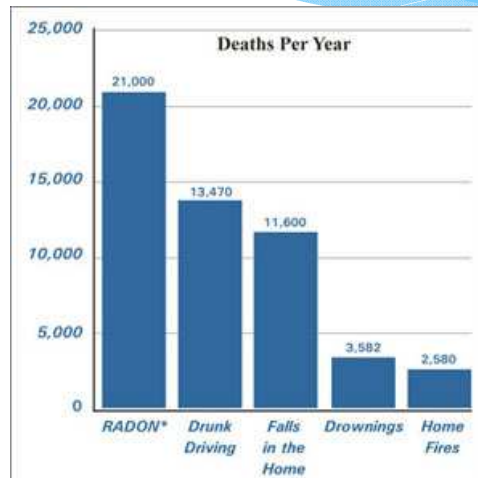


Radon gas decays into radioactive particles that can get trapped in your lungs when you breathe. As they break down further, these particles release small bursts of energy. This can damage lung tissue and lead to lung cancer over the course of your lifetime.

Not everyone exposed to elevated levels of radon will develop lung cancer. The amount of time between exposure and the onset of the disease may be many years

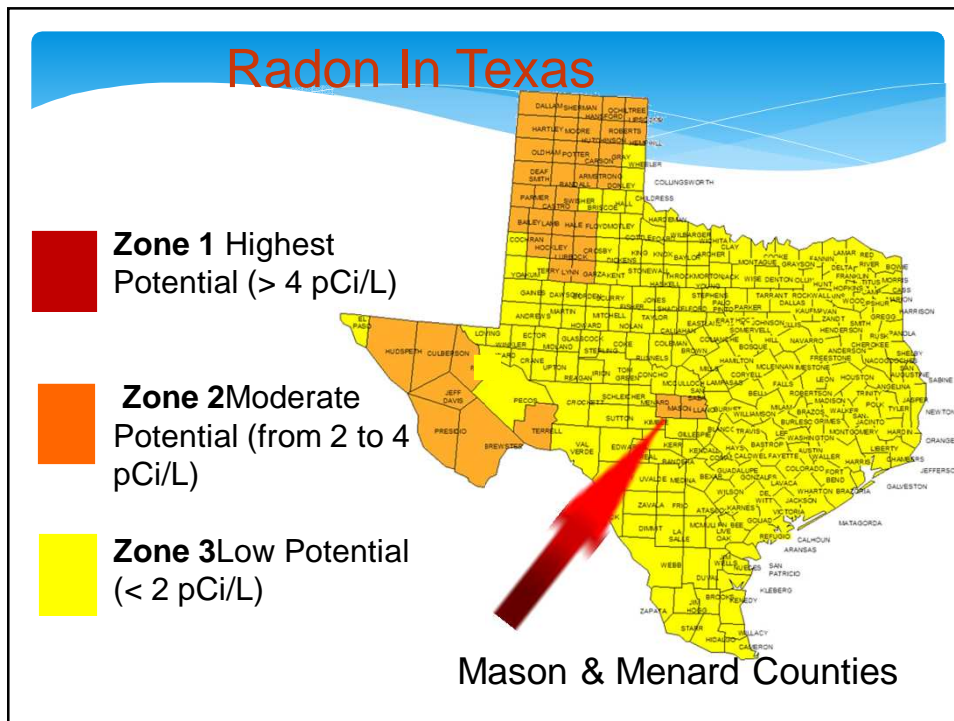
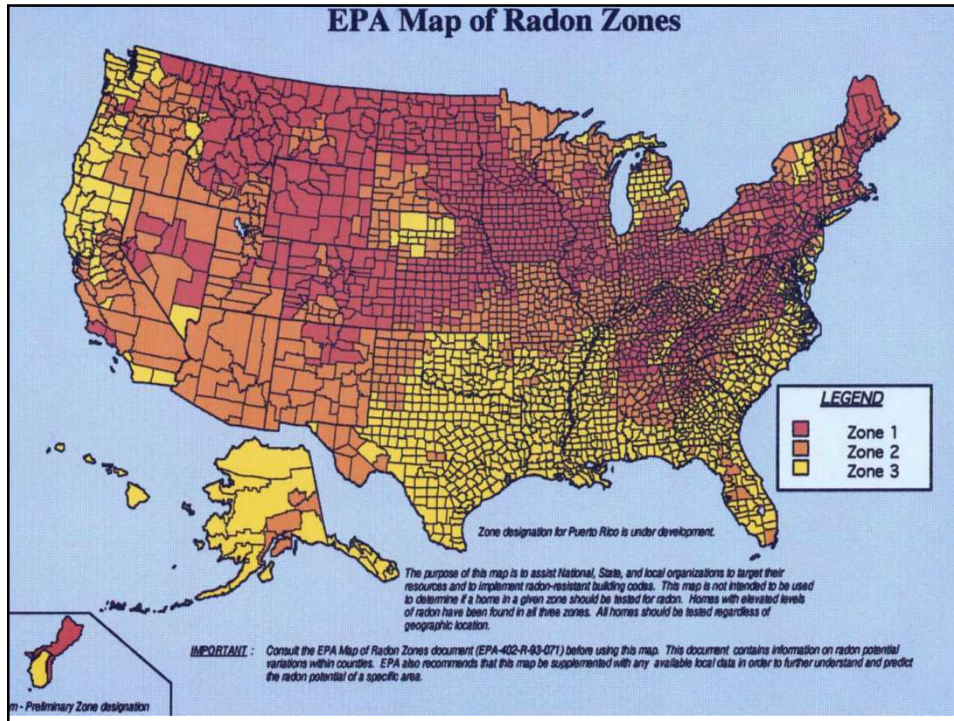


