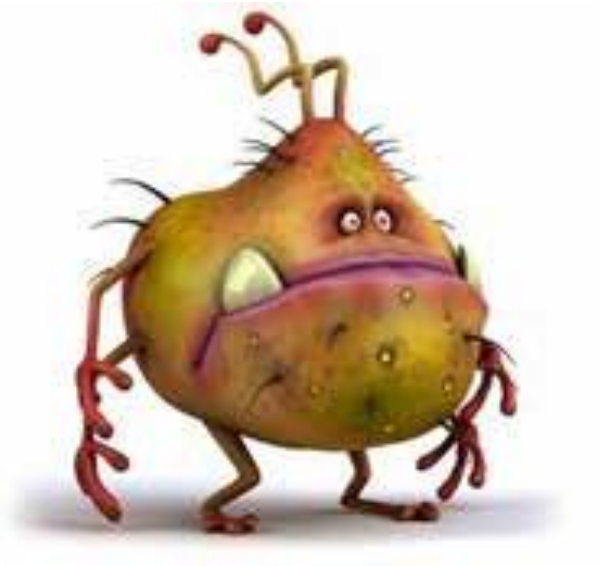
Breathe Healthy

A Guide for Those Responsible for Indoor Environments



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Introduction

March 2020

Are you responsible for the indoor environment of others? Are you concerned about that environment? Should you be? In this advanced time in history, we can control just about every part of our indoor climate simply for the sake of comfort. We can heat, cool, humidify, dehumidify, control pests, and increase or decrease ventilation. Newly constructed buildings are built to be energy efficient, air-tight, and climate controlled. Older buildings can be renovated to create a similar scenario. The same construction or renovation that brings such value to our buildings can, however, also provide conditions conducive to polluted environments. Whether a homeowner, facilities manager, property manager, builder, renovator, landlord, or realtor, we have occupants counting on us to create and maintain safe indoor living and working environments.

So, why be concerned? In today's fast-paced society, most people spend 80- 90% of their time indoors. Moreover, the health of the indoor environment influences the health of the building's occupants. People breathe an average of 3,000 gallons of air each day. According to the Occupational Safety and Health Administration (OSHA), "poor indoor air quality has been tied to symptoms like headaches, fatigue, trouble concentrating, and irritation of the eyes, nose, throat, and lungs."

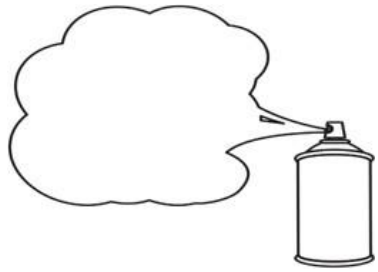
What is the likelihood of an indoor environment being polluted? The statistics may surprise you.

- The U.S. alone consumed 24,827,500 tons of asbestos from 1890 to 1969.
- An estimated one out of every 15 homes in the U.S. has elevated radon levels.
- In the U.S., 35% of all housing has lead-based paint.
- 20% of all illnesses are either caused by or aggravated by polluted indoor air.
- One out of six people who suffer from allergies does so because of the direct relationship to fungi and bacteria in air duct systems.
- Each day in the U.S. alone, 11 people die from asthma.
- Worldwide, a death occurs every 20 seconds due to poor indoor air quality.
- One out of four buildings in the U.S. can be classified as a Sick Building.
- Sixty-four million workers frequently experienced two or more symptoms associated with Sick Building Syndrome at work including nose irritation, eye irritation, and headaches.
- U.S. adults miss about 14 million workdays per year as a result of asthma, an issue commonly triggered by poor indoor air quality.
- A loss in productivity costs the US $60 billion due to poor indoor air quality.
- Indoor air quality problems cost the U.S. economy as much as $168 million per year.

Since 1990, the U.S. Environmental Protection Agency (EPA) has consistently ranked indoor air pollution as one of the top five environmental risks to public health. Studies show that levels of air pollution inside homes are often two to five times higher than outdoors. Volatile organic compounds could be up to 10 times higher indoors than outdoors. Per the EPA, “Indoor air pollution is one of our biggest environmental health threats … bigger than toxic waste sites and the destruction of the ozone layer.”

A myriad of factors impact indoor air quality, from ventilation issues to improper temperature control. Deteriorated asbestos-containing materials or lead-based paints are factors in buildings constructed before 1980. In newly constructed or renovated buildings, factors could include flooring, carpeting, upholstery, and cabinetry or

furniture made of pressed wood products. Pollutants can include excess moisture, pesticides, pest infestations, tobacco products, and sources that release gases or particles into the air. There is also dust from construction or renovation, vapors from cleaning supplies, chemicals, and combustion appliances.'



In addition to all of that are the pollutants released in the air through day- to-day living, such as personal care products, hobbies, and products used in regular cleaning and maintenance. The emissions of these pollutants can remain in the air well past their actual usage.

OSHA identified the vital attributes that typically lead to indoor air quality complaints as improperly installed, operated or maintained HVAC systems; overcrowding, moisture, and dampness events; the presence of outside air pollutants including radon; and internally generated contaminants.

Poor indoor air quality is also dependent on the quantity and toxicity of the contaminant, as well as the occupant's proximity to the source of the pollutant and the ability of the building's ventilation to remove or dilute the pollutant.

Air pollution in buildings causes a variety of health effects, dependent on the quantity and toxicity of the contaminant. An occupant's reaction to the contaminant can vary depending on their susceptibility. Some health effects include sore eyes, burning in the nose and throat, headaches, and/or fatigue. However, others can be more severe and could include worsened allergies, respiratory illnesses, heart disease, cancer, long-term health conditions, and death.

Typical indoor air pollutants can include:

- Mold
- Dust
- Dust mites
- Pet dander
- Pollen
- Other biological contaminants
- Carbon dioxide

- Carbon monoxide
- Tobacco smoke and secondhand smoke
- Particulate matter
- Lead dust
- Nitrogen oxide
- Pesticides
- Radon
- Formaldehyde
- Solvent vapors
- Vapors from cleaning agents
- Other volatile organic compounds
- The intrusion of outdoor pollution

The good news is poor indoor air quality can be remedied. The pollutant and the source of the contamination will determine the remedy. A variety of controls and actions can be taken to enhance interior breathing conditions and avoid the health issues generated from the presence of indoor air pollution. In general, a building will stay healthy if HUD's **Eight Healthy Homes Principles** are employed:

- **Keep it dry** by immediately addressing and controlling water intrusions, moisture content, and relative humidity.
- **Keep it clean** through regular, thorough housekeeping practices.
- **Keep it safe** with an entire list of practices such as controls around pools and regular checks of fire extinguishers and alarms for carbon monoxide.
- **Keeping it well-ventilated** becomes crucial in new buildings constructed to be air-tight causing a potential lack of fresh air.
- **Keep it pest-free and contaminate-free** through preventative measures, interim measures, and subsidizing with environmental controls.
- **Keeping our environment thermally controlled** allows occupants to operate through the day in comfort.
- The most important of the eight tips from HUD is **keeping it well-maintained.** Giving properties a check-up twice a year is crucial to preventing indoor pollution and contamination.

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

Operating and maintaining a home or building is a complex process, from temperature controls to plumbing issues. This guide will demonstrate how applying a routine of simple systems and preventative methods can keep indoor environments healthy for occupants. It is intended to assist by providing information and reminders to those responsible for indoor environments, along with tips for proper operating and maintenance routines. Following these tips will not only save in exorbitant repair and remediation costs, it will also lead to a healthy indoor environment that contributes to productivity, comfort, and a sense of healthiness for its occupants.

Preventing issues and maintaining buildings to prevent indoor environmental concerns or to address problems that arise and impact indoor air quality are basic and similar for all buildings no matter their design, age, or use. Maintenance of building systems is a process encompassing a wide range of issues:

- Preventing or eliminating odors, dust, and contaminants
- Circulating air to prevent stuffiness without creating drafts
- Controlling temperature and humidity
- Providing enough light for illuminating work surfaces without creating glare
- Controlling noise levels so not to interfere with activities
- Keeping areas sanitized and disinfected
- Providing clean drinking water
- Preventing fire, slips, falls, poisoning
- Introducing and distributing adequate ventilation
- Controlling airborne contaminants
- Controlling ergonomic stressors, such as designs for activities or adequate workstations
- Well-planned and properly managed

Proper communication is key to implementing maintenance processes and encourages the exchange of information actively. Communication is improved when occupants are educated and encouraged to notify when an environmental concern arises.

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

Breathe Healthy**, **A Guide for Those Responsible for Indoor Environments will educate on fundamental indoor environmental concerns, provide tips and tricks, as well as provide ideas on regular check- ups for our buildings and homes. The guide is intended to assist homeowners, facilities managers, property managers, builders, renovators, landlords, and realtors provide their building occupants the ability to ***Breathe Healthy.***

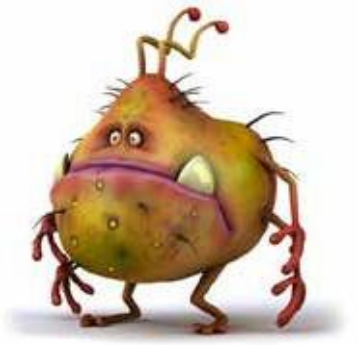
What did you breathe today?

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

Chapter One
The SILENT KILLER – Radon!

Published January 2019



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Breathe Healthy

A Guide for Those Responsible for Indoor Environments

INTRODUCTION

More than 21,000 lives are lost each year to lung cancer caused by RADON! This is not acceptable. We can protect occupants of buildings today from radon in two simple ways: Ask them to hold their breath – OR – test for radon and fix it, if needed.

Radon is an invisible, odorless, tasteless radioactive gas that seeps into our buildings through cracks in the floor and walls, construction joints, gaps around service pipes, cavities inside walls, and the water supply. It comes from the natural decay of uranium that is found in nearly all soils. Our buildings trap the radon inside where it builds up. With every breath our occupants take, they could be exposing their lungs to radon.

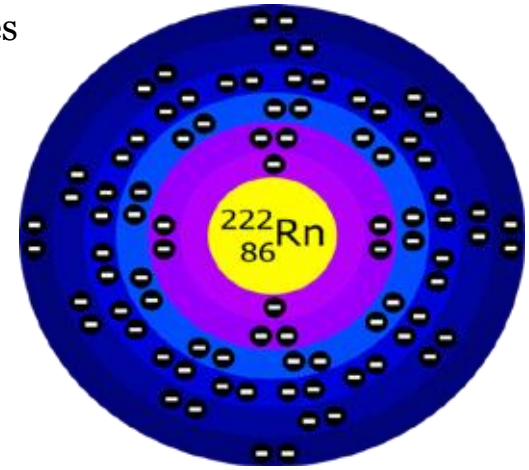
The EPA and the Surgeon General recommend that all residences and apartments below the second floor be tested for radon. Any building may have a radon problem: new or old, well-sealed or drafty, with or without a basement. It could be accumulating to unsafe levels in our environments right now.

The risk of developing lung cancer from radon depends on the concentrations of exposure and the amount of exposure time. The greater the concentration and the longer the exposure, the higher the risk.

WHAT IS RADON?

Radon is defined as a naturally occurring radioactive gas produced by the breakdown of uranium in our soil, rock, and water. It cannot be seen, smelled or tasted and is the second-leading cause of lung cancer in the U.S., surpassed only by smoking.

Primary research on radon concentrations in buildings has been performed in residences, with approximately one out of every 15 homes predicted to have elevated radon levels. Out of all the environmental hazards and pollutants we face, radon is one that can typically be easily remedied.



Uranium, present in the soil in all 50 states, causes radon concentrations in any type of building – homes, offices, schools. Testing is inexpensive and easy, and radon mitigation systems can reduce the levels of radon in buildings by up to 99%. The only way to know whether or not a building has a radon contamination is to test.

Despite all the research, many still question the known evidence of radon and its impact on our health. Knowledge is power. Knowledge about radon can empower us to protect the lives of our occupants.

RADON MYTHS & FACTS

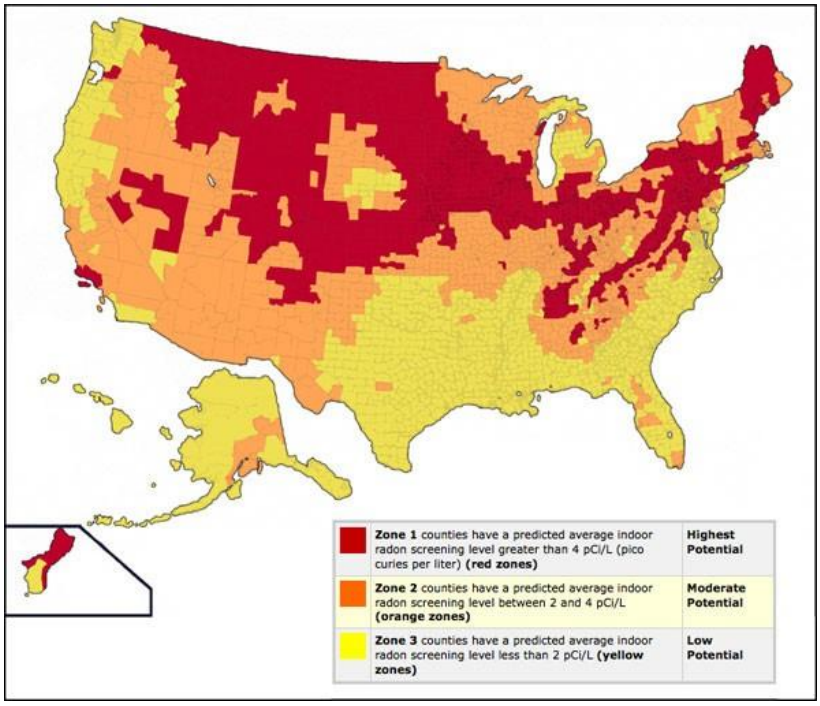
MYTH: Radon is only a problem in homes and buildings with a basement.
FACT: Any style building can have elevated radon levels.

MYTH: Opening a window will lower radon levels.
FACT: Because of the chimney-effect, radon levels can actually increase when windows are left open.

MYTH: Scientists are not sure that radon is really a problem.
FACT: The Center for Disease Control, the American Lung Association, and the American Medical Association agree with estimates that radon causes thousands of preventable lung cancer deaths each year.

MYTH: Radon testing is difficult, time-consuming, and expensive.
FACT: Radon testing is easy. Owners can test themselves or hire a qualified radon measurement professional. It only takes a small amount of time and effort to perform testing.

MYTH: Homes and buildings with radon problems can't be fixed. **FACT:** There are simple solutions to radon problems in buildings. Thousands of buildings have already been fixed. The average cost of a radon mitigation system for a home is between $800 and $2,500, which is the cost of an average repair or simple renovation.

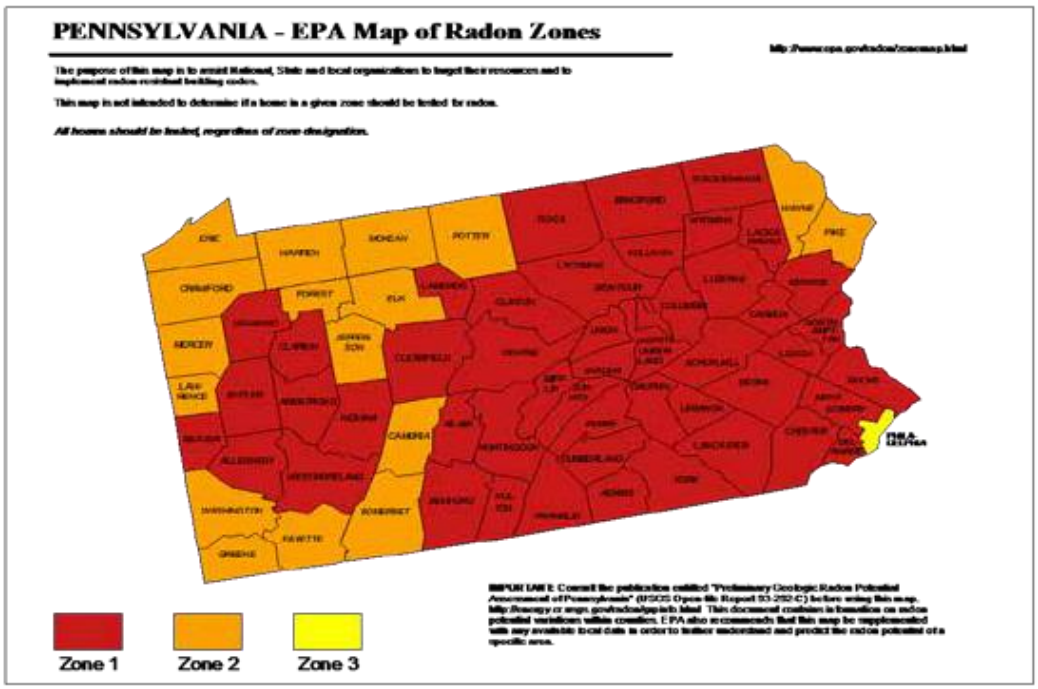


MYTH: All radon contractors are the same, so picking the cheapest is all right.
FACT: Professional Radon Contractors must be highly trained. Many states regulate radon activities and require licensure or certification.

MYTH: Radon only affects older homes.
FACT: Local geology, construction materials, and how the home was built are among the factors that can affect radon levels. Radon can be a problem in homes of all types … old, new, drafty, insulated, with or without basements or crawlspaces.

MYTH: Radon is only a problem in certain parts of the country.
FACT: Radon levels can vary greatly from area to area, but high radon levels have been found in every state across the U.S.

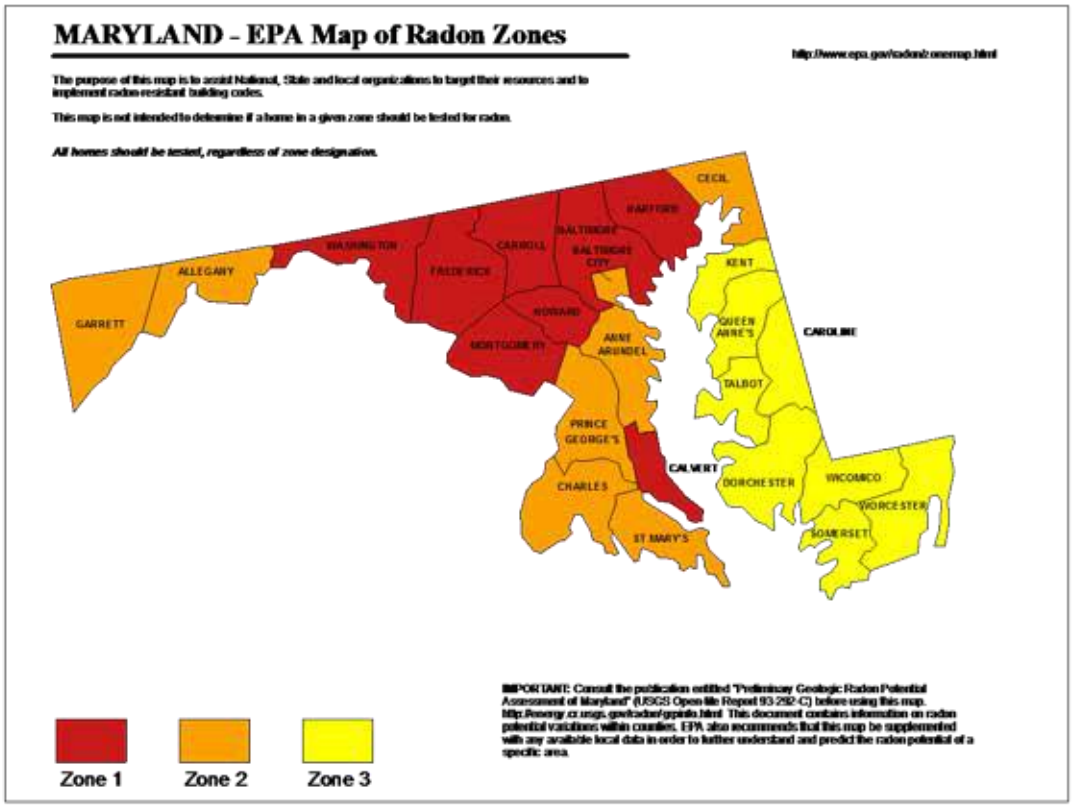
MYTH: A test result from a neighboring building is a good indication of whether your building has a problem.
FACT: Radon levels can vary greatly from building to building depending on the geological makeup, how the building is built, and the soil composition around the properties.