Harmful Radon



Radon Potential By County In Florida

- * Homes with elevated levels of radon have been found in all three zones
- * All homes should be tested regardless of geographic location
- * The map assigns each of the 3,141 counties in the U.S. to one of three zones based on radon potential

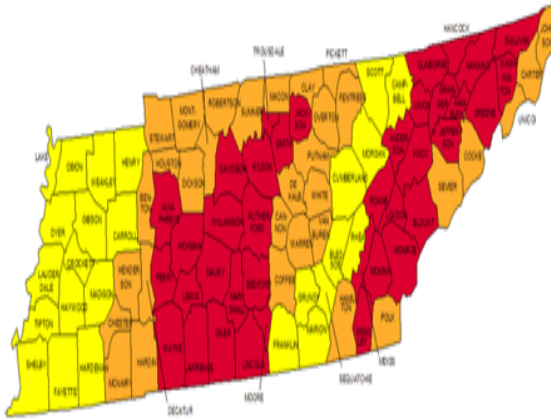


Radon in Tennessee

Zone 1 Highest Potential (> 4 pCi/L)

Zone 2 Moderate Potential (from 2 to 4 pCi/L)

Zone 3 Low Potential (< 2 pCi/L)
Homes with elevated levels of radon have been found in all three zones.



RADON LEVELS IN FLORIDA

By County

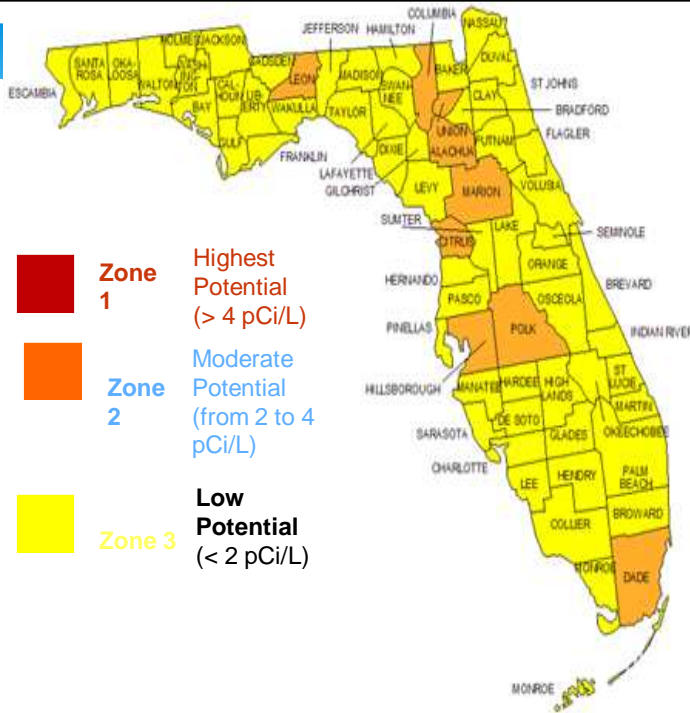
Ave. 1.8 pCi/L

Homes with elevated levels of radon have been found in both zones.