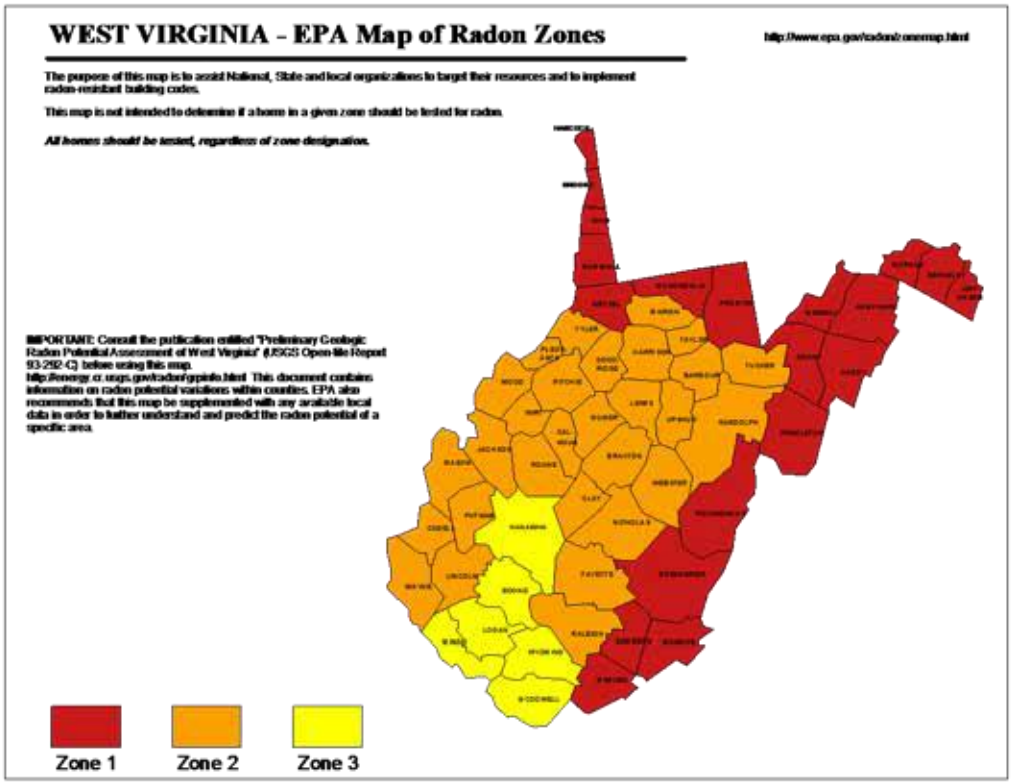
MYTH: Everyone should test their water for radon.
FACT: Although radon gets into some buildings through water, it is important to first test the air for radon.

MYTH: It is difficult to sell homes where radon problems have been discovered.
FACT: Where radon problems have been fixed, home sales have not been blocked. The added protection can be used as a great selling point.

MYTH: Short-term radon testing cannot be used for deciding whether to install a radon mitigation system.
FACT: The closer short-term tests are to 4 pCi/L, the less certain you can be about the year-round average. See the section on Radon Measurements for more detail.



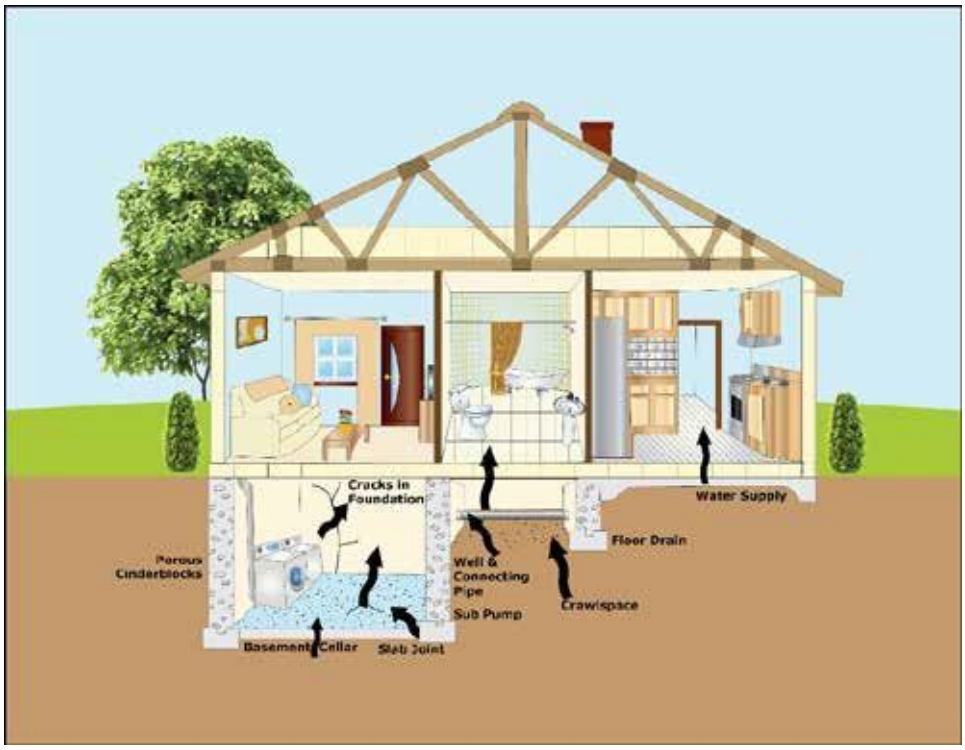
MYTH: In new construction, the building lot can be tested prior to construction to determine if radon-resistant building techniques should be employed.
FACT: No one can predict the impact that the site preparation will have on introducing new radon pathways or the extent to which a "stack effect" in the building will be produced.



HOW DOES RADON GET INTO OUR BUILDINGS?

Radon enters our buildings through cracks in the floors, construction joints, cracks in the walls, gaps in suspended floors, gaps around service pipes, cavities inside walls, and through our water supply. Air pressure from inside the building is typically lower than in the soil around the building's foundation. This causes buildings to act like a vacuum, drawing radon through all these possible paths. Radon can also be in our water supply and released into the air during showering or other similar uses.

Typically, radon entering our environment through water is a smaller risk than entering from the soil. In some cases, building materials such as granite or concrete can also release radon into the air. Rarely do building materials cause elevated radon levels by themselves. Radon gas from soil is the primary cause of elevated radon levels in our buildings.



Neither building style, age nor location predict radon levels. Rather, four main factors influence the entry of radon into our buildings, and these factors exist in all construction throughout our country.

Uranium is present in the ground throughout the U.S. Like all other decay chains, it follows a sequential series of transformations, decaying into radium, which decays into radon.

The soil allows the radon to migrate through it and into the building through the slab, basement or crawlspace.

All gases follow the easiest pathway to entry and exhaust. These pathways include small holes, cracks, service penetrations, or sumps in the building slab, foundation, or crawlspace. All buildings have pathways for soil gases, including radon, to enter.

The air pressure difference between the basement or crawlspace and the surrounding soil draws radon into the building. This is known as the “stack effect”.

The stack effect is the movement of air into and out of buildings due to a difference in indoor-to-outdoor air density resulting from temperature and moisture differences. The greater the thermal difference and the height of the

structure, the greater the force of the stack effect.

Contributing factors to the "stack effect" are:

- the use of exhaust fans that remove air from the inside of the house. When this air is removed, outside air enters to replace it. That outside air may contain radon.
- warm air rises. It leaks from openings in the upper portion of the house causing replacement air to enter the lower portion of the building.
- Furnaces, central air conditioners, and other mechanical systems may also contribute to the "stack effect." In areas where winters are mild, they can be a major contributor. Air handlers and leaky return ducts can draw in air including air with radon levels. They not only draw it in but can also then distribute it throughout the building.

HEALTH EFFECTS TO OCCUPANTS

There is no safe level of radon exposure. Any level of radon exposure presents the risk of causing lung cancer. Several factors play a part in the level of risk:

- the concentration of the exposure
- the length of the exposure
- the number of exposures
- whether or not one smokes
- the individual's personal susceptibility to disease

Research has shown that radon is the number two cause of lung cancer in our country today. Only smoking causes more lung cancer deaths. For someone who smokes and is exposed to high radon levels, their risk of lung cancer is exceptionally high.

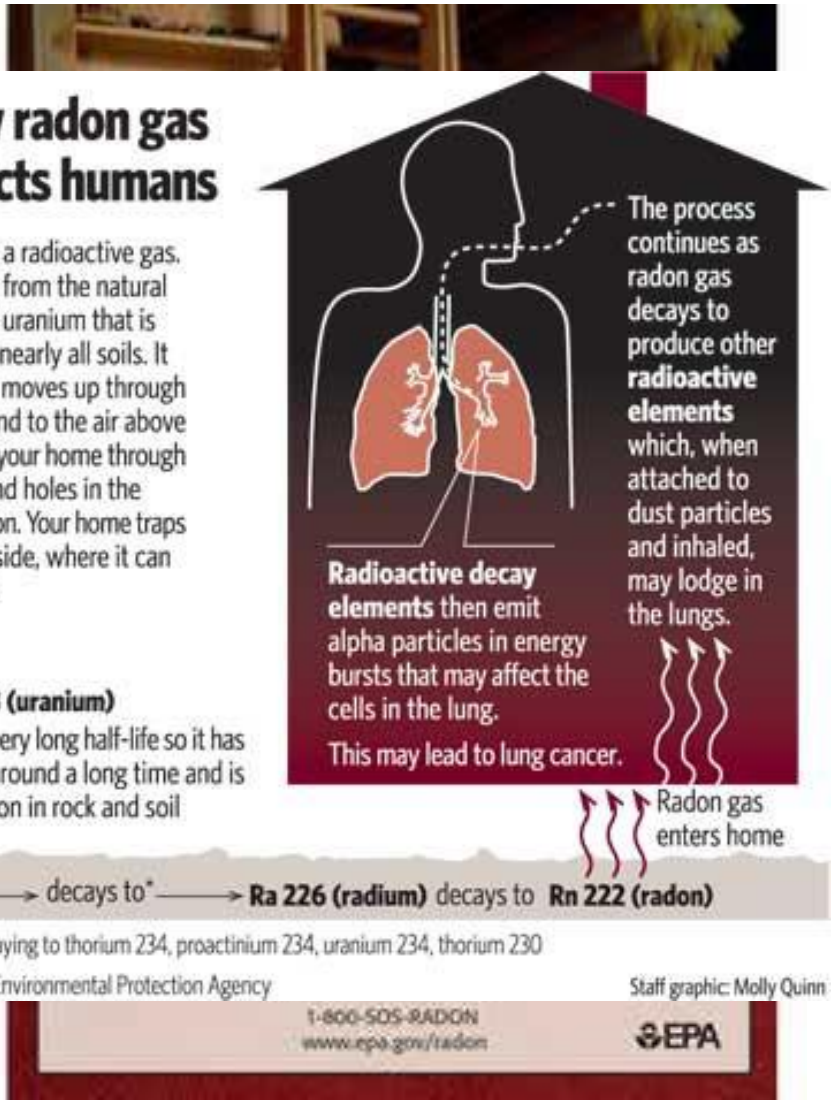
The Environmental Protection Agency (EPA) assesses chemicals and other agents in the environment and classifies them into five groups based on the existing scientific evidence for carcinogenicity. Radon has been labeled a "Group A" carcinogen by the EPA.

Group A is defined as a human carcinogen, meaning there is enough evidence to conclude that it causes cancer in humans. This is based on studies of miners who were exposed to radon gases. It is estimated that 15,000 to 22,000 deaths occur per year from lung cancer caused by radon exposures.

World scientific bodies also agree that radon mutates the DNA in an individual's system.

How does radon enter the lungs and cause so much devastation to a human being? Radon gas decays into radioactive particles. These particles are inhaled and become trapped in the lungs. As they decay further, these particles release small bursts of energy that damage lung tissue and lead to lung cancer over time.

Children have been reported to have a greater risk than adults of certain types of cancer from exposure to radiation. However, at this time, there is no conclusive data to support the impact of radon on children.



Radon Risk If You Smoke

Radon Level	If 1,000 people who smoked were exposed to this level over a lifetime*…	The risk of cancer from radon exposure compares to**…	WHAT TO DO: Stop smoking and …
20 pCi/L	About 260 people could get lung cancer	250 times the risk of drowning	Mitigate building
10 pCi/L	About 150 people could get lung cancer	200 times the risk of dying in a home fire	Mitigate building
8 pCi/L	About 120 people could get lung cancer	30 times the risk of dying in a fall	Mitigate building
4 pCi/L	About 62 people could get lung cancer	5 times the risk of dying in a car crash	Mitigate building
2 pCi/L	About 32 people could get lung cancer	6 times the risk of dying from poison	Consider fixing between 2 and 4 pCi/L
1.3 pCi/L	About 20 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/L is difficult.)
0.4 pCi/L	About 3 people could get lung cancer	(Average outdoor radon level)	

***Note**: If you are a former smoker, your risk may be lower.*

* Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).
** Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.

Radon Risk If You Have Never Smoked

Radon Level	If 1,000 people who never smoked were exposed to this level over a lifetime*…	The risk of cancer from radon exposure compares to**…	WHAT TO DO:
20 pCi/L	About 36 people could get lung cancer	35 times the risk of drowning	Fix your home
10 pCi/L	About 18 people could get lung cancer	20 times the risk of dying in a home fire	Fix your home
8 pCi/L	About 15 people could get lung cancer	4 times the risk of dying in a fall	Fix your home
4 pCi/L	About 7 people could get lung cancer	The risk of dying in a car crash	Fix your home
2 pCi/L	About 4 person could get lung cancer	The risk of dying from poison	Consider fixing between 2 and 4 pCi/L
1.3 pCi/L	About 2 people could get lung cancer	(Average indoor radon level)	(Reducing radon levels below 2 pCi/L is difficult.)
0.4 pCi/L		(Average outdoor radon level)	

Note: *If you are a former smoker, your risk may be higher.*

* Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).
** Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.

HOW TO TEST FOR RADON

The amount of radon in the air is measured in "picocuries per liter of air" or "pCi/L." The average indoor radon level is estimated to be about 1.3 pCi/L, and the average outside radon level is estimated to be about 0.4 pCi/L. The EPA believes that any radon exposure carries some risk – there is no safe level of radon. However, the goal is to get the radon level to 4 pCi/L or lower. While the U.S. Congress has set a long-term goal for indoor radon levels to be no more than outdoor levels, our current technology is unable to achieve a better average than 2 pCi/L. The important fact remains that the risk of lung cancer is reduced by lowering radon levels.

Following EPA measurement protocols will result in a 94% certainty that owners have the necessary data to allow for a good decision about whether or not to mitigate a property. **Testing makes the difference!**

Any changes to the earth or to the building can create new pathways for radon gas entry. The EPA, therefore, recommends that the lowest-occupied level of buildings be tested for radon concentrations every two years considering changes in the ground caused by weather, local construction activities, sudden breaks in underground rock, or seismic waves. It is also recommended that a property be tested for radon after it has undergone renovation activities.

Testing devices include passive radon testing devices and active radon testing devices.

Passive testing devices do not need power and include charcoal canisters, alpha-track detectors, charcoal liquid scintillation devices, and electret ion chamber detectors.

Active radon testing devices require power and include continuous radon monitors and continuous working level monitors.

Although testing with active radon devices costs more, they provide more data, including hourly readings and an average result for the test period. Whichever device is chosen, it is important to make sure that a qualified laboratory is providing the results.

There are two types of testing that can be performed **short-term testing** or **long-term testing**.

Short-term testing, depending on the device, can provide results within two to 90 days using charcoal canisters, an alpha track device, an electret ion chamber, a continuous radon monitor, or a charcoal liquid scintillation device.

Radon levels vary from day to day, season to season, and are impacted by weather conditions. A long-term test of more than 90 days using an alpha track device or an electret ion chamber would provide a year-round average.

If a year-round average is not needed or, if looking for quick results, they would want to perform the short-term test. If the short-term test results in an average close to 4 pCi/L, a second short-term or a long-term test may be

appealing prior to making a decision about mitigation. If the results of the short-term test far surpass 4 pCi/L, the owner may want to decide for the mitigation installation.

No matter which device is employed, consider these basic protocols when performing a radon test:

1. Follow the manufacturer's instructions or the protocols recommended by the testing laboratory.
2. For short-term testing, all windows and outside doors should be closed for the 12 hours prior to starting the test except for regular ingress and egress. They should remain closed during the testing period (except for regular ingress and egress).
3. Heating and air conditioning systems that re-circulate air should remain under normal operations.
4. Machines that bring in air from outside should not be operated.
5. Radon mitigation systems currently in place should be operated as normal.
6. Short-term testing should not be performed during severe storms or periods of high winds.
7. Testing should be performed in the lowest-occupied level and in a room that is regularly used. Testing should not be performed in a kitchen or bathroom.
8. The testing device should be placed at least 20 inches above the floor in a location where it will not be disturbed. It should be placed away from drafts, high heat, high humidity, and exterior walls.
9. Once the test is complete, it should be sealed and immediately sent to the laboratory. This is important because the radon trapped in the device will continue to decay.
10. Proper documentation sent with the device is also crucial to the timing. The exact start and stop dates and times should be noted since the laboratory will need to factor in the radon decay time.

The EPA recommends that the decision on a long-term or short-term testing be seriously scrutinized using the following thought-process:

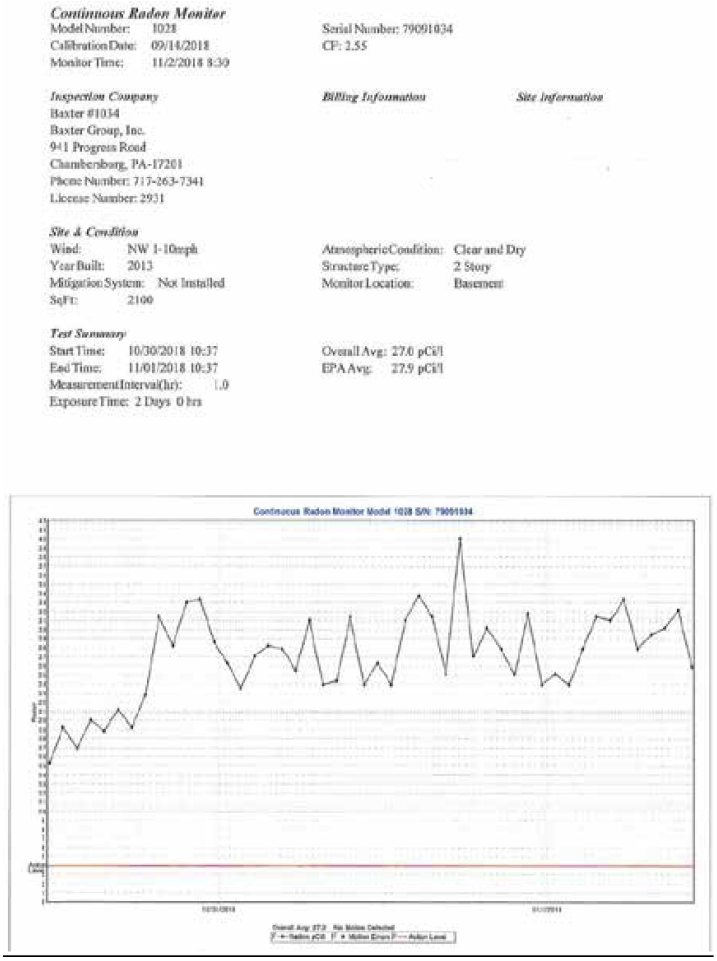
<u>Step 1:</u> Take a short-term test. If the results are 4 pCi/L or higher, take a follow-up test (Step 2) to be sure.

Step 2: Follow up with either a long-term test or a second short-term test: For a better understanding of your year-round average radon level, take a long-term test.

If you need results quickly, take a second short-term test.

The higher your initial short-term test result, the more certain you can be that you should take a short-term rather than a long-term follow up test. If your first short-term test result is more than 8 pCi/L, you should take a second short-term test immediately or decide to mitigate.

Step 3: If you followed up with a long-term test and the long-term test result is 4 pCi/L or more, then mitigate. If you followed up with a second short-term test, the higher your test results the more certain you can be that you should mitigate. Consider fixing, if the average of your first and second test is 4 pCi/L or higher.



Continuous Radon Monitor
Model Number: 1028
Calibration Date: 09/14/2018
Monitor Time: 11/2/2018 8:39
Serial Number: 79091034
CF: 2.55

Inspection Company
Baxter #1034
Baxter Group, Inc.
941 Progress Road
Chambersburg, PA-17201
Phone Number: 717-263-7341
License Number: 2931

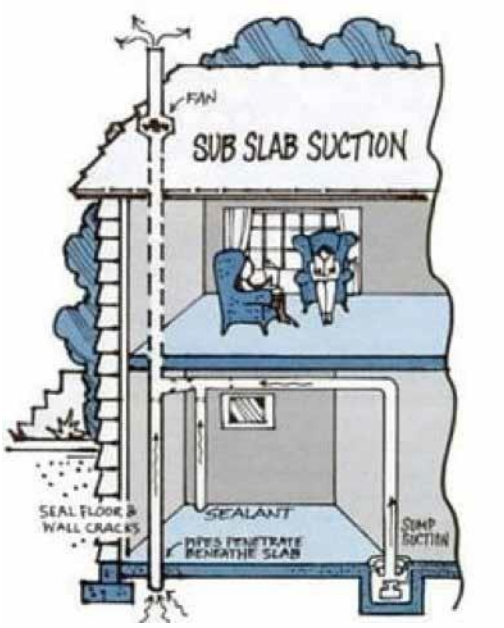
Billing Information

Site Information

Site & Condition
Wind: NW 1-10mph
Year Built: 2013
Mitigation System: Not Installed
SqFt: 2100
Atmospheric Condition: Clear and Dry
Structure Type: 2 Story
Monitor Location: Basement

Test Summary
Start Time: 10/30/2018 10:37
End Time: 11/01/2018 10:37
Measurement Interval(hr): 1.0
Exposure Time: 2 Days 0 hrs
Overall Avg: 27.0 pCi/l
EPA Avg: 27.9 pCi/l

RADON MITIGATION



Choosing the appropriate mitigation system depends on the design of the building, the foundation type, the ground composition, the geographical climate, and other factors. No matter the type of system, sealing cracks and openings should always be employed in conjunction with the system installation. This activity alone will not ensure continued reduction in radon levels, because the normal settling of a building opens new pathways and reopens old pathways for the entry of radon gases. Sealing cracks and openings, however, will limit the flow of radon into the building and will reduce the loss of conditioned air, making the radon mitigation system more effective.

During the pre-installation inspection, diagnostic tests may be performed to determine the best radon mitigation system and its best installation location(s). Small amounts of chemical smoke shot into cracks and openings can expose the pathways for radon entry and the direction of air flows. A soil communication test can be performed by drilling small holes in the slab and using a vacuum cleaner as suction at one hole while shooting chemical smoke above another hole. The smoke being drawn into the hole indicates that the gases are freely moving under the slab. In this case a sub-slab suction system could prove to be ideal.

An “active” system is one that is powered by electricity. A “passive” system is not. Passive systems are most often installed in new construction in such a way that, if the radon levels are found to be elevated, it can be converted to an active system.

For basement and slab-on-grade foundations, the most effective system has proven to be a sub-slab suction system. Other systems include the drain-tile suction, sump-hole suction, and block-wall suction types.

Typically, a hole is drilled into the slab to expose the gravel below. If there is no gravel, dirt is removed to allow better airflow. A four-inch PVC pipe is inserted into the slab and sealed. The PVC pipe is run to a height where it can exit the

building above ground level. In an active system, a fan is installed on the exterior of the building to draw the radon gas from below the slab, creating negative pressure like a vacuum beneath the slab. A passive system relies on the natural pressure differentials and air currents to draw the radon from below the slab. The PVC is continued up the side of the building until it exhausts above the building's roof. Additional suction pipes may be inserted into the floor and attached to the primary PVC, depending on how easily the air can flow from the gravel or soil under the slab and the concentration of radon. Other fan locations, depending on the design of the building, can include garage spaces and attics.

If the building currently has a water control system that includes drain tile or perforated pipe systems, suction on the pipe systems can be employed to reduce radon levels. If the building currently has a sump-pump to remove unwanted water, the sump can be capped to continue to draw water and serve as the location for the PVC radon suction point. If the building has a hollow block foundation wall, the suction can be placed in the wall to depressurize it similar to sub-slab suction. This system can also be used in conjunction with a sub-slab suction, which has proven to be the most successful system.

For the most effective radon mitigation system in a crawlspace without a slab, installation of a vapor barrier is recommended. High-density poly sheeting is sealed from the top of the walls and across the crawlspace floor. A vent pipe and fan are then used to draw the radon from under the sheeting to above the roof.

Less-effective systems include an active crawlspace depressurization system, ventilating the crawlspace. This involves drawing air directly from the crawlspace with a fan. To be effective, the crawlspace must be sealed from other portions of the building and care must be taken to avoid back-drafting of combustion appliances. Ventilating the crawlspace passively or actively with a fan includes opening or installing vents and using a fan to blow air through the crawlspace. When using this system, water pipes, sewer lines, and other system appliances will need to be insulated against the cold. Both of these systems may cause an increase in energy costs. There is also the concern of introducing moisture to the crawlspace, which could lead to issues with mold.

Building pressurization is a system that uses a fan to blow air into the basement or lower level from either outside or upstairs. The goal with this system is to create enough pressure in the lowest level of the building to

prevent radon from entering. To maintain the building pressure, windows must remain shut at all times and doors must only be opened during regular ingress and egress. Moisture intrusion is a concern with this system, which could lead to high humidity and mold issues.

Air-to-Air heat exchangers known as Heat Recovery Ventilators (HRV) may be installed to increase ventilation to reduce radon. These systems introduce outdoor air while using the heated or cooled indoor air being exhausted to warm or cool the incoming air. They are designed to ventilate all or a portion of the building. When properly balanced and maintained they can improve the air quality and ensure a constant degree of ventilation throughout the year. These systems tend to produce a significant increase on the heating and cooling costs.

Soil suction radon mitigation systems have proven to be the most effective system in reducing radon levels in buildings. They do not require major changes to the building and can include monitoring systems that indicate it is operating properly.

No matter which system is used, post-mitigation testing should be performed to confirm that the radon levels have been reduced below the EPA's recommended level of 4 pCi/L. If the system has not done so, it can be modified. The EPA further recommends that the environment be retested every two years. New radon entry paths can be created by local construction work, interior renovations, the building settling, or minor seismic activity.

HIRING A CONTRACTOR

A homeowner is permitted to install a radon mitigation system without any professional licenses or certifications. However, they do need to check with their local agencies to determine if any permits are required. The EPA recommends a qualified radon mitigation contractor be retained to install or fix radon mitigation systems, because lowering high radon levels requires specific technical knowledge and skill. Some states require that contractors installing systems have a state license or certification. Since 1985, a radon proficiency program has been in effect nationally for both radon testing and radon mitigation installation. For a radon contractor to become certified or licensed by their state, they must complete a comprehensive initial training course, pass a competency exam, perform regular quality assurance practices and procedures, submit proof of annualinstrument calibrations and performance evaluations, fulfill relevant continuing education requirements, and re-certify every two years. To find a qualified radon contractor, contact your state radon office or one of the radon proficiency programs:

- State Radon Office
- National Radon Proficiency Program
- National Radon Safety Board

Selecting a radon contractor should be handled the same as selecting any contractor:

- Get multiple estimates,
- Ask for references,
- Contact the references, and
- Compare the proposed estimates and the proposed systems.

Remember, a less expensive system may cost more to operate and maintain, may have less cosmetic appeal, or may be made from a lower quality building material. Cost and design need to be taken into consideration.

Sharing information will help in deciding on the right contractor and the right system for your building.

Ask questions of the contractors:

- Will the contractor provide post-mitigation test results to confirm the radon mitigation system is reducing radon levels to 4 pCi/L or less?
- Can the contractor explain what will be involved in the installation of the system, how the system works, and how it will be maintained?
- Did the contractor inspect your building, its structure, and its specific features to design a system and estimate?
- Will diagnostic tests need to be performed to develop the best radon reduction system?

Does the proposal or estimate include the following:

- Proof of certification or professional proficiency
- Proof of liability insurance
- Proof of all necessary licenses to satisfy local requirements
- A diagram of the installation location and design of the mitigation system
- Installation of a warning device to caution if the radon mitigation system is not working correctly
- Testing after installation to confirm the radon mitigation system works
- A guarantee to reduce radon levels to 4 pCi/L or below

Does the contract include:

- The total cost, including taxes, permit fees, amount of deposit, and when payment in full is due
- The time needed to complete the work
- An agreement that the contractor will obtain necessary permits and follow required building codes
- Evidence of liability insurance to protect persons in case of injury or damage to property
- A guarantee that the contractor will be responsible for damage during the job and cleanup after the job
- Details of any guarantee to reduce radon below a negotiated level
- Details of warranties or other optional features associated with the hardware components of the mitigation system
- A declaration stating whether any warranties or guarantees are transferable if you sell
- A description of what the contactor expects the homeowner to do, such as make the work area accessible, before work begins

Then check the contractor's work upon completion:

- Is the radon mitigation system clearly labeled to avoid accidental changes to the system that could impact its ability to properly function?
- Do the exhaust pipes vent above the surface of the roof, 10 feet or more above the ground at least 10 feet away from windows, doors and other openings, and at least two feet above these openings?
- Is the exhaust fan located in or below a livable area? *It should not be.*
- Does the exterior exhaust fan meet local building codes for exterior use?
- Are electrical connections installed to local electrical codes?
- Is the warning device to alert if an active system stops working placed where it can be seen or heard easily?
- Were post-mitigation radon tests taken within 30 days of the system installation but no sooner than 24 hours after the beginning of operation?

- Did the contractor completely explain the radon mitigation system, demonstrate how it operates and explain how to maintain it? Did they leave written operating and maintenance instructions and copies of any warranties?

By asking these questions before, during, and after the installation process, you and the contactor can have a positive and productive experience.

MAINTAINING THE RADON MITIGATION SYSTEM

One of the most important factors in maintaining a radon mitigation system is calendaring a re-test of the environment every two years. As discussed before, many factors can change the pathways for radon entry into a property. The only way to know for sure that the environment continues to be safe from radon is to test.

With an active radon mitigation system, check the system periodically to confirm that the fan is running and the warning device indicates that the system is operating properly. The fan should never be turned off.

With an HRV system, filters require regular cleaning and should be changed every two years. Fresh-air vents should be inspected for debris, and ventilators should be checked annually by a qualified HVAC contractor to confirm it is properly balanced.

INSTALLATION & OPERATING COSTS

The installation costs are dependent on the design of the building and the extent of the radon problem. Costs are significantly lower if a passive system was properly installed during construction. Average costs associated with the installation of a radon mitigation system in a ranch style home range from $800 to $2,500.

Operating costs vary depending on the operating system, the building size, the foundation type, whether or not there is some loss of conditioned air during operations, and the geographical climate. Sub-slab systems that use fans are more effective in reducing radon levels but cause a slight increase to the electric bill.

INSTALLATION & OPERATING COST TABLE

Technique	Typical Radon Reduction	Comments
Subslab Suction (Subslab Depressurization)	50 to 99 percent	Works best if air can move easily in material under slab.
Passive Subslab Suction	30 to 70 percent	May be more effective in cold climates; not as effective as active subslab suction.
Draintile Suction	50 to 99 percent	Can work with either partial or complete drain tile loops.
Block-Wall Suction	50 to 99 percent	Only in homes with hollow block-walls; requires sealing of major openings.
Sump-Hole Suction	50 to 99 percent	Works best if air moves easily to sump from under the slab.
Submembrane Depresserization in a Crawlspace	50 to 99 percent	Less heat loss than natural ventilation in cold winter climates.
Natural Ventilation in a Crawlspace	0 to 50 percent	Costs variable.
Sealing of Radon Entry Routes	See Comments	Normally only used with other techniques; proper materials and installation required.
House (Basement) Pressurization	50 to 99 percent	Works best with tight basement isolated from outdoors and upper floors.
Natural Ventilation	Variable/Temporary	Significant heated or cooled air loss; operating costs depend on utility rates and amount of ventilation.
Heat Recovery Ventilation (HRV)	Variable/ See comments	Limited use; effectiveness limited by radon concentration or the ammount of ventilation air available for dilution by the HRV. Best Applied in limited-space areas like basements.
Private Well Water Systems: Aeration	95 to 99 percent	Generally more efficient than GAC; requires annual cleaning to maintain effectiveness and to prevent contamination; requires venting radon to outdoors.
Private Well Water Systems: Granular Activated Carbon, or GAC	85 to 95 percent	Less efficient for higher levels than aeration; use for moderate levels, around 50,000 pCi/L or less in water: radioactive radon by-products can build on carbon; may need radiation shield around tank and care in disposal.

RADON IN WATER

The main source of radon in buildings is the soil around and under the building. However, radon in water supplies can pose an inhalation risk as well as an ingestion risk. Research has shown that the risk of lung cancer from radon is much greater than the risk of stomach cancer from swallowing water contaminated with radon. The major risk from water contaminated with radon is from the release of radon into the air when the water is in use, such as running sink water, spraying down floors, or showering.

The source of water contaminated with radon is typically private wells or public water supplies that use ground water. Public water suppliers test water regularly and can supply those test results upon request. Testing private wells

is quite simple: either hire a testing contractor or order the test kit from a laboratory. The laboratory will send a special collection cup. A water sample is collected as per the laboratory's instructions with no air bubbles or head space and then immediately returned to the lab for analysis.

The water supply system can then be treated with either a point-of-entry system or a point-of-use system. The point-of-use system treats only the water used where the system is installed, such as at the tap, and is ineffective in reducing the radon released into the air from other water uses in the building. A point-of-entry system is the preferred treatment since it removes radon from the water before it enters the property. These systems consist of either a granular activated carbon (GAC), filters, or aeration systems. There are pros and cons with all systems that are impacted by the design and use of the building.

RADON AND REAL ESTATE

Sellers often fear the potential buyer question, "Do you have radon?" The best answer is an answer other than "I don't know." More and more buyers and renters are asking this question, so it is best to know. If handled correctly, having a radon measurement and, if needed, a radon mitigation system installed, can enhance the real estate transaction - especially if the seller and the buyer want a quick close to the deal.

If a seller waits to test for radon, they can be faced with several negative consequences. The buyer requests a test and fix and the seller is asked to pay for it. The sale is delayed awaiting testing and mitigation and then post- testing. If the seller or agent discourages a test once it's been requested, they may open themselves up to liability for future illnesses.

The best solution for the seller, the buyer, and the agents involved is to test for radon NOW and save the test results to pass on to the other parties as part of the real estate transaction. Buyers quite often want test results from a third-party professional so that they can better trust the results. When performing a radon test in anticipation of a potential building sale, it is recommended that the area tested not be the lowest-occupied area, but the lowest-potentially-occupied area, in case the buyer is considering renovations.

For residential real estate transactions, consult the EPA's *Home Buyers and*

Sellers Guide to Radon for further recommendations. If buying a home not yet constructed, consult the EPA document entitled *Building Radon Out* for details on radon-resistant homes.

RADON AND RENOVATIONS

Renovations, particularly structural renovations, can have a huge impact on the pathways for radon entry. Using radon-resistant techniques as outlined in the next section (*Radon-Resistant Building In New Construction*) should be employed. Even if the property was not tested for elevated radon concentrations, using radon-resistant building techniques can save future contaminations should the soil around the building be impacted in any way.

If a new foundation or building addition is to be installed, using radon-resistant techniques is highly recommended and may save expenses associated with mitigation in the future.

Once renovations are completed, the area should once again be tested for radon concentrations. Radon gases choose the easiest pathways to enter an indoor environment. Those pathways could have been created by the renovations.

RADON-RESISTANT BUILDING IN NEW CONSTRUCTION

Simple radon-resistant features and building techniques employed properly and completely can reduce radon levels significantly. These features and techniques are inexpensive and add value to the property, are easier to install at the time of construction, and … **SAVE LIVES!**

The initial radon mitigation system is typically a passive system that is established to easily transition to an active system if radon levels are at or above 4 pCi/L.

Contractors responsible for new construction of homes and buildings are finding that by employing radon-resistant features in their construction practices, they are attracting more potential buyers and closing more sales. One in every six homes are being built with radon-resistant features. We find ourselves in a time where the public has become highly aware of the impact that our indoor

environment has on our overall health. The demand has increased for not only energy-efficient construction but healthy, environmentally friendly buildings. Radon-resistant features reduce and inhibit the pathways for radon entry as well as for moisture, molds, methane, pesticide gases, volatile organic compounds (VOCs), and other indoor air quality contaminants.

Radon-reducing techniques in new construction are very basic. First, install a sub-slab or sub-membrane depressurization system with the objective of creating a vacuum beneath the foundation. The soil gases that accumulate beneath the foundation of the building are vented to a safe location outside the building.

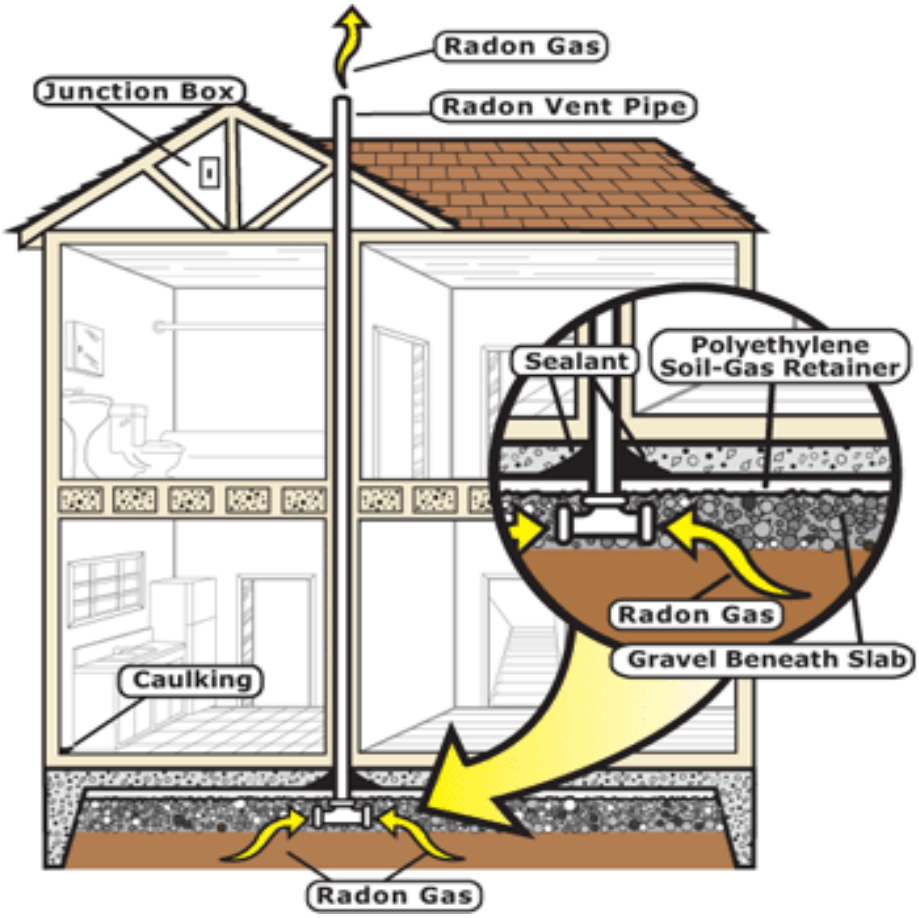
Mechanical barriers are employed to eliminate pathways for soil gas entry. Poly sheeting under the foundation, sealing the foundation, and caulking all openings can serve as barriers to soil gas pathways. Sealing and caulking reduce the negative pressure in the lower levels of the building, therefore reducing the "stack effect."

All ductwork and air-handling units in the basement, crawlspace, and lower levels of the building should be sealed to prevent air from being drawn into the systems. Ducts with no areas that need sealed are preferred in the crawlspaces and beneath the slabs.

Radon-reducing features in new building construction would include:

- **Gas permeable layer** – four-inch layer of clean, coarse gravel under the slab to allow the soil gas to move freely underneath the building. Consider whether or not installing a loop of perforated pipe would enhance this feature.
- **Poly sheeting** – placed on top of the gas permeable layer to help prevent the soil gas from enter the building and keeps the concrete from clogging the gas permeable layer when the slab is poured.
- **Vent pipe** – four-inch PVC runs from the gas permeable layer through the building and roof to safely vent soil gases above the building.

- **Electrical junction box** – wired in case an electric venting fan is needed later to activate the system.



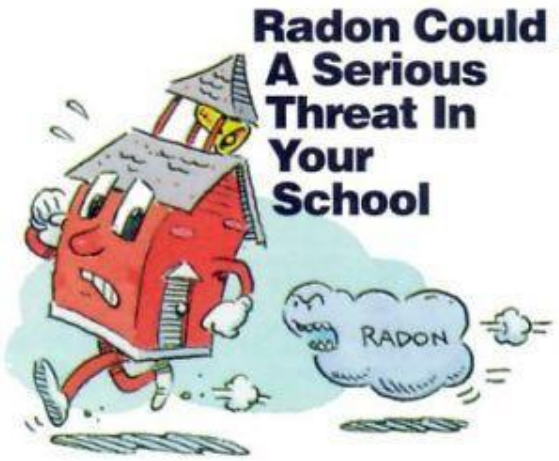
- **Sealing and caulking** – all openings in the foundation floor to prevent soil gas from entering. Sealing and caulking the rest of the building envelope reduces the "stack effect." Keep in mind that sealing large cracks and openings is important, but research has shown that attempting to seal all of the openings is both impractical and ineffective as a stand-along technique.

See the EPA's publication *Building Radon Out – A Step-by-Step Guide on How to Build Radon-Resistant Homes* for more details.

RADON IN SCHOOLS & COMMERCIAL BUILDINGS

The most crucial buildings that need tested for radon are our homes. We spend more time in our homes, averaging 16 breaths per minute when resting and 12 to 20 breaths per minute while sleeping. These are many opportunities for inhaling radon gas.

Consider next where else we spend a significant amount of time: as adults, our workplaces; as children, our schools. Both become a concern. A nationwide survey of radon in schools estimates that one in five schools has a least one classroom at 4 pCi/L or greater. That's 70,000 schoolrooms.



Many schools have followed the EPA's recommendation to test for radon as a part of an effective Indoor Air Quality Management program. The EPA's Indoor Air Quality Management Program outlines an entire strategy for successful indoor air quality management and control of radon exposure.

A successful program starts by connecting administrators and facilities managers with radon professionals. They partner with parents, health departments, and industry organizations to build understanding, trust and support. Using the EPA's *IAQ Tools for Schools Action Kit* they can tie their goals for radon testing with other indoor environmental goals and activities. A team can be assembled to plan for the radon testing and, if needed, radon mitigation system installations. This team would design standard operation procedures (SOPs) and work with radon professionals and other building system professionals to develop testing and mitigation protocols and action steps.

The team would take on the responsibility of communicating with all who may be impacted to keep them abreast of the program plan, embracing full transparency.

Radon assessments would be performed in conjunction with all other indoor air quality protocols. A plan would be developed, working in stages to identify action steps, scheduling the testing plan, and to obtain guidance from the radon professionals and the building system professionals to propose the best mitigation systems for the design of the school building(s). The program would

then go through a regular evaluation for continuous improvement and ongoing quality management.

For more information, visit www.epa.gov/radon/radon-schools.

CONCLUSION: IN THE NEWS

An excerpt from **The Spokesman-Review**, Sunday March 8, 2009, by John Stucke:

As Debbie Greenman lay on her stomach, the doctor pushed a needle through her back to extract a bit of lung tissue.

She was nervous yet confident about the biopsy.

"I thought, 'No way. This can't be happening to me. I have never smoked. My parents never smoked. I'm a runner.' So what happened was just completely unexpected," said the third-grade teacher at Evergreen Elementary in north Spokane. . .

Greenman calls herself lucky. Physicians caught her cancer early, at stage 1, while running routine tests in preparation for an unrelated surgery.

It didn't take them long to find ominous spots on the lower lobe of her left lung in a chest X-ray.