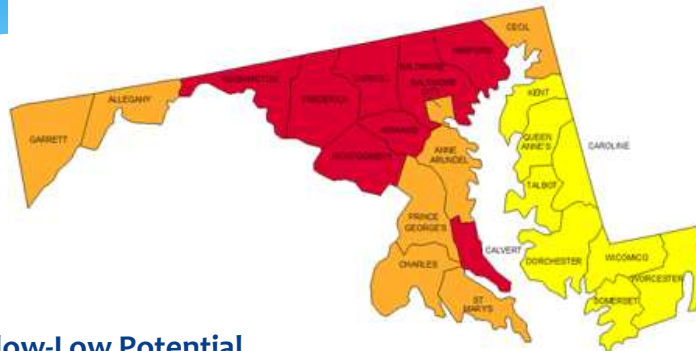
Zone 1 Highest Potential (> 4 pCi/L)

Zone 2 Moderate Potential (from 2 to 4 pCi/L)

Zone 3 Low Potential (< 2 pCi/L)

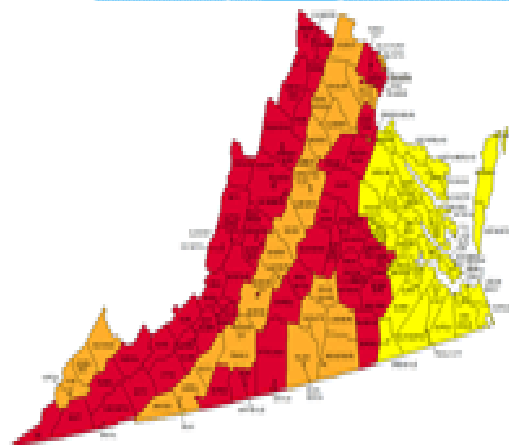


Radon - Maryland



- * **Yellow-Low Potential**
- * **Orange –Moderate Potential**
- * **Red- High Potential**
- * Homes with elevated levels of radon have been found in all three zones.

Radon - Virginia



- * **Yellow-Low Potential**
- * **Orange –Moderate Potential**
- * **Red- High Potential**
- * Homes with elevated levels of radon have been found in all three zones.

Testing For Radon

- * **SHORT-TERM TESTING:**
- * The quickest way to test is with short-term tests. Short-term tests remain in your home for two days to 90 days, depending on the device.
- * Because radon levels tend to vary from day to day and season to season, a short-term test is less likely than a long-term test to tell you your year-round average radon level.

Testing For Radon

- * **How To Use a Test Kit: Testing is easy and should only take a few minutes of your time.**
- * If you are doing a short-term test, close your windows and outside doors and keep them closed as much as possible during the test.
- * Heating and air-conditioning system fans that re-circulate air may be operated. Do not operate fans or other machines which bring in air from outside. Fans that are part of a radon-reduction system or small exhaust fans operating only for short periods of time may run during the test.
- * The test kit should be placed in the lowest lived-in level of the home (for example, the basement if it is frequently used, otherwise the first floor). It should be put in a room that is used regularly (like a living room, playroom, den or bedroom) but not your kitchen or bathroom.
- * Place the kit at least 20 inches above the floor in a location where it won't be disturbed - away from drafts, high heat, high humidity, and exterior walls.

Asthma and Indoor Environments

- * Asthma, which can be triggered by either indoor or outdoor air pollution, annually accounts for:
 - * An estimated three million lost workdays for adults
 - * 10.1 million lost school days in children
- * Asthma costs the USA \$12.7 billion in health care costs annually. (Source: American Lung Association, Trends in Asthma Morbidity and Mortality, 2002)

Asthma and Indoor Environments

- * Asthma is no longer a childhood disease
 - * Children do not “grow out of it” instead they become pulmonary cripples
- * Nationally the occurrence of asthma has nearly doubled in the past decade and now affects some 20 million Americans 1 in 15

Asthma and Indoor Environments

- * The prevalence of asthma has been increasing since the early 1980s across all age, sex and racial groups
- * Asthma is the most common chronic condition among children.
- * Asthma is more common among adult women than adult men
- * Asthma is more common among boys than girls

Asthma and Indoor Environments

- * Each day 11 Americans die from asthma. There are more than 4,000 deaths due to asthma each year, many of which are avoidable with proper treatment and care. In addition, asthma is indicated as “contributing factor” for nearly 7,000 other deaths each year.
- * Since 1980 asthma death rates overall have increased more than 50% among all genders, age groups and ethnic groups.