So five days after Christmas, surgeons cut it out, reducing her lung capacity by 20 percent. She now uses an incentive spirometer that measures how well the lungs fill with each inhalation.

Though she acknowledges that she will never know what caused her cancer, radon gas is a suspect.

It didn't take her long to reach a best-guess conclusion. When doctors told her about the cancer, she did what anyone stricken with a surprise illness would do: "I began to research on the Internet."

She learned from the American Lung Association and the American Cancer Society Web sites that radon causes lung cancer. She dug deeper, found corroborating scientific materials published by federal health and environmental experts. So she drove to the local hardware store, bought an $8 test kit, set it up in a few minutes and waited.

She sent the kit to the test lab. On the same day surgeons were cutting away part of her lung, lab workers in Florida were analyzing her radon kits.

When she was well enough to go home, she opened her e-mail and read the results.

Greenman would have gasped, but her lungs were too weak. The radon levels from two basement bedrooms showed 214.5 and 193.4 picocuries per liter.

"I thought maybe they had the decimal point wrong," she said. The EPA considers 4 picocuries per liter dangerous enough to take action. A picocurie is a measurement of radioactivity units.

With the levels at her house "off the chart," Greenman promptly moved with her husband, Jerry, into the Deer Park home of her parents – Clarence, a former nuclear engineer at Hanford, and Wanda Kassens.

David Gerard, of Advanced Radon Technologies Inc., arrived at the Greenman home skeptical of the numbers. He has helped engineer and install radon mitigation systems in the region for years.

Rarely has he seen a reading that high.

So he set up more sophisticated equipment at the home on Deer Lake north of Spokane. It was built in 1998 with a system that was supposed to vent the radon out of the house.

His tests came back showing picocurie levels of 250.

He began running more tests and determined that the Greenman home was built wrong when it comes to radon. It was a trap.

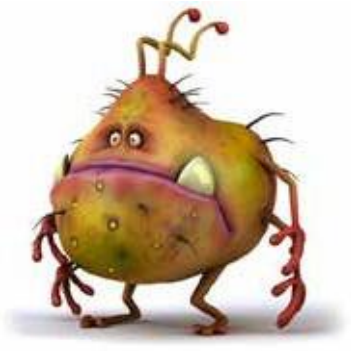
This past week he finished installing a system of pipes that will collect the radon and blow it out of the home using a fan.

Greenman has said she won't move back in until plenty of tests are run that prove the home is safe.

The EPA dedicates the entire month of January to RADON AWARENESS. By employing the simple rule to our property management strategies – TEST and FIX - we can be responsible for saving the lives of those who rely on us for safe and healthy indoor environments.

Chapter Two
The Miracle Mineral – Asbestos!

Published February 2019



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ASBESTOS MYTHS & FACTS

MYTH: Asbestos is no longer a problem in the U.S.
FACT: *American Journal of Respiratory and Critical Care Medicine* reported in its September 2004 issue that asbestos is still a hazard for 1.3 million US workers in the construction industry and for workers involved in the maintenance of buildings and equipment.

MYTH: Asbestos has been banned from use in the U.S.
FACT: On July 12, 1989, the EPA issued a final rule under Section 6 of
The Toxic Substances Control Act (TSCA) banning most asbestos-containing products in the U.S. In 1991, the rule was vacated and remanded by the Fifth Circuit Court of Appeals. Most of the original ban on the manufacture, importation, processing, or distribution in commerce for most of the asbestos-containing product categories originally covered in the 1989 final rule was overturned.

MYTH: If an asbestos-containing material gets disturbed, vacuuming it up will resolve any issues.
FACT: Asbestos fibers can be small enough that they cannot be seen, can linger in the air for up to 72 hours, and can penetrate even the best vacuum bags.

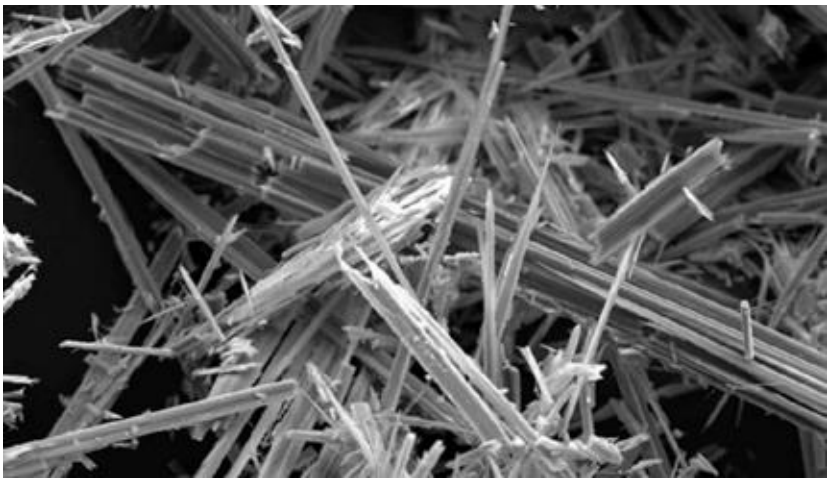
MYTH: An asbestos survey is not required if the building was constructed after 1980.
FACT: An asbestos survey is always required before the renovation or demolition of a building.

MYTH: Construction materials produced after 1980 do not contain asbestos.
FACT: Most asbestos containing products can still be manufactured, imported, processed and distributed in the U.S.; however, the production and use of asbestos has declined significantly.

INTRODUCTION

Considered at the time one of the most miraculous minerals ever discovered, asbestos fibers, when added to materials, make materials more resistant against intense heat, fire, chemical corrosion, water and electricity. It is high in tensile strength, absorbs sound, is flexible and durable, as well as relatively inexpensive. Most industries found benefits to adding it to its products because of these characteristics.

In the early 1900s, asbestos was added to our construction material, roofing materials, automotive components, automobile brakes, clothing, insulation, potting soils, steam engines, turbines, boilers, ovens and electrical generators, fire curtains, cement products, friction products, wire insulation, floor tile, mastics, and glues.



Looking through history, it is astonishing to see all the uses of asbestos over time. It is believed that as early as 4000 BC, long hair-like asbestos fibers were used for wicks in lamps and candles, allowing them to burn longer.

Between 2000-3000 BC, embalmed bodies of Egyptian pharaohs were found to be wrapped in asbestos cloth, protecting their bodies from deterioration. Europeans made clay pots containing asbestos fibers as early as 2500 BC, strengthening the pots and making them resistant to heat.
Romans wove asbestos fibers into their tablecloths and napkins. They could then clean them by throwing them into a fire, from which they came out

clean and white. Around 755 AD, the king of France had a cloth made of asbestos to be used against the accidental fires that frequently occurred during

feasts and celebrations. In 1095 AD, knights of the First Crusade used a catapult to fling flaming bags of tar wrapped in asbestos bags at their enemies. Displayed in London's Natural History Museum is a gift brought to England by Benjamin Franklin in 1725: a purse made of fireproof asbestos. In the 1800s the Italian government used asbestos fibers in its bank notes.

Asbestos mining and manufacturing became a flourishing industry during the late 1800s. During the Industrial Revolution the practical and commercial uses of asbestos became widespread. The pliable properties of asbestos made it an important binding and strengthening commodity for the manufacture of a limitless number of products. By the early 1900s, asbestos production had grown to 30,000 tons annually worldwide. While men worked in the mines, women and children were added to the asbestos workforce to prepare and spin the raw asbestos fibers.

Hollywood took advantage of the white, fluffy, fire-resistant fibers of asbestos as a "safe" alternative to the use of cotton during film productions. Products produced under the titles of "White Magic," "Pure White," and "Snow Drift" simulated real snow on the film sets and decreased the amount of fire hazards. The snow in famous poppy field scene in the 1939 MGM film "The Wizard of Oz," in which Dorothy fell asleep, was 100% chrysotile asbestos. The Wicked Witch's broom and the Scarecrow's outfit was also made from asbestos. In 1946, the snow that fell throughout the movie "It's a Wonderful Life" starring Jimmy Stewart was also manufactured asbestos.

Asbestos mining spiked in the 1960s and 70s with dozens of mines and plants in the U.S. The last active asbestos mine in the U.S., the King City Asbestos Company in California, did not close until 2002.

Hints that asbestos may have serious health effects dot throughout history. Medical evidence became strong in the 1930s that asbestos exposure could lead to lung diseases, but the Federal Government did not pass legislation limiting exposure until the 1970s.

If you were to ask building owners, property managers, facilities managers, and realtors today what year the U.S. banned asbestos, you would hear a dozen different dates. But the reality is that most asbestos bans have been vacated. This is why the EPA requires asbestos surveys prior to renovation or demolition of buildings regardless of its construction date.

WHAT IS ASBESTOS?

Asbestos is a naturally occurring mineral found in most countries. There are six types of asbestos: chrysotile, amosite, crocidolite, anthophyllite, tremolite, actinolite. Chrysotile has been the most widely used in the U.S.; Anthophyllite, tremolite, actinolite are rarer.

Products are considered Asbestos-Containing Material (ACM) when the material contains greater than 1% asbestos. Asbestos is described as either friable ACM or non-friable ACM: Friable ACM can be pulverized, crumbled or reduced to powder by hand pressure when dry; non-friable ACM cannot, though under certain conditions, its asbestos can become friable.

RECENT HISTORY OF ASBESTOS USE & REGULATONS

- **1900** World production of asbestos reached approximately 35,000 metric tons.
- **1910** World production of asbestos exceeded 109,000 metric tons.
- **1922** The U.S. Navy began requiring all asbestos workers to wear respirators.
- **1930** The U.S. began using asbestos-laced asphalt in the roads and continued to do so until the 1950s.
- **1972** The EPA banned the manufacture of sprayed-on insulation and fireproofing. OSHA established the first set of permanent asbestos regulations.
- **1973** Consumption of asbestos peaked in the U.S. at 804,000 tons; EPA banned application of sprayed-on material for fireproofing, insulation, etc.
- **1975** EPA banned molded and wet applied asbestos.
- **1976** EPA banned ACM for mechanical system insulation. 1978 EPA banned acoustical and decorative applications
- **1980** A dramatic decline began in the use of asbestos throughout the world. The public recognized the connection between asbestos exposure and debilitating lung diseases. Organized labor and trade

unions demanded safer and healthier working conditions.
- Liability claims against major asbestos manufacturers caused them to make and market asbestos substitutes.
- **1989** EPA banned multiple types of non-friable asbestos to be phased out in three stages by 1997.
- **1991** The US Fifth Circuit Court of Appeals set aside much of the 1989 original rule. The original 1989 EPA ban on the US manufacture, importation, processing or distribution in commerce of many asbestos-containing product categories did not take effect.
- **1993** Restrictions clarified by EPA following regulatory impact analysis

Six asbestos-containing product categories still subject to the asbestos ban include:

- Corrugated paper
- Roll board
- Commercial paper
- Specialty paper
- Flooring felt
- New uses of asbestos

Products not banned – YES, asbestos-containing product categories no longer subject to the 1989 TSCA ban include:

- Asbestos-cement
- Corrugated sheet
- Asbestos flat sheet
- Asbestos clothing
- Pipeline wrap
- Roofing felt
- Vinyl-asbestos floor tile
- Asbestos-cement shingle
- Millboard
- Asbestos-cement pipe
- Automatic transmission components
- Clutch facings
- Friction materials
- Disc brake pads
- Drum brake linings
- Brake blocks

  - Gaskets
  - Non-roofing and roof coatings

- **1999** 7,190 metric tons of asbestos sold or used by producers in the U.S.
- **2002** The last asbestos mine in the U.S. closed.
- **2003** Asbestos was partially or fully banned in Argentina, Austria, Australia, Belgium, Chile, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Poland, Sweden, Switzerland, Saudi Arabia, and the United Kingdom.
- **2005** Asbestos was banned throughout the European Union.
- **2016** OSHA enacts a new standard regulating the text requirements for asbestos signs and labels in areas where asbestos removal is present and where containers holding asbestos are stored.
- **2018** EPA announced that it would consider new uses of asbestos.

ASBESTOS IS STILL NOT BANNED IN THE U.S.!

HEALTH EFFECTS OF ASBESTOS EXPOSURE

In the Middle Ages, it was called "Slaves Disease," a disease that seemed to impact the lungs of the slaves working in the mines.

An 1898 report regarding the asbestos manufacturing process in England cited "widespread damage and injury of the lungs, due to the dusty surrounding of the asbestos mill."

The first documented death of an asbestos worker from pulmonary failure associated with asbestos was recorded in 1906 at London's Charring Cross Hospital. An autopsy revealed large amounts of asbestos fibers in the 33-year-old man's lungs.

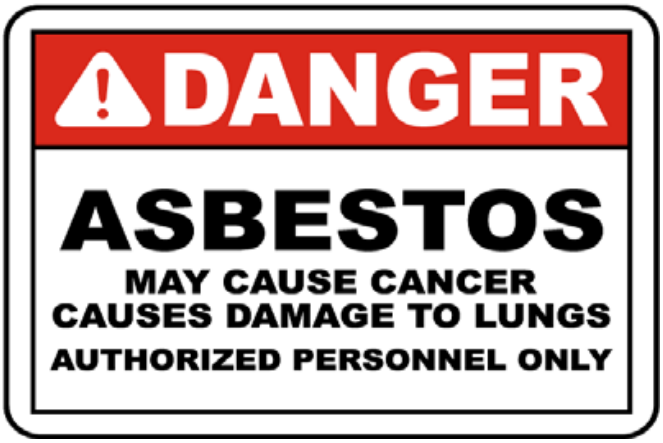
In the early 1900s, reports of deaths from a "fibrosis" among asbestos plant workers surfaced throughout Italy, France, and the U.S. The reports suggested that asbestos workers were dying unnaturally young.

In 1908, insurance companies in the U.S. and Canada began increasing premiums and reducing coverage to insure workers in the asbestos industry.

The initial wave of asbestos-related diseases was documented among the asbestos mine workers, namely: mesothelioma, what is now known as asbestosis, and lung disease. The second wave included the wives and children of the miners. Imagine a young wife, going through her daily housekeeping chores, picking up an armload of her husband's work clothes covered in the dirt of the mine, inhaling the fibers as she washed them one-by-one.

Many major diseases are associated with asbestos. Cancer of the lungs was the most prevalent. Smoking was very popular in the late 1800s and early 1900s. Smoking and working in the asbestos industry multiplied the risk of developing lung cancer. During this era, a typical asbestos worker used minimal or no respiratory protection and had a probability of developing lung cancer five times greater than a non-asbestos worker. A smoking asbestos worker had a probability of developing lung cancer 22 times greater than his non-smoking

counterpart. A smoking asbestos worker had a probability of developing lung cancer 90 times greater than a non-smoking, non-asbestos worker.



Mesothelioma is a cancer of the chest lining and abdominal cavity, known as the pleural lining. The pleural lining protects the lungs and digestive organs from friction. Asbestos fibers cause tumors in this lining. Life expectancy after diagnosis is typically six months to two years.

Asbestosis can only be caused by exposure to asbestos and is associated with high levels of exposure over long periods of time. Asbestos fibers cause extensive scarring to the lungs, which reduces the lung capacity. In severe cases, asbestosis can lead to death.

Digestive system cancer was caused by digesting asbestos fibers and is the rarest of the diseases.

The risk factors associated with developing these diseases depend on the size of the fibers inhaled, the length of exposure to asbestos fibers, the density of the asbestos dust and fibers, whether or not the person smokes, and the individual's personal susceptibility to disease.

WHEN TO BE CONCERNED ABOUT ASBESTOS IN A BUILDING

Asbestos-containing materials (ACM) do not become dangerous until they are disturbed, damaged, or deteriorated to the extent that asbestos fibers are released into the air where they can be inhaled. Generally, material in good condition will not release asbestos fibers.

Buildings containing ACM should be inspected regularly for signs of wear, deterioration, water damage, tears, abrasions and to confirm that the ACM is not being exposed to handling, vibrations, or air flow. If any deterioration or damage is found, access to the area should immediately be limited and an asbestos professional retained to address the issue.

ASBESTOS DO's & DON'Ts

- **DO** limit activities in any areas with damaged material that may contain asbestos.
- **DO** take every precaution to avoid damaging asbestos-containing material.
- **DO** have removal and major repair done by people trained and qualified in handling asbestos. It is highly recommended that sampling and minor repair also be done by asbestos professionals.
- **DO** clean the floors in areas with ACM with a wet mop. If the area contains a large quantity of damaged ACM, call an asbestos professional.
- **DO** remove dust by wet mopping or with a HEPA vacuum cleaner.
- **DON'T** dust, sweep, or vacuum debris that may contain asbestos fibers. This practice will release them in the air.
- **DON'T** saw, sand, scrape or drill holes in asbestos materials.
- **DON'T** use abrasive pads or brushes or power strippers to strip wax from asbestos flooring. Never use a power stripper on a dry floor.
- **DON'T** sand or try to level asbestos flooring or its backing.
- **DON'T** track material that could contain asbestos through the building.

WHERE IS ASBESTOS FOUND IN BUILDINGS?

- Steam pipes, boilers, and furnace ducts
- Boilers insulated with an asbestos blanket
- Pipes insulated with asbestos paper tape
- Resilient floor tiles, the backing on vinyl sheet flooring, and adhesives used for installing floor tile
- Cement sheet, millboard, and paper used as insulation around furnaces and woodburning stoves
- Door gaskets in furnaces, wood stoves, and coal stovesSoundproofing
- Decorative material sprayed on walls and ceilings
- Patching and joint compounds for walls and ceilings
- Textured paints
- Cement roofing, shingles, and sidingFireproof cloves
- Stove-top pads
- Ironing board coversHairdryers
- And so much more …

HOW TO IDENTIFY ASBESTOS-CONTAINING MATERIALS

You cannot simply look at building material and know if it contains asbestos unless it has been properly labeled. The most common method to identify asbestos-containing material is to have a bulk sample analyzed using a Polarized Light Microscope (PLM) or a Transmission Electron Microscope (TEM). Until a building component has been identified as asbestos containing, it should be treated as though it is.

Polarized Light Microscopy is primarily used to identify asbestos in bulk samples of building materials. The light microscopy technique utilizes the polarized light to observe minerals' specific optical properties. The lab technician can differentiate asbestos from non-asbestos fibers and classify the various types of asbestos.

Transmission Electron Microscopy is the recommended method for floor tile, mastic, and asphalt roofing materials. This technique transmits a beam of electrons through a specimen to form an image at a significantly higher resolution than light microscopes.

The current methods employed for both of these analysis procedures are found in the EPA 600/R-93/116, NIOSH 9002, and OSHA ID 191.
Accreditation is required through the National Voluntary Laboratory Accreditation Program (NVLAP).

ASBESTOS MANAGEMENT

Anyone responsible for a building that has asbestos-containing material within its makeup should ideally have an asbestos management plan in place. This plan can prevent the occupants of a building from exposure to asbestos fibers during maintenance, renovation, or demolition activities.

First, retain a Licensed Asbestos Inspector to perform an asbestos survey of the building who would then provide a document entitled "Asbestos Survey" that identifies the location and condition of all asbestos-containing material in the

building. Then protocols can be established for an Operations and Maintenance Program, an Asbestos Surveillance Program, and any renovation projects that could disturb the asbestos-containing materials.

Within in the Asbestos Surveillance Program, establish periodic inspections to assess the condition of the asbestos, address issues of deterioration or damage, and schedule any response that may be warranted. When minor damage is identified, repairs or clean up can be scheduled. An asbestos abatement project can be planned when major damage is identified. The procedures protect the occupants from asbestos exposure.

Repairs usually involve either sealing the asbestos material to bind the asbestos fibers together so they cannot be released or enclosing the material to capture any fiber release within the enclosure. Repairs are typically cheaper than asbestos removal or abatement; however, repairs may make removal more expensive if the components can no longer be repaired.

ASBESTOS ABATEMENT REGULATIONS

The asbestos abatement industry is heavily regulated by the U.S. Federal Government, the U.S. Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), each state's specific environmental department or agency, and local municipalities.

A private homeowner may remove asbestos-containing materials from their home without a license or training. It is essential to their personal well-being and the well-being of their family and other building occupants that they follow the methods and procedures of a trained asbestos abatement contractor so as not to expose themselves or others to the release of asbestos fibers.

Reminder: *Do not dust, sweep, or vacuum debris that may contain asbestos. Remove dust by wet mopping or with a HEPA vacuum cleaner.*

A private homeowner performing their own asbestos removal on the home in which they personally live is the only situation exempted from specialized training and licensing. Asbestos abatement, inspections, monitoring, surveillance, and laboratory analysis are all regulated to protect the health and safety of building occupants and asbestos workers.

The EPA has the following regulations which impact the Asbestos Abatement industry:

- AHERA - EPA Asbestos Hazard Emergency Response Act
- AIA- EPA Asbestos Information Act
- ASHARA - EPA Asbestos School Hazard Abatement Reauthorization Act
- CAA - EPA Clean Air Act
- SDWA - EPA Safe Drinking Water Act
- CERCLA - The Comprehensive Environmental Response, Compensation and Liability Act
- TSCA - Toxic Substance Control Act
- 40 CFR Part 763, Subpart E - Asbestos-Containing Materials in Schools Rule
- 40 CFR Part 763, Subpart G - Asbestos Worker Protection Rule
- 40 CFR Part 763, Subpart I Asbestos Ban and Phaseout Rule
- 40 CFR Part 61 - Asbestos National Emission Standard for Subpart M Hazardous Air Pollution (NESHAP)

Other agencies with Asbestos Regulations include Occupational Safety and Health Agency (OSHA), the Consumer Product Safety Commission (CPSC), National Institute for Occupational Safety and Health (NIOSH), World Health Organization (WHO), and the Mine Safety and Health Administration (MSHA).