Asthma and Indoor Environments

- * In 2005, 8.9% of children currently had asthma (6.5 million children).
- * Childhood asthma prevalence more than doubled from 1980 to the mid-1990s and remains at historically high levels.
- * The death rate for children under 19 years old has increased by nearly 80% percent since 1980.



Office Buildings



- * Many office buildings have significant air pollution sources
 - * Some of these buildings may be inadequately ventilated. IE: mechanical ventilation systems may not be designed or operated to provide adequate amounts of outdoor air
- * People generally have less control over the indoor environment in their offices than they do in their homes
- * Recently as people become more confident, there has been an increase in the incidence of reported health problems

HVAC

- * In the past, most buildings had windows that opened
 - * Airing out a stuffy room was common practice
- * Indoor-outdoor air pressure differences provided ventilation by movement of air through leaks in the building shell

HVAC

- * Today most newer office buildings:
 - * Are constructed without operable windows
- * Mechanical ventilation systems are used to exchange indoor air with a supply of relatively cleaner outdoor air

HVAC

- * The rate at which outdoor air is supplied to a building is specified by the building code
- * Supply rates are based primarily on the need to control odors and carbon dioxide levels
- * Carbon dioxide is a component of outdoor air, but its excessive accumulation indoors can indicate inadequate ventilation

HVAC

- * Ventilation is either the air movement within a building or the introduction of outdoor air
- * It is actually a combination of processes which results in the supply and removal of air from inside a building

HVAC

- * These processes typically include:
 - * Bringing in outdoor air
 - * Conditioning and mixing the outdoor air with some portion of indoor air
 - * Distributing this mixed air throughout the building
 - * Exhausting some portion of the indoor air outside

Ventilation System Problems and Solutions



- * Dilution of pollutants
 - * In general, increasing the rate at which outdoor air is supplied to the building decreases indoor air problems
- * Buildings with high ventilation rates may suffer indoor air problems due to an uneven distribution of air, or insufficient exhaust ventilation
- * Even in a well-ventilated building there may be strong pollutant sources which impair indoor air quality
 - * The closer such a source is to an exhaust however, the more effective the ventilation

Ventilation System Problems and Solutions

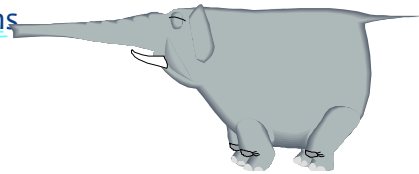
- * It is good practice to provide separate exhaust systems in areas where copy machines or solvents are used
- * Providing localized exhaust for these specific sources can result in a reduction of the amount of overall building exhaust ventilation necessary

Health Problems and Ventilation

- * Harmful pollutants from a variety of sources can contribute to building-related illnesses, which have clearly identifiable causes, such as Legionnaire's disease
- * HVAC systems that are improperly operated or maintained can contribute to sick building syndrome (SBS)
- * SBS has physical symptoms without clearly identifiable causes

Sick Building Syndrome (SBS)

- * Symptoms occur when person is inside and lessens when outside and away from the building
- * Symptoms include:
 - * Allergy and Asthma symptoms
 - * Respiratory illnesses
 - * Itchy Red eyes
 - * Runny Nose
 - * Chest pains
- * SBS is responsible for:
 - * Increased absenteeism
 - * Decreased work performance
 - * Increased health costs



Sick Building Syndrome (SBS)



- * Crowded conditions with poor air circulation can promote this spread
- * Some bacteria and viruses thrive in buildings and circulate through indoor ventilation systems
 - * IE: The bacterium causing Legionnaire's disease, a serious and sometimes lethal infection, and Pontiac Fever, a flu-like illness, have circulated in some large buildings