WHAT DOES AN ABATEMENT PROJECT LOOK LIKE?

To adhere to all regulations associated with an asbestos abatement project, please refer to the EPA, OSHA, state-specific, and municipality regulations asbestos licensing and abatement requirements.

As with any other construction project, there are the myriad of activities and documentation that linger in the background hidden from the public: training, licenses, safety, insurances, estimates, bids, contracts, supply ordering, pre-mobilization activities, etc. What the public does see is a tent-like barrier with shadows moving behind it. Entire books have been written on all that is involved in demolition and abatement projects. So, here we will paint a simple picture of an abatement project.

The Story

To better understand the story, we will want to understand the language.

Friable Asbestos Containing Material: material with more than 1% asbestos that, when dry, can be crumbled, pulverized, or reduced to power by hand pressure.

EPA Category I Asbestos: non-friable ACM resilient floor covering, mastic, asphalt roofing, packing, and gaskets.

EPA Category II Asbestos: all other non-friable ACM.

OSHA Class I Asbestos Work: activities involving removal of TSI and surfacing ACM and/or PACM.

OSHA Class II Asbestos Work: activities involving removal of ACM which is not TSI and surfacing material.

OSHA Class III Asbestos Work: repair and maintenance operations where ACM, including TSI and surfacing ACM and PACM material is likely to be disturbed.

OSHA Class IV Asbestos Work: maintenance and custodial activities during which employees contact but do not disturb ACM and PACM, and activities to clean-up waste and debris resulting from Class I, II, and III work.

A licensed asbestos inspector has completed an asbestos survey identifying the asbestos-containing material. The owner has decided whether to renovate or demolish an area or building with asbestos-containing material. A licensed asbestos project designer has designed the project. In doing so, he has determined if the project involves the following:

- RACM (Regulated Asbestos-Containing Material) per EPA regulations. RACM includes Friable ACM, Category I non-friable, which has become friable, Category I ACM which has been subjected to sanding, grinding,

cutting or abrading, Category II ACM that has a high probability of becoming friable.
- The amount of ACM will determine if the project falls under the EPA NESHAP regulations.
- He has also determined if the project is an OSHA Class I, II, III, or IV project.

Determining the category and class then lays the groundwork for the activities involving the initial administration, pre-abatement, mobilization, containment, removal, final clearance, waste disposal, and final administration requirements.

In this story we are dealing with the demolition of one large room in one building. The project falls under the EPA NESHAP regulations for EPA Category II ACM and OSHA Class I.

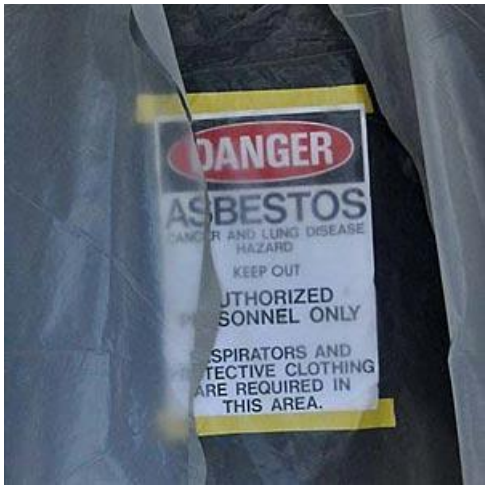
Administration

The Asbestos Administrator schedules the project and files a 10-day notice with the state and EPA. He schedules a Licensed Asbestos Supervisor as the project's Competent Person and assigns a crew of Licensed Asbestos Workers. He prepares a project book that includes all the documentation for the Asbestos Supervisor and any regulators that may visit the job site. He also schedules an Industrial Hygienist for daily monitoring of the work areas.

The Asbestos Administrator and the General Contractor notify all other trades involved in the project that regulated areas will be contained and that there should be no breech of the containment during the project. The Building Owner notifies all occupants of the building and employees of the same.

Project Log Book Contents	
Pre-work documents Load list Regulations Specifications Drawings and field notes Sign-in sheets Subcontractor information Air monitoring sheets	Daily report forms Emergency numbers Injury report forms Rental equipment Waste disposal Medical surveillance Training certificates Licenses / permits

Mobilization



Mobilization is simply stated: all materials and equipment are loaded for the project and delivered to the worksite. This takes time, organization, and labor.

Containment

The typical types of containment include glove bags, mini-enclosures in which no more than two workers can fit, and negative pressure enclosures. In our story, we are establishing a negative pressure enclosure because of the size of the project and the regulations.

The HVAC is shut off or isolated. The electrical system is locked out/tagged out. Critical barriers are erected to isolate the work area from the rest of the building. Typical barriers are constructed of 6-mil poly, duct tape and spray glue to limit the release of air. Asbestos warning signs are posted at all entrances of the work area building. A decontamination unit is established at the entrance of the work area. It is made up of a clean room, a shower room, and an equipment room. Negative air machines are established to exhaust to the outdoors. The containment is established to be airtight at - 0.02" of water column, and the negative air machines are established to provide four air changes an hour.

Once the containment is established, the necessary equipment and supplies will be staged in the work area.

Removal

The Supervisor and the Workers enter the containment through the decontamination unit. In the clean room they remove street clothing and don their disposable coveralls, applying tape around their ankles and wrists to limit the ability of asbestos fiber to enter the suit. They inspect and put on their respirator, then perform a positive and negative fit check to confirm the respirator is properly fitted to their face. The hood of their disposable coveralls goes over the respirator head-straps. They then pass through the shower to the equipment room. In the equipment room they put on any additional clothing

such as steel-toed work boots, hard hat, and gloves. They collect the tools they will be using in the work area and proceed out of the equipment room into the work area.

Using demolition tools and equipment, the work begins.

During the removal process wet methods and HEPA vacuum cleaners are employed to inhibit the release of asbestos fibers into the air. Wet methods typically include surfactant added to tap water to make it amended water that sticks better to asbestos fibers. All ACM removed is kept adequately wet. The HEPA vacuum cleaners include a HEPA filter that is 99.97% efficient for all particles 0.3 microns or larger.

As the asbestos containing materials are removed, the area is promptly cleaned up. The asbestos is bagged or contained and sealed in impermeable bags or containers. Large pieces are wrapped in poly and double-layered with 6-mil poly. Each waste container is labeled with the OSHA danger notice, the generator's name, and the address from which the asbestos is being removed.

For the final step of the removal process, the entire interior of the containment and the outside of the sealed waste containers are HEPA vacuumed and clean with wet methods.

Throughout the project, the Asbestos Supervisor manages several responsibilities. He confirms that there are no visible emissions of asbestos fibers during removal. If there are, the material is not being kept adequately wet. He checks the crew's protective clothing to confirm there are no breeches. He inspects the job site materials and equipment frequently and regularly to insure proper performance. Any newly discovered ACM or PACM is reported to the building owner within 24 hours.

The asbestos-removal process cannot include the use of any high-speed abrasive disc saws. Compressed air cannot be used to remove asbestos unless it is contained. There can be no dry sweeping. And, the practice of employee rotation to reduce exposure is not allowed. No smoking, eating, drinking, or applying of cosmetics is allowed in the work area.

Air monitoring is performed throughout the project to confirm respirators are appropriate.

When leaving the work site, workers HEPA vacuum their disposable coveralls before entering the equipment room. In the equipment room, the disposable coveralls are removed and placed in an asbestos waste bag. They proceed to the shower, which is equipped with soap, shampoo, and towels.

They remove and wash their respirator, then thoroughly wash their body and hair. The shower water is filtered and captured for proper disposal. The workers then proceed to the clean room to dry off, dress back in their street clothes, clean and dry their respirator, and replace their respirator filters, if necessary. This process is extremely important to protect their family from exposure to asbestos fibers that they could bring home on their clothes.

Final Clearance

The project is not complete, nor can the containment be removed, until the Industrial Hygienist establishes final clearance. Final clearance includes an inspection of the work area to confirm removal of all asbestos containing material and air samples indicating that no asbestos fibers are lingering in the air.

If this were a NESHAP-size project in a school, the Industrial Hygienist would collect five samples inside the work area, five samples outside the work area, one blank inside the work area, one blank outside the work area, and one unopened blank for the laboratory. Lesser samples are needed on non-NESHAP projects depending on the contract specifications, state specifications, etc.

Tear Down & Waste Disposal

Once the Industrial Hygienist clears the project, the sealed waste containers are removed from the project, the containment is torn down, and the work area is cleaned up as it would be in any construction or demolition project. Waste is loaded and transported to a temporary state-approved holding site or an EPA-certified landfill. Waste shipment records must accompany the waste to the EPA-certified landfill.

What's wrong in this picture????

Dry Sweeping!!! No Respirators!!!

Final Administration

Final air monitoring results are supplied to the building owner within 10 days after the completion of the project. Once waste manifests are returned to the Project Administrator by the EPA-certified landfill, a client book is created documenting the entire project. This documentation is to be maintained by the building owner for the life of the building or as long as the information is to be relied upon.

HIRING A CONTRACTOR

Typically, there are two main types of asbestos professionals that a homeowner, building owner, property manager, facilities manager, real estate agent or general contractor would hire - an Asbestos Inspector or an Asbestos Contractor.

An Asbestos Inspector inspects a building, assesses conditions, identifies and takes samples of suspected asbestos-containing material, and advises about corrective actions. During and after repair or removal of asbestos-containing materials, the Asbestos Inspector ensures that the contractor follows proper procedures, has performed proper clean up, monitors the air during the abatement process, and provides final clearance.

An Asbestos Contractor repairs or removes asbestos-containing materials.

Federal law does not require homeowners performing asbestos abatement in their own residence to be licensed or to retain a licensed asbestos contractor. However, this only applies to their primary residence and the abatement must be performed by them alone. Some states and municipalities are subject to different requirements. Any other situation involving asbestos abatement work performed on buildings must be performed by properly trained or licensed employees or contractors.

To avoid a conflict of interest, it is recommended that the asbestos professional hired to do the Asbestos Inspection or Survey should not be connected with the Asbestos Contractor performing the asbestos repair or removal.

When hiring an Asbestos Contractor, ensure a written contract has been drawn up specifying the work to be performed and a work plan, the amounts and

locations of abatement, cleanup procedures, and the regulations that will be followed. At the conclusion of the project, the client should receive confirmation of all work performed.

Abatement costs will vary depending on the type and difficulty of the project.

CONCLUSION: IN THE NEWS

EPA Takes Three Important Steps to Ensure Chemical Safety Under the Lautenberg Act, Proposes Action on Asbestos
Excerpts from epa.gov 06/01/2018
Contact Information:
EPA Press Office (press@epa.gov)

WASHINGTON – Today, the U.S. Environmental Protection Agency (EPA) is releasing the following for public comment: (1) the first ten problem formulation documents, (2) EPA's systemic review approach document, and (3) a significant new use rule (SNUR) proposal enabling the Agency to prevent new uses of asbestos – the first such action on asbestos ever proposed.

"**These actions provide the American people with transparency and an opportunity to comment on how EPA plans to evaluate the ten chemicals undergoing risk evaluation, select studies, and use the best available science to ensure chemicals in the marketplace are safe**," said EPA Administrator Scott Pruitt. "**At the same time, we are moving forward to take important, unprecedented action on asbestos."**

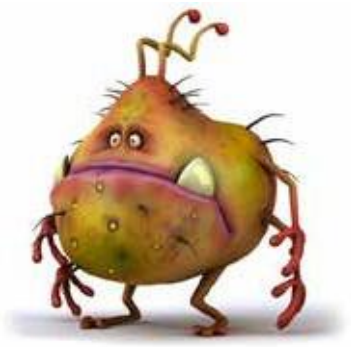
The problem formulation documents refine the scope of risk evaluations for the first ten chemicals selected under the Frank R. Lautenberg Chemical Safety for the 21st Century Act, which amended the Toxic Substances Control Act (TSCA). The Agency's problem formulation documents are an important interim step prior to completing and publishing the final risk evaluations by December 2019. They clarify the chemical uses that EPA expects to evaluate and describe how EPA expects to conduct the evaluations.

EPA's systematic review approach document will guide EPA's selection and review of studies in addition to providing the public with continued transparency regarding how the Agency plans to evaluate scientific information.

For asbestos, EPA is proposing a SNUR for certain uses of asbestos (including asbestos-containing goods) that would require manufacturers and importers to receive EPA approval before starting or resuming manufacturing, and importing or processing of asbestos. This review process would provide EPA with the opportunity to evaluate the intended use of asbestos and, when necessary, take action to prohibit or limit the use.

Chapter Three
Get the Lead Out!

Published March 2019



- **INTRODUCTION**
- **LEAD MYTHS & FACTS**
- **HEALTH EFFECTS OF LEAD**
- **WHY LEAD PAINT?**
- **HOW TO IDENTIFY LEAD HAZARDS**
- **MAINTAINING PROPERTIES WITH LEAD-BASED PAINT TO PROTECT OCCUPANTS**
- **MEASURING & TESTING FOR LEAD**
- **LEAD AND LEAD-BASED PAINT REGULATIONS**
- **IS IT A RENOVATION, STABILIZATION OR ABATEMENT PROJECT?**
- **WHAT DOES A LEAD PROJECT LOOK LIKE?**
- **LEAD-BASED PAINT AND REAL ESTATE**
- **CONCLUSION: IN THE NEWS**

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

INTRODUCTION

Picture this:

A young family in a cozy home. Their younger children running in and out of the back door to play in the yard. Their older children going in and out of the front door to visit with friends. Their infant spending time playing on the floor with toys while the parents go about their day. Since it's a beautiful sunny day, they open the windows to experience the fresh Spring air! A perfect day in the life of a young family.

But, every time the doors open and close, the friction points of the door and the door jamb rub against one another and release invisible dust. Every time the windows are opened and shut, more friction, more dust.

Every time they go from one room to another, opening and closing each room's door, more invisible dust. If their home or apartment was constructed before 1978, there is the chance that each release of dust contains lead.

Their infant innocently crawls on the floor, their moist, soft hands gathering the dust. He put his hands in his mouth, sucking and chewing. He picks up his toys (covered in the invisible dust) and puts them in his mouth. Mom fixes lunch on the kitchen counter, which is covered with invisible dust, then sets the infant in his highchair on which the fold-down tabletop is covered with invisible lead dust. Dad feeds the infant the food which was delightfully placed on the contaminated plates.

No surprise now that this infant is suffering from lead-poisoning.

Many buildings, homes, and apartments built before 1978 were painted with lead-based paint. Why?

In the late 1800s through the early 1900s farmers did not paint their barns. It was a waste of time, because within a matter of two to three years, the paint would begin to peel. The maintenance of painted buildings was not affordable, in time, energy, or money.

Then the Dutch released lead-based paint. It was magical! The paint would easily adhere to surfaces and withstood the pressures of weather conditions. The new dream home was surrounded by the famous "white picket fence." We painted everything!

Today about 57 million homes in the U.S. contain lead-based paint. Homes built before 1940 are 90% likely to have lead paint, and homes built between 1960 and 1978 are 62% likely to have lead paint.

Lead is dangerous to all, but more so to children under the age of six. At that age, their brains and nervous systems are more sensitive to the damaging effects of lead. Their bodies mistake the lead entering their body as calcium and absorb it into their system.

One out of every 40 American children has too much lead in their bodies.

Other sources of lead can include drinking water from plumbing with lead or lead solder, occupational exposure, painted toys or furniture, lead crystal, lead-glazed pottery or porcelain, lead smelters, and hobbies.

LEAD MYTHS & FACTS

MYTH: No need to be concerned about lead until after the baby is born.
FACT: Women with a high lead level in their system prior to or during pregnancy expose the fetus to lead through the placenta during fetal development.

MYTH: Children will show signs of lead exposure right away.
FACT: Even children who seem healthy can have high levels of lead in their bodies.

MYTH: Children get poisoned by chewing lead chips or chewing on windowsills painted with lead-based paint.
FACT: People can get lead in their bodies by breathing or swallowing lead dust and by eating plants that were grown in contaminated soil.

MYTH: To be safe, all lead-based paint must be removed from a building.
FACT: There are many options for reducing lead hazards. In most cases, lead-based paint in good condition is not a hazard.

MYTH: Lead-based paint must be removed by any method possible.
FACT: Removing lead-based paint improperly can increase the danger to building occupants.

HEALTH EFFECTS OF LEAD

Even exposure to low levels of lead can be severely harmful to children.

In children, lead can cause:

- nervous system damage
- kidney damage
- learning disabilities, attention deficit disorder, and decreased intelligence
- speech, language, and behavior problems
- poor muscle coordination
- decreased muscle growth
- decreased bone growth
- hearing damage
- seizures, unconsciousness, and death

Lead can damage the body without feeling any symptoms. Often, presenting symptoms are mistaken for the flu. Lead attaches to our red blood cells, travels throughout the entire body, and can then be stored in the body for more than 30 years.

In adults, lead can cause:

- increased illnesses during pregnancy
- brain damage or death to a fetus
- fertility problems
- high blood pressure
- digestive problems
- nerve problems

- memory and concentration problems
- anemia
- damage to blood cell formation
- muscle pain
- joint pain.

Lead harms blood cells, impacts hearing, harms kidneys, the nervous system, bone tissue, the brain, impacts the ability to learn, impacts coordination, the digestive system and the heart, impedes blood cell formation, and impacts reproductive organs which can cause men to have problems having an erection and cause women to have miscarriages or stillbirths. Lead poisoning often goes unrecognized because of the wide range of symptoms which can include fatigue, sleep issues, weakness, dizziness, irritability, joint pain, clumsiness, muscle pain, vomiting, stomach aches, loss of appetite, nervousness, headaches, difficulty concentrating, depression, constipation, loss of sexual drive, forgetfulness, hyperactivity, numbness. Additionally, the signs of lead poisoning may come and go.

To reduce a child's exposure to lead, two practices should be embraced. First, the children should be tested by their physician. This includes a very simple blood test. Lead levels are measured in micrograms per deciliter (µ/dL). If a child's level is 10 µ/dL, it is too high. The second practice should be to have the buildings they spend time in and that were built prior to 1978 tested so that preventative measures may be instituted.

How much lead is dangerous? Even a small amount of lead can poison an individual. Naturally, the higher the exposure the more likely one is to be poisoned. A low dose of lead can make a person feel tired and irritable. A high dose of lead can cause permanent damage to the brain, nervous system, and kidneys. A very high dose can lead to death.

WHY LEAD PAINT?

Lead (chemical symbol Pb) is a heavy, grey metal that is soft and pliable. When added to products, lead makes these products much more durable. It will not crack easily with wear and tear, weather, or temperature change.

When used in areas with high humidity and moisture, it kills mold and mildew. When added to paint it prevents rust corrosion and applies a stronger binding

to the surface it is applied to. The lead also enhances the colors of the paint. House paint is the major source of lead poisoning.

The federal government defines paint as lead-based paint when the lead levels are equal to or greater than 1.0 milligram per square centimeter or more than 0.5% by weight.

Lead-based paint is still permitted in the U.S. for industrial purposes, such as for use on bridges and on the inside and outside of steel structures to prevent rust and corrosion. About 90,000 bridges in the U.S. are coated in lead-based paint.

Because of its mechanical strength, it was also added to products designed to block radiation, such as lead aprons used to block x-rays.

Lead was added to gasoline as an anti-knock agent. The lead then released into the air through the car exhaust, polluting both the air and the soil along the roads. In 1978, the EPA reduced the amount of lead allowed as an additive. This move proved to be successful when, in 1982, we found the U.S. national average level of lead in blood dropped by 37%. Much of our roadside soil remains contaminated with lead.

Lead is still used to make batteries, ceramics, lead crystal, bullets, and plastics. As such, many exposures to lead come through our hobbies, such as glazed pottery making, target shooting, electronics, car and boat repair, refinishing furniture, renovations, use of some of the pigments in art paint, making lead fishing lures, and stained-glass activities.

Some occupations also exposure workers and their families to lead: renovators, demolition workers, welders, sheet metal workers, plumbers, miners, lead workers, ceramic glaze manufacturers, electronics makers, police officers, artists, radiator repair workers, car mechanics, printers, scrap yard workers, and recyclers.

HOW TO IDENTIFY LEAD HAZARDS

Lead-based paint is usually not a hazard if it is in good condition and not on a friction surface, like a window frame or door frame.

A lead paint hazard is defined as lead-based paint that is deteriorating through peeling, chipping, chalking, cracking, or is damaged. It is also a hazard when found on surfaces that children can chew or that is exposed to wear and tear, like windows, windowsills, doors, door frames, stairs, railings, banisters, and porches.

Lead dust is released when lead-based paint is scraped, sanded, or heated. Dust also forms when painted surfaces are bumped or rubbed together.

Lead soil can be a hazard when children play in bare soil or when soil is brought into a house or building on our shoes or feet.

The only way to find out if a lead hazard exists in paint, dust, and soil is to test for them.

Regulations established by the EPA/Federal government put lead as a hazard at these levels:

- 40 micrograms per square foot (µ/ft2) and higher for floors including carpeted floors
- 250 µ/ft2 and higher for interior window sills
- 400 parts per million (ppm) and higher in play areas of are soil
- 1,200 ppm and higher in bare soil outside of play areas

Lead sampling can be performed when we are concerned about a particular painted component. A lead-based paint inspection can be performed of all painted surfaces or just the painted surfaces that are a concern. A lead risk assessment can be performed which also identifies the risks associated with the painted components and provides advice and solutions to address the situation.

MAINTAINING PROPERTIES WITH LEAD BASED PAINT TO PROTECT OCCUPANTS

***Start with this Lead Poisoning Building Checklist*:**

- Was the building built before 1978?
- Is there cracking, flaking, chipping or peeling paint?
- Are there places where paint is being rubbed or where friction points are created, such as windows or doors?
- Are there water pipes made with lead or joined with lead solder?
- Do the children play in the soil near the building?
- Has the building been recently renovated or remodeled? Is food stored in imported pottery?
- Do any of the occupants work with lead in their job?

If any of these were answered yes, the building should be professionally inspected by a licensed lead-paint inspector and the occupants should be tested for lead in their blood!

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

Those responsible for the health of our buildings and the safety of occupants should:

- Inspect buildings annually for peeling, chipping, or deteriorating paint and address immediately.
- Clean up paint chips immediately.
- Clean floors and counters around windows and doors weekly, daily if children occupy the area.
- Use disposable towels for cleaning and dispose of upon completion.
- Wash hands often; wash children's hands before naps, eating, or bedtime.
- Clean play areas daily.
- Do not allow children to put painted surfaces or articles in their mouth.
- Clean or remove shoes before entering the building or home.
- Enjoy a good diet. Children with good diets absorb less lead.

Temporary actions to reduce lead hazards include repairing damaged painted surfaces and plating grass to cover soil with high lead levels. These "interim controls" are not permanent solutions and will need ongoing inspections and maintenance.

Permanent actions to remove lead hazards include removing, sealing, or enclosing lead-based painted components with specialized materials. Just painting over the hazards with regular paint is NOT a permanent fix.

Take precautions to protect occupants during renovations:

- Do not use a belt-sander, propane torch, high temperature heat gun, dry scraper, or dry sandpaper to remove lead paint. These actions create large amounts of lead dust and fumes.
- Temporarily remove occupants until renovations are complete and the building is properly cleaned.
- Seal off the work area from the occupied area during renovations.

One of the best moves toward protecting our occupants or our employees is to test so that all are aware of what is in the environment.

MEASURING & TESTING FOR LEAD

Those responsible for the health of building environments or the health of the occupants and workers in our buildings need to be aware of the amount of lead in the air during work activities, in blood, in paint, in lead dust, in soil, and in waste materials.

Deciding what type of testing to perform depends on how the test results will be used: to protect employees who are handling lead-based painted components, to protect occupants, to prepare for renovations or demolition, to bring a property to full lead-free status, or to put a maintenance program in place.

Lead inspectors and risk assessors must be certified and licensed by the EPA or their state. Laboratories performing the analysis of lead samples must be accredited by the National Voluntary Laboratory Accreditation Program (NVLAP).

Lead in Paint & Lead-Based Paint Inspections

Lead in paint can be determined by an XRF analyzer or by analysis of a paint chip. When using an XRF, any surface coating that contains more than 1.0 milligrams per square centime (mg/cm2) is considered to be lead- based paint. (Maryland and DC have established the definition of lead- based paint as 0.7 mg/cm2). When analyzing a paint chip, if lead is 0.5% of the weight of the paint, the paint is considered lead-based paint.

According to HUD, an inspection consists of "a surface-by-surface investigation to determine the presence of lead-based paint (in some cases including dust and soil sampling) and a report of the results." The HUD guidelines recommend testing all types of painted and varnished exterior and interior surfaces in pre-1978 housing. This includes ceiling, walls, floors, crown molding, baseboards, window components, door components, and other interior components such as trim, staircase components, shelves, and radiators. It also includes exterior items such as porches, exterior siding, gutters and downspouts, roofs, sheds, and fences.

Testing can be performed by paint chip analysis. Typical protocol requires removal of a 1-inch by 1-inch paint chip from surfaces and sent to a laboratory for analysis. The preferred method employs the use of an XRF (X-Ray Fluorescence) Analyzer. The XRF emits x-rays into the surface causing lead atoms to "glow" by emitting a fluorescent light. The XRF measures the intensity of the fluorescent light and displays the amount of lead in the surface on an attached computer. This method is much faster, more efficient, and not destructive to building components compared to collecting paint chip samples.

Inspectors that employ an XRF analyzer must have additional training on the proper handling of an XRF and must follow state and federal regulations involving radiation and radioisotopes.

Lead Risk Assessments

Where an inspection indicates the presence and location of lead-based paint, a risk assessment goes further and identifies if the lead-based paint could cause a health hazard to occupants and how identified hazards can be controlled. A lead risk assessment could include a lead inspection, dust wipe testing, and soil testing.

Lead in Dust

Lead in dust is measured by collecting dust wipe samples on surfaces. Dust tests cannot be used to determine the presence of lead-based paint in components, but they can show if a lead dust hazard is present. Dust wipe testing is typically performed prior to the re-occupation of a rental property, during risk assessments, or for clearance criteria following a renovation or abatement project involving lead-based paint activities.

Results from these tests are measured in micrograms per square foot (µ/ft2). The clearance levels for dust are:

- Window wells 400 µ/ft2
- Windowsills 250 µ/ft2
- Floors 40 µ/ft2
- Exterior concrete 800 µ/ft2

Lead in Soil

Soil sampling and analysis usually indicate the amount of lead in the upper one-half inch of soil. High levels of lead are usually found close to a building with lead-based paint or close to a street after years of exposure to exhaust fumes from lead-containing fuel. Soil sampling can be a part of a lead risk assessment or a lead inspection.

Soil testing tubes are used to collect soil samples to be analyzed by a laboratory. Soil is considered contaminated when the concentration of lead is equal to or greater than 400 parts per million (ppm) in play areas or 1,200 ppm in other bare soil areas.

Lead in the Air

When working with lead-containing materials, it is crucial to measure the air workers breathe. Personal monitoring with a small air-collection pump and sample media worn by a percentage of the workers through the workday can collect lead dust and reveal the exposure levels.

OSHA has established the safe level to be under 30 µ/m3 (30 micrograms per cubic meter) of air. OSHA's Action Level is anything over 30 µ/m3. At this point the worker must be involved in a medical surveillance program. The air must be sampled at least every six months or any time the activity or work environment changes. The worker must be trained on lead hazards.

OSHA's Permissible Exposure Level (PEL) is 50 µ/m3. The PEL is the highest average amount of lead over an 8-hour period a worker can be exposed to without protection. At 50 µ/m3, OSHA's Lead in Construction Standard goes into effect, requiring workers to wear respirators, protective clothing, be supplied with washing facilities, medical surveillance, protective equipment, changing areas, showers if feasible, and specific training on activities involving lead work.

OSHA has established three lead abatement classes:

- **Class I Work** involves exposures from 50 µ/m3 to 500 µ/m3 and requires workers to be provided with and to wear half-mask respirators. This work usually includes demolition of buildings and structures, scraping and sanding of paint, using a heat gun, cleaning with power tools that are supplied

with dust collection systems, and spray-painting lead-based paint.

- **Class II Work** involves exposures up to 2500 µ/m3 and requires workers to be provided with and to wear powered air-purifying respirators. This work typically involves using lead-based mortar, burning lead, rivet busting lead- painted surfaces, power tool cleaning without dust collection systems, cleaning with dry abrasives, and tearing down enclosures used for abrasive blasting.

- **Class III Work** involves exposures up to 2,500 µ/m3 and requires pressure- demand supplied-air respirators. This work typically involves abrasive blasting, welding, cutting torch burning of lead-containing materials.

Lead in Blood

The OSHA Lead in Construction Standard requires a blood test when our employees first work with lead. Blood is measured in micrograms of lead per deciliter (µ/dl). When a worker has a blood lead level above 50 µ/dl, the employer is required to begin "Medical Removal," which means the employee must be removed from any work in which they would be exposed to lead.

Lead in Waste

Waste from lead projects is considered a hazardous waste when there are 5 ppm of lead in a representative sample of the waste. The laboratory performs a test called a Toxic Characteristic Leachate Procedure (TCLP) to determine the lead content. The lab determines if the waste material will leak or release a hazard, such as lead into the soil or groundwater under the landfill. Such hazardous waste must be transported to a disposal facility that is licensed by the EPA to accept lead waste.

LEAD & LEAD-BASED PAINT REGULATIONS

Like asbestos, the lead inspection, stabilization, and abatement industry are heavily regulated by the U.S. Federal Government, the U.S. Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and in many cases each state's specific environmental department or agency and local municipalities.

A private homeowner may remove lead-based painted components from the home in which they reside without a license or training. It is essential to their personal well-being and the well-being of their family and other building occupants that they follow the methods and procedures of a trained lead abatement contractor so as not to expose themselves or others to the release of lead dust. A private homeowner performing their own lead abatement or stabilization on the home in which they personally reside is the only situation exempted from specialized training and licensing. Lead stabilization, abatement, inspections, monitoring, surveillance, and laboratory analysis are all regulated to protect the health and safety of building occupants and lead workers.

The following regulations impact the Lead Abatement industry and provide guidance on the performance of projects and the maintenance of buildings containing lead-based painted components:

- OSHA's Lead in Construction Standard 29 CFR 1926.62
- HUD's Lead Safe Housing Rule 29 CFR Title 25, Subtitle A, Part 35
- EPA's RRP (Renovation, Repair and Painting Program) Rule 40 CFR 745, Subpart E
- EPA's Lead Abatement Program 40 CFR 745, Subpart E
- EPA's Title X 40 CFR, 745, Title X

OSHA Lead in Construction

OSHA Lead in Construction Standard was established to protect workers involved with lead. The regulations include an initial medical surveillance, on-going medical surveillance, and the conservation of medical records, including an exit medical exam.

The initial medical surveillance includes a set of special blood tests used to determine the employee's current lead level and zinc protoporphyrin (ZPP) test. This establishes the baseline for biological monitoring.

If an employee may be exposed to lead on the job at or above the Action Level for more than 30 days in a year, then the surveillance would include the biological monitoring, a six-part medical exam, and a medical consultation.

The employer is required to keep the medical records associated with this testing of the blood for 30 years after the employee's last day of employment. All employees have the right to request an exit exam at that time.

HUD's Lead Safe Housing Rule

HUD's Lead Safe Housing Rule covers pre-1978 federally owned or assisted housing and federally owned housing that is being sold. HUD's rule is similar to the EPA's RRP rule (discussed below), except for the requirements involving training, minor repair, and maintenance. On these projects, there must be a Renovator certified by EPA or an EPA-authorized state. All workers must have completed a HUD-approved course, or the crew must be supervised by a Renovator certified by the EPA or a Certified Lead Abatement Supervisor. All untrained workers must receive on-the-job training from the Certified Renovator.

RRP Rule

When the project is a renovation or remodeling project, the EPA's RRP (Renovation, Repair and Painting Program) Rule may apply. The term renovation covers all activities done for compensation that disturb painted surfaces including most repair, remodeling and maintenance activities, including window replacement, weatherization and demolition. This Rule applies to all renovation work performed in residential houses, apartments and child-occupied facilities such as schools and day-care centers built before 1978. The contractors involved in these types of projects must have an EPA Certified Renovator assigned to the project and each member of the crew must be trained.

Contractors, property managers and others who perform renovations for compensation under this Rule are required to distribute the EPA's *Renovate Right* pamphlet to occupants and owners of the property before starting renovations.

Work practice requirements include work-area containment to prevent dust and debris from leaving the work area. Inside the containment, open flame burning and use of heat guns at greater than 1,100 degrees Fahrenheit are prohibited. The use of power tools must include a high-efficiency particulate air exhaust control (HEPA) to collect any generated dust.

Thorough cleaning is required and must be verified.

Minor repair and maintenance activities of six square feet or less per interior room or 20 square feet or less per exterior project are exempt from the RRP rule, except when window replacement or demolition is being performed.

EPA's Lead Abatement Program

EPA's Lead Abatement Program provides a framework for lead abatement, lead risk assessments, and lead inspections. Those performing abatement, risk assessments and lead inspections must be trained and certified by the EPA or by an authorized State.

TITLE X

Title X was presented by the EPA in 1992 and requires that all known information about lead hazards be provided at the time of sale or rental of any pre-1978 housing unit. If a seller does not know if lead-based paint is present, then the regulation allows homebuyers 10 days to arrange for a risk assessment or inspection to identify lead hazards.

IS IT A RENOVATION, STABILIZATION OR ABATEMENT PROJECT?

Homeowners, facilities managers, property managers, and contractors need to be aware of the applicable regulations prior to performing renovation, demolition, or remodeling in properties that impact lead-based painted surfaces.

When the entire *intent* of the project is to remove or abate *all* lead-based paint and lead-based painted components, the project is a lead abatement project and falls under EPA and OSHA regulations, and in some areas, local state and municipal regulations as well.

WHAT DOES A LEAD PROJECT LOOK LIKE?

Considerations Prior to Starting the Project

The following is a general overview of the steps one should be taking into consideration prior to commencing a renovation or demolition project that will impact lead-based paint. When designing a specific project, details will change. Regulations change based on the size of the area to be impacted, whether or not the area is occupied by children, whether or not the property is residential or commercial, whether it is an exterior or interior project and so on. Contractual specifications must also be taken into consideration. The following steps will provide us with a picture of what a contractor must consider when establishing a workplan involving lead- based paint activities. This project overview assumes that a lead-based paint inspection has been performed and lead-based paint has been identified.

Determine if the job involves lead-based paint.

- Have a lead inspection performed by a Licensed Lead Inspector.
- If the building does not have any lead-based painted surfaces, the renovator does not have to apply any special standard concerning lead-based paint.

- If lead-based paint is identified, the project should be designed to address the painted surfaces so that the workers, occupants, and the community is protected during the renovation project.
- What is the ultimate goal or intent of the project?
- Is this a renovation, remodel, demolition, paint stabilization or paint abatement project?

Determine which regulations apply to the project.

- EPA's RRP Rule
- EPA's Lead Abatement Program
- State-authorized Lead Abatement Program
- OSHA's Lead in Construction Regulation
- HUD's Lead Safe Housing Rule

The applicable rules will guide the design of the project to keep workers, occupants, and the community safe.

Establish a project work plan that follows the required regulations and obtains the objective of the project while providing lead-safe practices for renovation or lead abatement of the property.

Provide the required pre-renovation education about lead-based paint hazards to the proper individuals, owners, residents, or occupants.

Determine that the contractor and supervisor are properly licensed and certified to do the work.

Determine if the property will be vacant or if the contractor will need to establish areas for occupants to reside or work in the building during renovations.

Determine if the contents of the area will be removed prior to the commencement of the project or if contents will need to be moved or protected during the project.

Determine if the property will require pre-cleaning. If the paint is deteriorating, the work areas may already be contaminated and will need to be addressed prior to establishing containment.

Design the containment to protect the exterior environment and to prevent cross-contamination to other areas.

Determine the waste storage area.

Plan on covering any articles or components that could not be removed from the work area with poly sheeting.

Determine the engineering controls, such as negative air machines, to protect workers.

Identify the locations to establish restrictions to access the work area.

Determine the level of worker protection needed, such as respirators.

Plan the actual renovation, abatement, or demolition using lead-safe work practices. The stabilization or abatement could include removal and replacement of building components, enclosures methods, paint removal methods, and/or soil and exterior dust abatement. The proper practices and procedures must be implemented for the abatement method taking into consideration the project as a whole. The basic planning changes depending on the type of lead clean-up or the ultimate goal of the project.

Determine who will provide daily clean up and who will perform daily visual examinations and inspections.

Plan for final cleanup upon completion of the project, such as HEPA vacuuming and wet cleaning of all hard surfaces. Cleaning of area rugs, wall-to-wall carpet, upholstered furnishings, drop ceilings, and ductwork.

Determine who will perform the final clearance or cleaning verification.

Plan for the possibility of the need to repeat cleaning if clearance fails.

Plan on who will collect the TCLP of the waste, what laboratory will analyze the TCLP, and based on the laboratory results, the proper waste handling and disposal of waste.

Plan the notification that will be sent to occupants upon the completion of the project.

The plan and all the documentation associated with the project need to be maintained to fulfill the EPA, OSHA, and state requirements.

The final consideration is the ongoing lead-safe maintenance.

During an abatement project, there are other considerations that would need to be addressed including the length of time of the project, monitoring and re-evaluation of the project, the type of abatement that will be employed, and the relationship the lead abatement project has to the project as a whole. For example, if the project is predicted to take three months to perform, the containment will need to be designed and stable enough to maintain dust control over this longer period of time.

Project Steps

Step 1: Contain the work area.

- Protect the floor and remaining components in the work area with poly sheeting. The RRP Rule requires that the work area be protected with poly sheeting that extends a minimum of six feet for interior projects and ten feet for exterior projects in all directions from the location where paint will be disturbed.
- For exterior renovations within ten feet of the property line, vertical containment or equivalent extra precautions are required. All dust and debris generated by the work must remain within the area protected by the poly sheeting.
- Warning signs and barrier tape or fencing must be posted, and unauthorized persons and pets must be prohibited from entering the work area.

Step 2: Protect the workers.

- Disposable protective clothing coveralls, painter's hat and booties should be worn to limit contamination of clothing and to eliminate lead dust from leaving the contaminant on workers' clothing.
- A disposable N-100 rated respirator or half-faced respirator should be worn to prevent workers from inhaling lead dust.

- No smoking, drinking or eating should be permitted in the containment.
- Workers should wash their hands and face each time they stop working. Their clothes should be washed separately from their family laundry.

Step 3: Minimize the dust.

- Keep the work area closed off from the rest of the building. The containment must be sufficiently isolated and maintained to prevent escape of dust or debris. Ensure that all personnel, tools, and other items exiting the work area are free of dust and debris.
- Vacuum with a HEPA-filtered vacuum and damp wipe everything and everyone leaving the work area.
- Keep painted surfaces wet while working or use wet sanders and misters to keep down the dust created during sanding, drilling, and cutting.
- Use HEPA vacuum attachments on power sanders and grinders.
- Only use heat guns with temperature settings below 1,100 degrees Fahrenheit.
- Score paint with a utility knife before separating components. Pry and pull apart components instead of pounding and hammering.
- Keep components that are being disposed of in the work area until they can be contained. All debris must be wrapped, bagged, or canned prior to removal and stored in a safe area away from building occupants.

Step 4: Leave the work area clean.

- The work area should be left clean at the end of every day and must be cleaned thoroughly at the end of the job.
- Daily the trash should be bagged, the work area should be vacuumed using a HEPA vacuum cleaner, and the tools should be cleaned.
- At the completion of the project, the renovation firm must clean the work area and two feet beyond the work area until no dust, debris, or residue remains.
- Walls and all surfaces must be HEPA vacuumed or damp wiped. The floor should be mopped, and all upholstered furniture should undergo a final HEPA-vacuum.

Step 5: Control the waste.

- Waste must be contained to prevent releases of dust before the waste is removed from the work area for storage or disposal. This includes dust, debris, paint chips, poly sheeting, HEPA filters and waste bags, dirty water, cloths, mop heads, wipes, protective coveralls, hats, and booties, N-100 respirators, gloves, etc. Bags, wrapped components, or disposal cans must be sealed. A representative TCLP should be taken of the waste so that it can be determined what disposal method should be used.
- Always check state and local requirements before disposing of waste.

Step 6: Verify work completion with the Clearance Verification.

- To ensure work areas are safe for re-occupancy, cleaning verification is required by the RRP Rule.
- If the housing receives federal assistance, clearance testing is required.
- Depending on the situation, an EPA Certified Renovator, a Certified Lead Inspector, Certified Lead Risk Assessor or Certified Lead Sampling Technician must perform the cleaning verification procedure.

It is our moral, ethical and legal responsibilities to abide by the EPA, OSHA, state and municipal standards. It is highly recommended that those who impact lead-based paint obtain copies of the regulations surrounding their project.

LEAD-BASED PAINT AND REAL ESTATE

Owners, buyers, and renters are encouraged to check for lead before renting, buying, or renovating pre-1978 housing. Federal law requires that individuals receive certain information before renting, buying, or renovating a pre-1978 housing:

Landlords have to disclose known information on lead-based paint and lead based paint hazards before leases take effect. Leases must include a disclosure about lead-based paint.

Sellers have to disclose known information on lead-based paint and lead-based hazards before selling a house. The sales contract must include a disclosure about lead-based paint. Buyers have up to 10 days to check for lead.

Renovators disturbing more than 6 square feet of painted surfaces have to give the owner/occupants the EPA pamphlet entitled "Protect Your Family from Lead In Your Home" before starting work.

CONCLUSION: IN THE NEWS

Children in Pennsylvania need to be tested for lead poisoning

The LNP Editorial Board Sep 5, 2017

THE ISSUE

Gov. Tom Wolf proposed last week that every Pennsylvania child under age 2 be tested for lead poisoning. As LNP reported, the governor called on the state Department of Health to work with the General Assembly and community partners to draft legislation to require universal testing statewide. Pennsylvania has one of the highest rates of child lead poisoning in the country.

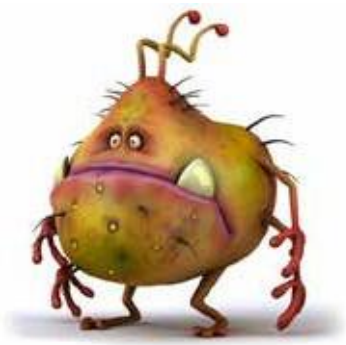
This is still an issue. It shouldn't be but it is. It's hard to believe that almost 40 years after lead paint was banned from use in housing, we're still dealing with cases of children exposed to lead. But we are.

And unless Pennsylvania wants to hold the title of America's Lead Poisoning Leader, we need to do something about it. The sooner the better.

In Lancaster County, at least 11 percent of children tested were found to have elevated lead levels in their system, LNP's Susan Baldrige reported last week. The children whose levels were elevated were found to have 5 or more micrograms of lead in their system, ranking the county one of the worst in the state and among the worst in the country -- worse even than Flint, Michigan, where children were poisoned by lead in drinking water. According to the Centers for Disease Control and Prevention, a level of 5 or more micrograms of lead per deciliter of blood in young children is considered extremely serious.