SBS

- * A committee of the World Health Organization estimates that as many as
 - * 30% of new or remodeled buildings may have unusually high rates of sick building complaints
- * While this is often temporary, some buildings have long-term problems which linger, even after corrective action



SBS

- * The complaints may be localized in a particular room or zone, or may be widespread throughout the building
- * The National Institute for Occupational Safety and Health reports that poor ventilation is an important contributing factor in many sick building cases

Building Related Illness (BRI)

- * Building Related Illness (BRI) is used when:
 - * Symptoms of diagnosable illness are identified
 - * Can be attributed directly to airborne building contaminants.
- * Building occupants complain of symptoms such as:
 - * Cough, chest tightness
 - * Fever, chills and muscle aches

Building Related Illness (BRI)

Inadequate ventilation: In the early and mid 1900's, building ventilation standards called for approximately 15 cubic feet per minute (cfm) of outside air for each building occupant, primarily to dilute and remove body odors.

As a result of the 1973 oil embargo, however, national energy conservation measures called for a reduction in the amount of outdoor air provided for ventilation to 5 cfm per occupant.

In many cases these reduced outdoor air ventilation rates were found to be inadequate to maintain the health and comfort of building occupants.

Building Related Illness (BRI)

Inadequate ventilation, which may also occur if heating, ventilating, and air conditioning (HVAC) systems do not effectively distribute air to people in the building, is thought to be an important factor in SBS.

Building Related Illness (BRI)

- * In an effort to achieve acceptable IAQ while minimizing energy consumption, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) revised its ventilation standard in 1989 to provide a minimum of 15 cfm of outdoor air per person (20 cfm/person in office spaces).
- * Up to 60 cfm/person may be required in some spaces (such as smoking lounges) depending on the activities that normally occur in that space
- * Ventilation rates, are commonly expressed in units of cubic feet per minute per person (cfm/person)

Ventilation Standards and Building Codes

- * Standard applies to all types of facilities including:
 - * Dry cleaners & laundries
 - * Hotels
 - * Dormitories
 - * Retail stores
 - * Sports and amusement facilities
 - * Teaching, convalescent and correctional facilities

Ventilation Standards and Building Codes

- * It is a voluntary standard
 - * It becomes enforceable only after a state or locality adopts the standard in its building code
 - * Most current building codes pertaining to ventilation are standards only for the way buildings in a particular jurisdiction must be designed
 - * They are not enforceable standards for the way the buildings are operated

System Design

- * Intermittent air flow
 - * Minimum ventilation rates should be defined by air cleanliness and distribution, as well as temperature and humidity
- * Distribution of air:
 - * Placement of partitions, furnishings or other barriers within a space can also impair air movement
 - * Precautions must be taken to maintain comfortable thermal conditions, if not people can and will block supply registers if they emit air that is too hot or cold



System Design Problems

- * Building supply and exhaust locations
 - * To close to building vents allows contaminated air back into building
 - * Placement of supply vents near outdoor sources of pollution
 - * Loading docks
 - * Parking and heavy traffic areas
 - * Chimneys
 - * Dumpsters
- * They all provide a pathway for contaminants into the building's ventilation system

HVAC- Obstacles

* **Proportion of Outdoor Air**

- * To dilute and eventually remove indoor contaminants, HVAC systems must bring in adequate amounts of outdoor air
- * It is costly to heat cold winter air and to cool hot summer air
 - * It is a common practice for building engineers to reduce or eliminate the amount of outdoor air brought into the system during hot and cold spells
 - * This allows contaminated air to accumulate inside, causing pollutant concentrations to increase.
 - * It interferes with a continuous supply of fresh air;
 - * How is clean air being provided?

HVAC- Obstacles

* **Periods of Operation**

- * The HVAC system is automatically turned on several hours before and after posted office hours
- * If not, the system can cause an increase in building-and occupant-generated pollutant levels
- * Similarly, if the system is off during periods of non-occupancy (e.g., at night and on weekends) building-generated pollutants may accumulate

HVAC- Obstacles Maintenance

- * Systems must be properly maintained to promote indoor air quality
- * If this is not done, ventilation systems can become a source of contamination or become clogged and reduce or eliminate air flow
- * Humidification and dehumidification systems must be kept clean to prevent the growth of harmful bacteria and fungi

HVAC- Obstacles Maintenance

- * Failure to properly treat the water in cooling towers to prevent growth of organisms
 - * Such as Legionella which is the bacterium that causes Legionnaires' disease, a lung infection
 - * Can introduce such organisms into the HVAC supply ducts and cause serious health problems
- * Accumulations of water anywhere in the system may foster harmful biological growth that can be distributed throughout the building



BASE

- * Building Assessment, Survey and Evaluation Study
 - * EPA used a standardized protocol to collect extensive indoor air quality data from 100 randomly selected public and commercial office buildings in 37 cities in 25 States
 - * This study fills a significant data gap regarding baseline indoor air quality (IAQ) in public and commercial office buildings



What is I-BEAM?

- * The Indoor Air Quality Building Education and Assessment Model (Software)
 - * Designed to be used by building professionals and others interested in indoor air quality in commercial buildings
 - * Is designed to be comprehensive state-of-the-art guidance for managing IAQ in commercial buildings

3 Strategies For Improving Indoor Air Quality

- * **Source Control**

- * Usually the most effective way to improve indoor air quality is to:
 - * Eliminate individual sources of pollution
 - * Reduce their emissions
- * Some sources, like those that contain asbestos, can be sealed or enclosed
- * Gas stoves, can be adjusted to decrease the amount of emissions

3 Strategies For Improving Indoor Air Quality

- * In many cases, source control is also a more cost-efficient approach to protecting indoor air quality than increasing ventilation
 - * Increasing ventilation can increase energy costs

3 Strategies For Improving Indoor Air Quality

- * **Ventilation Improvements to increase outdoor air ventilation rate**
 - * Increase the amount of outdoor air coming indoors
 - * Most home heating and cooling systems, including forced air heating systems, do not mechanically bring fresh air into the house
 - * Opening windows and doors, operating window or attic fans, when the weather permits

3 Strategies For Improving Indoor Air Quality

- * **Ventilation Improvements to increase outdoor air ventilation rate**
 - * Opening windows and doors, operating window or attic fans, when the weather permits
 - * Running a window air conditioner with the vent control open
 - * Local bathroom or kitchen fans that exhaust outdoors remove contaminants directly from the room where the fan is located

3 Strategies For Improving Indoor Air Quality

- * **Air cleaners** are designed to make living spaces more comfortable
- * They reduce air pollutants that contribute to poor indoor air quality, and many filter common allergens like dust and pollen – a great benefit for people suffering from asthma or allergies
- * If you're considering a room air cleaner keep these characteristics in mind:



Air Cleaners

- * 3 CADR numbers - one for tobacco smoke, one for pollen and one for dust
- * The CADR indicates volume of filtered air delivered by an air cleaner.
- * The higher the tobacco smoke, pollen and dust numbers, the faster the unit filters the air.



Clean Air Delivery Rate
Certified Rating

From air cleaner to air cleaner, compare the CADR numbers. First, look at suggested room size. Then refer to the dust, tobacco smoke and pollen Clean Air Delivery Rate (CADR) numbers. The higher the numbers, the faster the unit filters the air.

This air cleaner is suggested for use in a single closed room up to 120 square feet.

Room size ratings conform to the AHAM Certification Program criteria of 80% smoke reduction. Higher Clean Air Delivery Rates provide improved performance in all room sizes. Portable air cleaners will be much more effective in rooms where all doors and windows are closed.

Dust: 80 Tobacco Smoke: 80 Pollen: 80

These values represent performance that can be expected within the first 72 hours of operation. Subsequent performance may vary with use.

Association of Home Appliance Manufacturers **AHAM**

Air Cleaners

- * Air cleaners can reduce the allergic reactions produced by larger particles such as:
 - * Pollen, house dust allergens, some molds, and animal dander
 - * Most of these particles are found where they settle on surfaces in the home, rather than in the air
 - * They cannot be removed by an air cleaner unless disturbed and re-suspended in the air

Air Cleaners for Gaseous Pollutants

- * It is unclear if:
 - * Air cleaners that do not contain activated carbon or alumina, will remove gaseous pollutants, including radon, or reduce their associated health effects
 - * The effectiveness of air cleaners in reducing the health risks from radon progeny (decay products) cannot be adequately evaluated at present
 - * Health effects from these pollutants may be serious, however and they are of concern in indoor air