Chapter Four
Monsters in Your Buildings?

Published April 2019



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Breathe Healthy

A Guide for Those Responsible for Indoor Environments

INTRODUCTION

"A Monster in Your Basement?"

The white-haired 85-year old lady reminded me of my grandmother as she opened the front door with a huge smile, followed by a deep exhausting cough. She gestured for me to enter her exemplar home. Although the furnishings were dated, every piece was placed with purpose. The living room and kitchen were immaculate, spotless, absolutely pristine. The surroundings wreaked of pride in her home.

She immediately dove into reflecting upon her concerns. With a heavy gasp, she mentioned that her "smeller" didn't work so well anymore. Her grandbabies had visited and expressed a concern about the odor in the basement. Her breathing was labored, and she appeared quite fatigued. Could her home be making her sick?

The minute I opened the door to the basement I recognized the familiar smell . . . the musty, wet-soil odor of mold. As I ventured down the steps, she began to tell me how much she missed her husband. He had passed away two years ago. He was the one who would be investigating this mystery odor, if he were still here on Earth with us. As the odor engulfed my senses, there was no doubt that this basement was occupied by a monster! Had the sump pump failed? The dehumidifier been disconnected? The pipes been leaking?

This story reflects just one of thousands we hear every year. A home or building in the midst of a crisis that could have been avoided. Someone dismissed the leaking pipe, the broken fence, the dirty filters, the mouse dirt, the shingle in the yard, the disconnected downspout. In this particular case, our client's husband had always been the one that emptied the dehumidifier in the basement. She didn't even know there was a dehumidifier in the basement. Mold grew thick in the corners, had consumed all the cardboard boxes, and destroyed her teddy bear collection . . . the collection she was saving to leave to her grandchildren.

WHY IS MOLD GROWING IN MY HOME/BUILDING?

Mold is a vicious contaminant. It hides under carpets, spreads inside walls or deep in heating and air conditioning vents, or other locations that cannot be seen. Hidden mold can still be missed even after a thorough investigation and assessment. If you already have a mold problem – ACT QUICKLY. A mold contamination will not go away on its own; and if the right conditions persist, it will consume an environment.

All mold needs to grow is a spore, something for it to attach to, a nutrient, and moisture. Spores are everywhere all the time. If we were to take a tape sample of three desks in three different buildings, there is a 99% chance that mold spores will show up on all three samples.

The components mold can attach to are all around us: drywall, furnishings, concrete block, 2 x 4 framing …The nutrients mold needs are in the dust within our buildings.

And finally, moisture - the only element within our control. Without moisture, mold spores will not root and grow. Moisture does not necessarily have to be a water intrusion. It can simply be high humidity.

Our bodies need moisture in our environment. If humidity drops below 35%, our skin will get dry, flake or crack, our lips can chap, and our nose may bleed. At 50% humidity, alarms should go off warning us that we are getting near a danger zone. At 60% or more humidity, the perfect environment has been created for the growth of mold. Under these circumstances, mold can root and propagate within 12 hours.

Any source of moisture can provide opportunities for mold growth: plumbing, roof and window leaks, condensation, wet foundations, damaged gutters or downspouts, poor landscaping, improper ventilation of stove exhaust fans or bathroom fans.

WHAT IS MOLD?

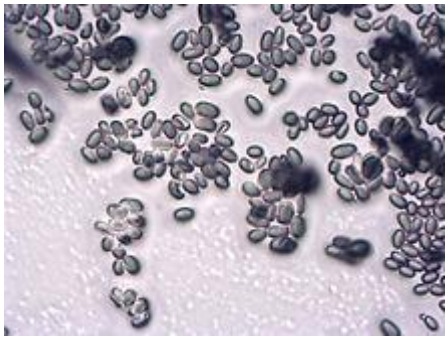
Mold is a fungus that grows in the form of multicellular filaments called hyphae. Mold is known as nature's recycler, since it causes the decomposition

of the organic and porous materials on which it roots and grows.

There are thousands of known species of molds. They all require moisture for growth. Like all fungi, molds derive their energy not through photosynthesis but from the organic matter on which they root and grow.

Molds reproduce by producing large numbers of small spores. These spores are adapted for wind dispersal and may remain airborne for long periods of time.

The presence of mold is not visible until it forms large colonies. A mold colony is an interconnected network of hyphae.



When conditions do not enable mold growth to take place, the mold spore remains alive but dormant. Some molds remain dormant during harsh conditions, such as low temperatures and snow-cover, then propagate when conditions improve.

Molds common to the state of Pennsylvania, Maryland, and West Virginia and their descriptions per Environmental Hazards Services, L.L.C. include:

Alternaria: Reported to be allergenic. Commonly found growing in carpets and on indoor textiles. This fungus has been indicated as a potential cause of hypersensitivity pneumonitis. Rare species known to produce tenuazonic acid and other toxic metabolites that may cause disease in humans.

Aurebasidium: Reported to be allergenic. Commonly found in high moisture areas such as bathrooms and kitchens. Rarely associated with skin disorders.

Cercospora: No information regarding the health effects of this genus is available at this time. All mold should be treated as potential allergens.

Cladosporium: Reported to be allergenic. Most commonly identified spore in

outdoor samples. Highly seasonal. Indoor species may differ from outdoor species. Typically found inside supply ducts.

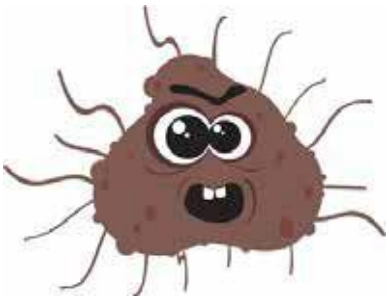
Curvularia: Reported to be allergenic. No additional health data for this genus is available at this time.

Drechslera/Bipolaris group: Toxigenic. Also recognized as an allergen. Under certain conditions, these fungi have been documented to produce the mycotoxin, sterigmatocystin. Studies have indicated that this toxin may cause damage to the liver and kidneys in laboratory animals.

Epicoccum: Reported to be allergenic. Commonly found on plants, textiles and products made of paper.

Fusarium: Toxigenic. Also recognized as an allergen. Certain species of Fusarium may produce the mycotoxin, trichothecene, under appropriate condition, which has been documented to cause problems associated with the circulatory, alimentary, skin and nervous systems. Absorption of trichothecene into the tissues of the human lung may cause a condition known as pneymomycosis. Symptoms may appear following exposure from either inhalation or ingestion. Rarely connect to infections of the eye, skin, and nails.

Nigrospora: Reported to be allergenic. No additional health data for this genus is available at this time.



Penicillium/Aspergillus group: Reported to be allergenic. Many species have been documented to produce mycotoxins, which may be associated with pulmonary disease in humans and other animals. Research studies have implicated several of these toxins as carcinogens in laboratory animals following inhalation. A wide number of organisms have been grouped into these two genera. Extremely difficult to identify down to species level. Typically identified in soil, cellulose, food, paint, compost piles, carpeting, wallpaper and in the fiberglass insulation used in interior ductwork.

Peronospora/Oidium: No information regarding the health effects of this genus is available at this time. All mold should be treated as potential allergens.

Pestalotia: No information regarding the health effects of this genus is available at this time. All mold should be treated as potential allergens.

Pithomyces: Reported to be allergenic. Some species may, in rare instances, produce the toxin sporidesmin.

Stachybotrys: Toxigenic. Also recognized as an allergen. Typically, a fungus of dark green/black coloration, it grows readily on building materials with a high cellulose content but low in nitrogen and is rarely observed in outdoor samples. Certain strains of Stachbotrys may produce the mycotoxin, trichothecene under appropriate conditions which has been documented to cause problems associated with the circulatory, alimentary, skin and nervous systems. Absorption of trichothecene into the tissues of the human lung may cause a condition known as pneumomycosis. Although there have been conflicting studies concerning the toxicity of this fungi, it still appears that extreme caution should be practiced when dealing with this mold.

Smuts, Periconia, Myxomycetes: Reported to be allergenic. This class of fungal spores is most often related to agriculture and plant disease and is rarely found indoors.

Torula: Toxigenic. Also recognized as an allergen. Studies have shown that certain species may produce a toxin in the laboratory.

Molds are identified through the use of a microscope. They come in all types of colors - green, black, brown, white, pink, yellow. Their genera, age, and location determine their color. Quite often we hear someone state that their property was contaminated with “black mold,” referring to the famous toxic mold stachybotrys. However, since many types of mold may be black, it should not be assumed it is stachybotrys simply because it is black.

As mentioned previously, mold spores are everywhere, outdoors and indoor. An environment becomes unhealthy when the concentration of molds spores exceeds healthy levels. The spore alone is not dangerous but rather the mycotoxins that they carry. It is not enough to just kill the mold. Dead or alive, it still carries the mycotoxin. And, for those sensitive to mold, their sensitivity can continue even when the spores are dead.

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

MOLD MYTHS & FACTS

MYTH: Only dirty environments, buildings, or homes get mold contaminations.
FACT: Dirt provides mold with a nutrient, but small amounts of dust and most building components can provide the nutrients needed to grow mold.

MYTH: There are no mold regulations.
FACT: Some states such as Florida and Virginia have established mold remediation regulations. Professional mold remediation companies typically follow the guidelines and standards set by the IICRC S520 or the EPA's guide "Mold Remediation in Schools and Commercial Buildings." Although focused on schools and commercial buildings, this brochure is applicable to all building types.

MYTH: Mold will not grow unless it is exposed to LOTS of moisture.
FACT: All that is needed for mold to grow is one spore and a high level of humidity.

MYTH: My house is new, just recently built, so it cannot have mold.
FACT: It does not matter whether you have an old building, a new building, cheap construction, or a multi-million-dollar building. They can still become contaminated in as little as 12 hours when an environment conducive to the growth of mold is created.

HEALTH EFFECTS OF MOLD

Most people experience no health effects from exposure to mold ordinarily present in normal indoor or outdoor air. The most common health effects are allergies either to the mold spore or the mycotoxin carried by the mold spore. Allergic responses can include hay fever-type symptoms, such as sneezing, runny nose, red eyes, and skin rash. Allergic reactions can be immediate or delayed. Mold is also known to irritate the eye, skin, nose, throat, and lungs of both mold-allergic and non-allergic people.

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

In *Mold Remediation in Schools and Commercial buildings (2001)*, the EPA concluded that, "When moisture problems occur and mold growth results, building occupants may begin to report odors and a variety of health problems, such as headaches, breathing difficulties, skin irritation, allergic reactions, and aggravation of asthma symptoms, "'some or all of which could plausibly be associated with mold exposure.'"

Research on the health effects of mold is ongoing. In their book entitled *Nature's Mold Rx, the Non-Toxic Solution to Toxic Mold*, Edward R. Close and Jacquelyn Close, RA, site several research projects. In one such report, researchers at Lawrence Berkeley National Laboratory, Indoor Environment Department, reported in the peer reviewed *International Journal of Indoor Environment and Health (June, 2007)* that approximately 4.6 million cases of asthma may be attributed to dampness and mold exposure in the home.

The Harvard University School of Public Health studied ten thousand homes in the U.S. and Canada and found that half of them had conditions of water damage and mold associated with a 50 to 100% increase in respiratory symptoms.

A 1999 study by the Mayo Clinic found that 96% of the 37 million Americans who suffer from chronic sinusitis symptoms do so because of mold exposure.

Environmental Health Perspectives (EHP), a peer-reviewed journal published by the National Institute of Environmental Health Sciences (NIEHS), March 2, 2005, says "Exposure to mold and dampness in homes as much as doubles the risk of asthma development in children."

Dr. Close explains that most medical doctors are not trained to screen for mold spores or their associated mycotoxins in the blood as a matter of course or to consider that mold may be the cause or contributor to a specific health problem. What needs to be recognized within the medical community as well as the public perceptions of health is the relationship between the human body and its environment. As humans we impact our environment, and the environment impacts our health.

Dr. Close recognizes/believes the illnesses and symptoms that can be scientifically linked to an exposure to mold include:

Allergies
Allergic rhinitis
Asthma
Blooding lungs
Breathing difficulties
Cancer
Central-nervous-system problems
Chronic coughing
Colds (chronic, frequent, recurring)
Coughing up with blood
Dandruff problems (chronic)
Death
Dermatitis
Diarrhea
Digestive difficulties
Earaches and chronic ear infections
Eye and vision problems
Fatigue (chronic, excessive)
Flu-like symptoms
General malaise
Hair loss
Headaches
Hearing impairment or hearing loss
Hemorrhagic pneumonitis
Hives
Hypersensitivity pneumonitis
Irritability
Itching of the nose, mouth, eyes, throat, skin
Kidney failure
Learning difficulties
Mental dysfunction
Memory loss or memory difficulties
Nausea
Personality changes
Redness of the eyes
Runny nose
Seizures
Sinus congestion, sinus problems and chronic sinusitis
Skin sores, lacerations, and rashes
Skin redness
Sleep disorders
Sneezing fits
Sore throat
Sudden Infant Death Syndrome
Tremors
Verbal dysfunction
Vertigo
Vomiting

For more information on health-related impacts of mold, see www.fungusdoctor.org.

WARNING SIGNS OF MOLD

An investigation for mold contamination should be performed anytime there is an increase in allergy or respiratory problems for occupants or their pets. Chronic on-going colds, headaches, or flu-like symptoms are an indication of a potential mold contamination. Other indications of mold contamination include musty, earth-like odors, water stains or discoloration, and/or peeling paint or wallpaper on ceilings or walls. Dots of any color, particularly black, yellow or green, may be the beginnings of a mold colony developing. Areas should be investigated after a high-humidity event, a water intrusion, a plumbing or roof leak, or when standing water or condensation has been noted. Warped boards also signal the presence of high humidity or a water intrusion.

Mold not only impacts our heather, but it can gradually destroy the building components on which they grow.

"Dampness and moisture, combined with organic nutrient materials and dirt indoors, trigger a biological spark that changes a relatively dry, stable environment into a living, thriving ecosystem within a building." ~Dr. Robert Close

PREVENTING MOLD GROWTH

Prevention of mold is accomplished through the control of moisture. Again, mold spores will not root and grow without the presence of moisture. **The key to mold prevention is MOISTURE CONTROL.** If the mold is cleaned up but the source of the moisture remains, the mold WILL come back.

Some tips for mold prevention include:

- REACT immediately to a water, moisture, or high humidity event
- Immediately clean up water leaks or spills indoors
- Address the cause of any condensation on windows or pipes
- Control humidity by keeping it between 35-45%
- Increase ventilation or air movement by opening doors and/or windows or use fans when humidity nears 55%
- Use dehumidifiers in at-risk areas
- Establish humidity monitors in at-risk areas and check regularly
- Fix plumbing leaks immediately
- Scrub visible mold off of hard surfaces
- Clean and repair roof gutters and down spouts regularly
- Landscape ground and sidewalks away from the building foundation
- Clean air conditioning drip pans regularly
- Vent appliances that produce moisture, such as clothes dryers, stoves, and kerosene heaters. Exhaust to the outdoors where possible
- Run the bathroom exhaust fan during showers plus twenty minutes
- Use exhaust fans when cooking, running the dishwasher or other moisture creating tasks
- Dispose of porous materials in which mold has rooted (ceiling tiles, carpet, drywall).
- When removing mold contaminated components, if disposal requires moving through non-contaminated areas, bag the components so as not to cross-contaminate other areas in the building.
- Do not paint or caulk moldy surfaces without first cleaning the surface and ridding it of the mold colonies.
- Minimize clutter. Mold spores get trapped in the clutter and will lay dormant until a moisture events occurs.

INVESTIGATING FOR MOLD CONTAMINATION

Investigating for mold colonies can be quite difficult since mold can be hidden behind walls, under carpeting, in furniture, etc. Also, while investigation for mold colonies, be cautious not to disturb the colonies. Disturbing the colonies can cause a spore release that can exasperate the situation.

Places mold can hide are limitless:

- Back of drywall
- Back of wallpaper
- Back of paneling
- Top side of ceiling tiles
- Underside of carpets
- In carpet pads
- Inside walls
- Around pipes
- Surface of walls behind furniture
- Inside ductwork
- In roof materials around ceiling tiles
- Inside exhaust fans
- Window air conditioning units
- Pipe chases
- Utility tunnels
- Condensate drain pans inside air conditioning units
- Porous thermal or acoustic liners inside ductwork

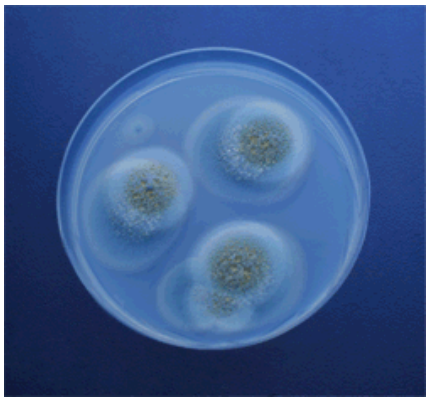
TESTING OR SAMPLING FOR MOLD

Testing can help determine whether or not mold has contaminated the air we breathe. When a mold contamination is suspected but cannot be found, taking air samples can determine whether or not the air is contaminated.

This does not necessary prove that no mold exists, only that if there is mold hidden somewhere, it is not impacting the air that we breathe. No action would necessarily need to be taken, but a suspect area should be inspected and tested regularly.

Unless the genera and species need to be identified, mold testing is unnecessary to prove there is a contamination when the mold is visible. However, testing should be performed once the mold has been cleaned up to determine if the remediation project was successful and is complete.

Source sampling with a tape or slide is not appropriate to determine if an area is contaminated, because there are mold spores everywhere all the time; most tape samples will indicate that there is mold. However, if it is necessary to deem a surface clean, a tape sample is appropriate. Or, if the genera or species of mold in the area must be identified, a source samples is appropriate.



Mold culture tests do serve a purpose, but not at determining whether or not there is a mold contamination. Since there are mold spores everywhere all the time, mold spores will accumulate on the culture and grow. But the culture will not tell you the concentration in the breathing zone of the area.

Sample analysis should follow analytical methods recommended by the American Industrial Hygiene Association (AIHA), the American Conference of Governmental Industrial Hygienists (ACGIH), or other professional organizations.

MOLD CONDITION

The IICRC S520 is a standard and reference guide for professional mold remediation put out by the Institute of Inspection, Cleaning, and Restoration and approved by the American National Standard Institute. This standard establishes definitions for mold conditions in indoor environments.

Condition 1 constitutes normal fungal ecology: An indoor environment that may have settled spores, fungal fragments or traces of actual growth whose identity, location and quantity are reflective of a normal fungal ecology for a similar indoor environment.

Condition 2 constitutes an environment with settled spores: An indoor environment primarily contaminated with settled spores dispersed directly or indirectly from a **Condition 3** area and which may have traces of actual growth.

Condition 3 constitutes an environment with actual growth: An indoor environment contaminated with the presence of actual mold growth and associated spores; actual growth includes growth that is active or dormant, visible or hidden.

TIPS FOR SAFELY CLEANING ISOLATED MOLD

In an isolated contamination situation, the mold is visible on a surface but has not rooted into the surface nor has reached the point of contaminating the air in the room or area. Safeguards should be taken to protect the person remediating or cleaning up the mold as well as precautions put in place to not disperse mold spores in the surrounding areas or rooms.

Safeguards for the person cleaning the mold off surfaces or in a very small area:

- Avoid breathing in mold spores. Wear an N-95 respirator when cleaning up mold.
- Protect skin by wearing rubber gloves that cover the lower arm as well.
- Wear a disposable coverall or remove clothing prior to leaving the area if there is the possibility of getting spores on the clothing. This will also reduce the chances of getting spores on your clothes and then spreading them to areas outside the contaminated area.
- Avoid getting mold spores in your eyes by wearing eye protection.

Precautions to avoid cross-contamination of surrounding areas:

- Dispose of porous materials in which the mold has rooted (ceiling tiles, carpet, drywall) directly to the outdoors. If the area does not have an exterior exit, wrap the debris before leaving the work area.
- Do not paint or caulk moldy surfaces; mold must be cleaned off surfaces and the surfaces should be dried prior to painting.
- Non-porous materials can be dried out, fully cleaned, and reused. Clean hard and non-porous materials using a detergent. After cleaning, rinse and thoroughly dry surfaces.
- Semi-porous materials (wood and concrete), if structurally sound, can be cleaned and disinfected. By encapsulating the material with an inhibiting mold encapsulant or wax, any remaining spores would be suffocated.
- Porous materials (drywall, carpets, insulation, ceiling tile) are very difficult to fully clean, because water and mold penetrate into them. As a general rule, if a porous material has been wet for over 48 hours or the root is visibly intact, remove and replace the component.

PRINCIPLES OF MOLD REMEDIATION

per the IICRC S520

- Provide for the safety and health of workers and occupants.
- Document the conditions and work processes.
- Control the contaminant at its source.
- Physically remove the contamination (source removal).
- Correct the moisture problem to prevent recontamination.

One consideration to not overlook when it comes to the health and safety of mold remediators and building occupants is the potential for disturbing lead-based paint, asbestos-containing material, or other environmental contaminants. Perform a full inspection of the area prior to establishing the remediation plan.

The HVAC system should also be inspected prior to establishing the remediation plan. Spores are easily pulled into the return duct work and can become trapped in the system or spread throughout the building. Mold colonies will also grow in any damp areas of the HVAC air handler or ductwork. The EPA's guide *Should You Have the Air Ducts in Your Home Cleaned*? explains the concerns associated with the ductwork and mold contamination. Do not run the HVAC system if mold contamination is suspected.