Types of Air Cleaners

- * Mechanical filters
 - * Similar to, and including, the typical furnace filter
- * Electronic air cleaners (for example, electrostatic precipitators) which trap charged particles using an electrical field
- * Ion generators which act by charging the particles in a room. The charged particles are then attracted to walls, floors, draperies, etc. or a charged collector
- * "Hybrid" devices, which contain two or more of the particle removal devices discussed above

Types of Air Cleaners

- * Three types of air cleaners on the market are designed to deactivate or destroy indoor air pollutants:
 - * Ultraviolet germicidal irradiation (UVGI) cleaners
 - * Photocatalytic oxidation (PCO) cleaners
 - * Ozone generators sold as air cleaners.

Types of Air Cleaners-UVGI Cleaners

- * Use ultraviolet radiation from UV lamps that may destroy biological pollutants such as viruses, bacteria, and molds that are airborne or growing on HVAC surfaces (e.g., cooling coils, drain pans, or ductwork).
- * UVGI cleaners should be used with, but not as a replacement for, filtration systems.
- * Typical UVGI cleaners used in homes have limited effectiveness in killing bacteria and molds. Effective destruction of some viruses and most mold and bacterial spores usually requires much higher UV exposures than a typical home unit provides.

Types of Air Cleaners-PCO Cleaners

- * Use UV lamps along with a substance, called a catalyst, that reacts with the light.
- * These cleaners are designed to destroy gaseous pollutants by changing them into harmless products, but they are not designed to remove particulates.
- * The usefulness of PCO cleaners in homes is limited because currently available catalysts are ineffective in destroying gaseous pollutants in indoor air.

Types of Air Cleaners- Ozone Generators

- * Use UV lamps or electrical discharges to produce ozone that reacts with chemical and biological pollutants and transforms them into harmless substances.
- * Ozone is a potent lung irritant, which in concentrations that do not exceed public health standards, has little potential to remove indoor air contaminants.
- * Ozone generators are not always safe and effective in controlling indoor air pollutants.

Types of Air Cleaners-Portable Air Cleaners

- * Generally contain a fan to circulate the air and use one or more of the air-cleaning technologies discussed above
- * They may be an option if a home is not equipped with a furnace or a central air-conditioning system
- * Many portable air cleaners have moderate to large air delivery rates for small particles
- * However, most of the portable air cleaners on the market do not have high enough air delivery rates to remove large particles such as pollen and particles that contain dust mite and cockroach allergens from typical-size rooms



- * **"True" HEPA filters provide a DRY environment**
 - * Captured bacteria and virus will dry out because without moisture, there is nothing to facilitate their growth and keep them alive
 - * Without moisture the bacteria will die
 - * Bacteria can breed within the filter **ONLY** if the air coming into the filter is moist



- * **"True" HEPA filtration is recognized as one of the most efficient air filtration methods known and proven to remove airborne particles, down to the size of 0.3 microns**
 - * Particles that are 0.3 micron in size are the most difficult particles to trap and contain within a filter.
 - * 0.3 micron particle, when inhaled, passes easily into the body's respiratory system so the body's natural defense system is more vulnerable to these small particles



* High Efficiency Particulate Air Filters

There is only one air cleaning method Approved and Required in circumstances where human life, health, or safety is dependent upon cleaning relatively large volumes of air. That method is used in *orthopedic operating rooms, biological safety cabinets for infectious disease research, to contain radioactive particles, and in pharmaceutical production facilities to ensure the purity of medications.*

That one method is TRUE HEPA filtration." - *Allergy and Asthma Network - Mothers of Asthmatics, Inc.*

Air Cleaners: Other Factors

- * Ion generators and electronic air cleaners may produce ozone
 - * Usually happens if they are not properly installed and maintained.
 - * Ozone can be a lung irritant
- * Gases and odors from particles collected by the devices may be re-dispersed into the air
- * The odor of tobacco smoke is largely due to gases in the smoke, rather than particles
 - * The smell of tobacco may remain even when the smoke particles have been removed

Air Cleaners: Other Factors

- * Some devices scent the air to mask odors, which may lead you to believe that the odor-causing pollutants have been removed
- * Ion generators, especially those that do not contain a collector, may cause soiling of walls and other surfaces

Air Cleaners: Other Factors

- * You may be bothered by noise from portable air cleaners, even at low speeds
- * Maintenance costs, such as costs for the replacement of filters, may be significant
- * Usually, the most effective units are also the most costly

Air Cleaners: Other Factors

- * **It is important that there is proper installation, use, and care**
- * **Perform routine maintenance**
 - * Most require extensive frequent cleaning and filter replacement to function properly
- * **Proper placement**
 - * They are placed near a specific pollutant source
 - * They force the cleaned air into occupied areas
 - * The inlet and outlet are not blocked by walls, furniture, or other obstructions

Want Fresh Air? Try Plants

- * Many plants can help clean air of formaldehyde and other VOC's released by particle board, carpeting and other materials
- * Common plants include:
 - * **Boston Fern**
 - * **English Ivy**
- * While they are no substitute for good ventilation and eliminating the sources of bad air, they at the very least can make you feel better

3 Essential Green Plants

"The Living Room Plant"

Areca Palm

(Chrysalidocarpus lutescens)



"The Bedroom Plant"

Mother-in-law's Tongue

(Sansevieria trifasciata)



"The Specialist Plant"

Money Plant

(Epipremnum aureum)



3 Essential Green Plants

The **Areca Palm** is does great air cleansing work during the day.

About 4 shoulder height plants per person should do the trick.

The **Mother-in-law's Tongue** takes over by converting CO₂ to O₂ at night. You want about 6 to 8 of these waist high plants per person.

The **Money Plant** does the job of filtering out removing Formaldehyde and other VOC's (Volatile Organic Compounds)

3 Essential Green Plants

This isn't just some half-baked theory, Kamal Meattle has been testing this theory out for the last 15 years at the at Paharpur Business Centre A 20 year old, 50,000 sq ft building by filling it with over 1,200 plants for 300 building occupants.

The Indian Government has rated the building the healthiest building in Delhi

[USGBC Platinum, first office in India under LEED for Existing Buildings \(O & M\) and Bureau of Energy Efficiency 5 Star Rated](#)

3 Essential Green Plants

Studies have shown that after spending 10 hours in the building your body will be working better than before. Aside from being a natural and beautiful source of fresh air,

This method also helps reduce energy consumption, because you don't need to filter or bring fresh air in.

<http://greenspaces.in/>

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* The Indoor Air Quality Association (IAQA) is a nonprofit, multi-disciplined organization, dedicated to promoting the exchange of indoor environmental information, through education and research, for the safety and well being of the general public

www.OSHA.gov



- * **Indoor Air Quality:**
- * **Standards**
- * **How can I recognize poor IAQ in my workplace?**
- * **Hazard Recognition:**
 - * **How can I evaluate and control the IAQ in my workplace?**
- * **Where can I find additional information?**

Sources

- * CA Erdmann, KC Steiner, MG Apte, "Indoor Carbon Dioxide Concentrations and Sick Building Syndrome Symptoms in the BASE Study Revisited: Analyses of the 100 Building Dataset," *Proceedings of Indoor Air 2002*, III pp. 443-448, (2002)
- * Paula Baker-LaPorte, Erica Elliott, John Banta, Lisa Flynn "Prescriptions for a Health House"

Sources

- * John Bower, Lynn Marie Bower, "The Healthy House Answer Book : Answers to the 133 Most Commonly Asked Questions"
- * Manfred Kaiser, "How Indoor Air Quality Affects Your Health", Melbourne : Michelle Anderson Publishing ,2002
- * Prescriptions for a Healthy House, Paula Baker- Laporte, Erica Elliott, John Banta, Lisa Flynn, 2001, New Society Publishers
- * Home Safe Home, Deborah Lynn Dadd, New York: Tarcher/Putnam ,1997
- * As Natural as Breathing, 3/6/2003, Washington Post **Author:** Rebecca R. Kahlenberg
- * <http://EPA.gov>
- * <http://epa.gov/iaq/largebldgs/download.htm> (for IBEAM)
- * www.cadr.org
- * <http://ecologycenter.org>

Sources

- * www.epa.gov/iaq/largebldgs/base/base_publications.
- * **Indoor Air Quality-Information Clearinghouse (IAQ INFO)**
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