An overview of a mold remediation project consists of the following steps:

- Address the source of the problem that led to the mold contamination.
- Contain the area to prevent cross-contamination.
- Remove all contaminated components (except structural).
- HEPA vacuum area.
- Clean mold off all surfaces.
- HEPA vacuum again.
- If structural components had mold rooted in it, encapsulate.
- Take an air sample to confirm the project was successful. If not, reclean.
- Confirm the source of the problem was properly addressed.

Every mold remediation project is unique. Each remediation plan should be customized to address the uniqueness.

The IICRC S520 has broken remediation plans into small area, medium area, large area, and extensive area.

SMALL AREA OF MOLD CONTAMINATION REMEDIATION *(Less than 10 SF)*

Require less control.

Work area should be unoccupied.

Removing people from adjacent spaces is not necessary but is recommended for infants, persons recovering from surgery, immune-suppressed people, or people with asthma, hypersensitivity pneumonitis, and severe allergies.

Containment may not be necessary – ask, "will spores be released and spread?"

Cover surfaces in the work area with secured plastic sheeting to exclude spores, dust, and debris to prevent the spread of mold to these surfaces.

Leave area clean, dry, and free of visible debris.

MEDIUM AREA OF MOLD CONTAMIANTION REMEDIATION *(10-30 SF)*

Work area should be unoccupied.

Removing people from adjacent spaces is not necessary but is recommended for infants, persons recovering from surgery, immune- suppressed people or people with asthma, hypersensitivity pneumonitis, and severe allergies.

Containment may not be necessary – ask, "will spores be released and spread?"

Cover surfaces in the work area with secured plastic sheeting to exclude spores, dust, and debris to prevent the spread of mold to these surfaces.

Use dust suppression methods, such as misting surfaces prior to remediation.

Clean and/or remove materials based on their type. Unless taking them directly outside, seal materials being removed in plastic bags.

Leave area clean, dry, and free of visible debris.

LARGE AREAS OF MOLD CONTAMINATION *(30-100 SF)*

The work area and areas directly adjacent to it should be unoccupied.

Cover surfaces in the work area with secured plastic sheeting to exclude spores, dust, and debris to prevent the spread of mold to these surfaces.

Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.

If remediation procedures are expected to generate a lot of dust or occur where mold growth is heavy, follow the extensive contamination procedures and guidelines for protecting workers listed below.

Leave area clean, dry, and free of visible debris.

EXTENSIVE MOLD CONTAMINATION REMEDIATION PROJECT
(Greater than 100 SF)

Because extensive mold contaminations are very hazardous, the following plan has been adapted using the IICRC S520 and the EPA's *Mold Remediation in Schools and Commercial Buildings* to grasp all the details for a successful project. Each of these projects should start with developing a remediation plan customized to the uniqueness of the building and the contamination. The plan should address work area isolation, the use of exhaust fans with high-efficiency particulate air (HEPA) filtration, the design of airlocks/decontamination room, and negative pressure enclosures. Upon completion, the area must be clean, dry, and free of visible debris.

Definition of Extensive Contamination: evident mold which may not be isolated to a specific area, that has embedded into building components and may have grown into interior of walls, floors, ceilings, and which may have contaminated the air quality of an entire room or unit.

During the entire remediation process, remediators should attempt to identify further origins of moisture that would allow mold colonies to develop. Workers should wear protective gear, including N-95 masks or respirators, Tyvek suits and latex gloves once the remediation has started. Evaluate any permanent damage to any components or furnishings for a decision on repair, restoration, replacement, or disposal.

If isolated to a specific area, a containment and/or decontamination unit should be temporarily constructed to isolate the contaminated area. Begin work at the furthest point from the exit and move work performance from this point toward the exit.

If necessary and/or possible, air scrubbers or negative air machines should be strategically placed inside the containment.

Scrape, scrub, or clean all apparent mold colonies within the containment with a mold-killing disinfectant.

Perform any destructive remediation, such as removal of wooden components.

Bag or wrap all debris in poly prior to removal from the containment so as not to spread mold spores to other areas of the house.

HEPA vacuum the entire interior of the contained areas beginning with the ceilings, followed by the walls and permanent fixtures, concluding with the floor.

Clean the entire interior of the contained area with a mold-killing disinfectant beginning with the ceilings, followed by the walls and permanent fixtures, concluding with the floor.

The entire interior of the contained area beginning with the ceilings, then the walls and permanent fixtures, then the floor should be HEPA vacuumed a second time.

The entire contained area should receive a daily fogging with a non-toxic antimicrobial disinfectant.

Encapsulate the contaminated building components with a mold-inhibiting

encapsulant.

Collect post-remediation air quality samples from the containment area to determine if unusual mold conditions still exist and further remediation is required. In order for the laboratory to have a comparison sample, an outdoor sample should also be collected.

If post-remediation results report that "no unusual mold conditions exist" in the areas from which the samples were collected, the project will be considered complete and successful.

If post-remediation results report that any of the areas from which samples were collected are still contaminated, additional cleaning and sampling should be performed until those areas return result stating that "no unusual mold conditions exist."

NOTE: *Mold may cause staining and cosmetic damage.*

CONTENT REMEDIATION

When mold is visibly apparent on contents or when air samples taken in the area where the contents were kept fails clearance testing, the contents should be considered contaminated. Any contents made of porous material need to be inspected and a decision needs to be made on whether to clean and restore the contents or dispose of them. The decision should lean toward the side of caution.

The contents should then be HEPA vacuumed, cleaned with a mold-killing disinfectant, dried, then HEPA vacuumed a final time.

It is highly recommended that a post-remediation report be composed documenting the pre-remediation conditions, the remediation plan followed, and any changes to the original remediation plan. The documentation should include the final air clearance reports.

HOW TO KNOW WHEN REMEDIATION IS FINISHED

The mold remediation project is successfully completed when:

- The original source of the water intrusion or high humidity has been addressed.
- There is no visible mold. *Note: Mold may cause staining and cosmetic damage.*
- There is no recognizable odor that one would associate with mold.
- Air samples indicate low levels of mold spores.

THE ARGUMENT FOR/AGAINST CHEMICAL USE IN REMEDIATION

Bleach is a chemical solution composed of sodium hypochlorite or hydrogen peroxide used to whiten or sterilize materials. It is not recommended for mold remediation in that the chemicals quickly evaporate and leave water behind. Mold loves water.

Biocide and fungicide are solutions that destroy or inhibit the growth of living organism such as mold. The EPA recommends the use of a detergent such as Dawn Dish Liquid. However, by adding a biocide or fungicide to the remediation plan, mold spores that may be left behind from HEPA vacuuming will be destroyed and/or their growth inhibited. Professional judgement and discretion are necessary in determining if a biocide is appropriate for any unique project.

For a project where the occupants may have a suppressed immune system or may be sensitive to chemicals, caution is warranted. Biocides and fungicides can be toxic for this population. If the decision is made to use such chemicals, the area should be ventilated and the areas outside the containment should be unoccupied by humans, animals, or plants.

Another consideration with biocides and fungicides is that the effect is immediate, and there are no long-term residual effects.

Disinfectants are liquid chemicals that destroys bacteria. A mold and mildew disinfectant will kill bacteria, mold, and mildew. Many such chemicals are EPA-registered and have been specifically formulated to disinfect against bacteria, kill mold at their roots, and kill the mold spores. These solutions therefore prevent the regrowth of the mold.

Essential oils are a concentrated hydrophobic liquid containing volatile chemical compounds from plants. More simply stated, essential oils are the oils extracted from the plant. Some blends of essential oils have been found to eradicate mold spores. Both Thieves, distributed by Young Living, and On-Guard, distributed by DoTerra, have proven to be useful in the elimination of residual spores left behind after a mold remediation project, both on surfaces and those lingering in the air.

Baxter Group, Inc. tested these products in the field and were amazed by their residual implications. Air samples were collected before remediation projects, after remediation was completed, after diffusing these essential oils, and then again weekly for several weeks. The initial post-remediation samples cleared the project as being completed. The testing performed after diffusing and then weekly indicated a reduction in spore counts each week.

Thieves and On-Guard eliminated both dead and alive spores. They are non-toxic, support health and wellness, and have long-lasting residual effects. Although these efforts increase the expense associated with the mold remediation project, they prove to be well worth it. Which is best for a mold remediation project: biocide, fungicide, a disinfecting mold and mildew cleaner or essential oils? That depends on the project and which choice fits the project best. No matter which one is chosen, addressing the cause of the moisture issue and removing the mold colonies must remain the primary means of remediation. The product should complement the remediation process.

CONCLUSION: IN THE NEWS

Mold Allergies May Be Making You Sick All Year

By Lynn Allison | Monday, 08 April 2019 09:54 AM

If your allergies seem to be more year-round than seasonal, you may be allergic to mold spores. According to the Asthma and Allergy Foundation of America while the really severe mold season lasts from July to mid-fall, mold and mildew can become a nuisance anywhere and at any time of the year.

"It's estimated that 25 percent of people who have allergies are allergic to mold," Dr. Andy Nish, MD., an allergy and asthma specialist from Gainesville, Georgia, tells Newsmax. "The symptoms of mold allergy, particularity from indoor molds, may be even more insidious than springtime pollens would cause.

"That is because the exposure may be more prolonged instead of occurring in peak and valleys when you are outdoors. Mold allergies can cause more inflammation in the body so you may have more nasal congestion and if it triggers asthma, you may have difficulty exercising or sleeping through the night," says the expert.

AAFA explains that if mold spores get into your nose, they can cause allergy symptoms, and if they get into your lungs, they can cause asthma.

Typical allergic symptoms, besides nasal congestion, include:

- Itchy, watery eyes
- Sneezing
- Rashes
- Stomach cramps
- Vomiting
- Diarrhea
- Bloating

Typical asthma symptoms include:

- Coughing
- Wheezing or making a whistling noise when you breathe
- Shortness of breath
- Rapid breathing
- Chest tightness

Nish says that in preventing mold allergies, "the best offense is a good defense." Here are some suggestions:

Wear a dust mask if you are working outdoors cutting grass, digging around plants, picking up leaves or disturbing other plant materials.

Keep the windows of your car and house closed to minimize exposure to mold.

Limit your exposure to mold spores outside when the mold count is high, says AAFA. Stay indoors.

To reduce your exposure to mold inside the home, use a certified asthma and allergy friendly filter with your central air conditioning. For more allergy-friendly products check out the asthma & allergy friendly certification program.

Lower your indoor humidity. No air cleaners can work efficiently if there is too much moisture in the air. If your indoor humidity is above 50 percent, mold spores will thrive. AAFA recommends keeping the humidity in your home below 45 percent but 35 percent is better.

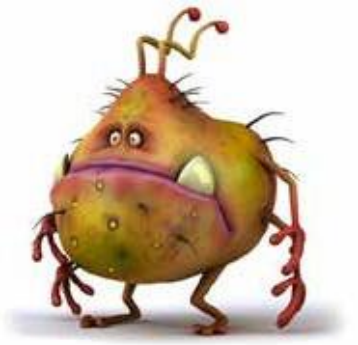
- Pay close attention to mold building up in areas like the basement, laundry room or bathrooms and be aggressive in reducing dampness.
- Improve the air flow throughout your rooms and use exhaust fans if necessary.
- Fix any leaks promptly.
- Make sure that rainwater drains AWAY from your house.

If these steps do not alleviate your allergies, speak to your healthcare provider about taking medication or having allergy shots to reduce your symptoms, says Nish.

Read Newsmax: Mold Allergies May Be Making You Sick All Year | Newsmax.com

Chapter Five
Healthy Buildings Tool Kit

Published May 2019



- **INTRODUCTION**
- **VISUAL ASSESSMENT**
- **HEALTHY BUILDING ASSESSMENT**
- **BUILDING SITE ASSESSMENT**
- **PLAY AREA ASSESSMENT**
- **BUILDING EXTERIOR ASSESSMENT**
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Breathe Healthy

A Guide for Those Responsible for Indoor Environments

INTRODUCTION

Reflect back on the last chapter's opening story, "A Monster in Your Basement?" The white-haired 85-year old lady had years of sharing her home with her husband, years of being a responsible homeowner, years of showing pride in home ownership. Yet, overlooking one crucial preventative maintenance task cost her huge losses and expenses.

The sump pump had not failed. There were no leaky pipes. But the last time the dehumidifier had been emptied was one week prior to her husband's death eight months earlier. Humidity filled the basement providing the perfect environment for a terrarium of mold. In addition to the expense for remediation, she lost the carpeting, the cloth and porous furniture, and paperwork stored in cardboard boxes. Over the last few months, she also developed significant respiratory issues. Most significant to her, she lost the teddy bear collection she had intended to pass on to her grandchildren. She was heartbroken.

Preventative maintenance is key to avoiding huge repair costs and health issues among our building occupants. There is a direct tie between our indoor environment and occupant health, especially in a world where we now spend as much as 90% of our day indoors. In workplaces, unhealthy environments significantly impact productivity and profitability. Poor indoor environments impact how we work, live, perform, and feel.

Optimizing all the building systems to provide the ideal living and working environment will lead to improving health, productivity, profitability, and quality of life.

A **Healthy Building Toolkit** should include regular maintenance tools, subcontractors for the repairs that cannot be handled in-house, a maintenance checklist employed once or twice a year depending on the property, and finally, a task-list or work order system to address building concerns *before* they become a crisis project.

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

By employing a Healthy Buildings Toolkit and addressing any items that have a "call to action," our buildings and properties stay healthy and our occupants are protected. Just like humans having annual check-ups, the same process is true for our buildings. Regular inspections of our properties are the foundation of a Healthy Building Toolkit and the backbone of a strong maintenance program. This tool is meant to identify, prevent, and control maintenance problems before they grow into environmental crises. It is a useful tool in preventing illnesses and injuries that typically arise from poor indoor environmental quality.

This Healthy Building Toolkit is not intended to replace any current maintenance programs but rather to enhance current maintenance programs. The checklist provided as an appendix in this eBook can be provided to the reader in a Microsoft Word document so that it can be modified to create a customized healthy building assessment specific to a property or properties.

Requests may be emailed to info@baxtergroupinc.com or jm@baxtergroupinc.com.

VISUAL ASSESSMENT

The Healthy Buildings Checklist is visual assessment form used to collect information on current property conditions and to provide a *Call to Action* that can be turned into a task list or work orders to address maintenance concerns. It also provides a record of conditions at a specific point and time which may prove useful in the future. Saving completed Healthy Buildings Checklists provides a history and reference that can assist in determining building issues that may develop over time.

Instructions:

Identify Wall or Side A as the side that is nearest to being parallel to the street on which the address is denoted. Then move clockwise to identify Side B, Side C, Side D.

Use the "Comments" section for any additional information that could be useful in addressing the "Call to Action" or could provide important reference information in the future.

Use one assessment per site or property. The section denoted as "Room Equivalent" should be photocopied to meet the needs of the number of rooms in a building. Room Equivalent could be bedrooms, parlors, or a common area. A floor plan should be drawn of each building, indicating Wall or Side A, B, C, or D and providing a unique name or identifier to each room.

The most crucial section will be the "Call to Action" section which will be used to create the task list or work orders necessary to bring the property back to good health or to prevent building health issues. Comments should note any indications of water intrusions, suspect mold, peeling paint, buckling walls or floors, and any other items that are indications that a problem may be in its beginning stages.

This Healthy Building Checklist should go hand-in-hand with any asbestos surveys, lead-paint risk assessments, radon testing, water testing, pest inspection, mold testing, electrical inspections, and HVAC inspections. If the Healthy Building Checklist identifies that suspect asbestos pipe

insulation is beginning to deteriorate, or that lead-based paint is beginning to chalk or crack, these issues can be addressed in time to keep the environment safe.

Major Inspection Areas:

- Property/Building site
- Play area
- Building exterior
- Building systems
- Room equivalents
- Bathroom
- Kitchen
- Patio
- Stairwell
- Basement

CONCLUSION:

The Office Manager sounded panicked as she described the situation to a Certified Indoor Environmentalist (CIE). Fred, one of their long-term employees, was angry and threatening to call OSHA. He was feeling fatigued and experiencing headaches every time he worked in the office. He loved his job, so he insisted it had to be the office that was making him sick.

A visual investigation noted no evidence of mold or pests. Actually, the office was quite clean. The CIE set up the GrayWolf Sensing Probe and left it for 24 hours. The probe took a reading of the temperature, humidity, carbon monoxide, carbon dioxide, and ozone levels every 15 minutes. The carbon dioxide was very high. This typically indicates either insignificant fresh air coming in or too many people sharing the air in too small a space.

The Office Manager recalled that two years ago there were only eight people in this office space. They experienced some incredible growth and now had twenty-two people sharing the same area.

Their in-house HVAC Specialists reviewed the historical records from their Healthy Building Assessments and HVAC inspections, made a few adjustments to the HVAC unit, and the problem was solved.

Chapter Six
Safe Renovations

Published June 2019

- **INTRODUCTION**
- **PROCESS DESIGN**
- **MATERIAL SELECTION**
- **RENOVATION WORK PLAN**
- **IMPROVEMENTS TO DAMP AREAS**
- **KEEPING OUR CHILDREN SAFE DURING RENOVATIONS**
- **CONCLUSION: IN THE NEWS**

Breathe Healthy
A Guide for Those Responsible for Indoor Environments

INTRODUCTION

The early 20th century house sat just off the sidewalk of a side street of the little Pennsylvania town. The missing steps and deserted tools evidenced the porch under construction. There were no curtains in the front window, and a 2x4 could be seen leaning over the inside of the window. The sound of a running bandsaw vibrated through my ear as I headed for the side entrance as instructed in our phone conversation. I knocked on the door, the saw went silent, and I was greeted at by the retired couple. Huge smiles and a welcoming hand captured my attention immediately. As I shook Mr. W's hand, he gently drew me into his kitchen.

After introductions, he said, “Let me show you what we are doing.” With enthusiasm, he noted that the kitchen was complete, and he was currently working on the front living room and performing some work upstairs. After a tour of the living room, fireplace room, back porch and upstairs living room, we settled on the bar stools at the kitchen island. Mr. W pulled out the report from his doctor noting that the lead in his blood was at 97 - dangerously high for an adult. He suspected that the lead may be leaching from the solder in the old copper pipes of their home and current renovation project. They had stopped drinking from their well water, but their doctor recommended that he have the water tested.

As my eyes glanced across the counter, I noted it was the only space without a layer of dust. I expressed my concern about the possibility that the dust was the issue. Mr. W looked at me puzzled, then commented, "But, I'm not eating the dust." I handed him the EPA brochure, "*The Lead Certified Guide to Renovate Right"* and let him know I had brought the water test kit he had requested on the phone. I had also brought my XRF Analyzer and would like to have permission to take an analysis of some of the painted surfaces he was disturbing. Staring at the pamphlet, he nodded his head in a slow, still puzzled, "Yes."

Returning to the kitchen, I walked into the living room, walked pass the band saw, pressed the nose of the XRF against the wall, and pulled the trigger. Twenty-five seconds later the screen displayed a number and the word "negative." Mr. and Mrs. W released a sigh of relief as I announced the negative reading. Then I went to the pile of baseboards that had been removed from the wall, placed the nose of the XRF against one of them and pulled the trigger: positive.

- Windowsills: positive.
- Crown moldings: positive.
- Hall wall: positive.
- Hall floor: positive.
- Fireplace mantel: positive.
- Stair rail: positive.
- Stair stringer: positive.
- Stair tread: positive.
- Bedroom wall: positive.

I took a sample of the water, and a few days later the lab report returned with a negative for lead. The dust wipes I had collected, however, came back with high readings for lead content. When I called Mr. W with the results, it was obvious he had not only read the pamphlet I provided him with, he had also done some on-line research. He had become the expert on SAFE RENOVATIONS. He had also scheduled an appointment for Mrs. W to have her blood tested. He shared his deep regret that he had not protected his wife of 40 years from potential lead poisoning. He then added, "… and what else could I have disturbed that could cause us and our visiting family future health issues?"

Many safe renovation practices have been reviewed earlier in this e-book. Asbestos, lead, mold, radon, and other indoor environmental contaminants are not to be feared but respected and controlled during and after renovations. Through some simple practices, we keep our building occupants and the community safe from hazardous exposures. However, many environmental hazards do not make us sick the day we are exposed … but months or years later.

Unless the property is a private residence and the renovations are being performed by the owner, an asbestos and lead inspection may be required. Check with your local, state, and federal regulatory agencies to determine which inspections are required by law prior to a renovation or demolition project.

Mr. W. would have been safe if he had contained the work areas so as not to cross-contaminate the areas around the work area and had he donned the proper personal protective equipment.

PROCESS DESIGN

Renovations to any building are an exciting experience, especially for a property manager or owner as they watch the transformation from old, outdated styles to restored or upgraded designs. The excitement of the renovations and the speed in which we want to get everything done cannot outweigh quality workmanship and safe work practices.

The typical renovation project should follow the process of design inception (putting the dream in writing), material selection, development of a work plan, work area containment, encapsulation when necessary, required abatement, demolition, clean-up, rebuild, and final construction clean-up.

When designing and planning the project, safe work practices are weaved throughout to keep the workers, occupants, and neighbors safe. Impacting mold without containment can lead to mold growth in other areas of the property. The mold spores lay silent until a humidity or moisture event occurs. Disturbing lead-based paint or asbestos-containing material can contaminate the entirety of both the property and the neighboring properties if not properly contained. A radon test should be performed after any renovation whether there is a mitigation system or not. Radon entry pathways can be changed by renovations. After renovations, if any occupant experiences negative health

effects, it is possible that new products and components could be off-gassing hazardous vapors or Volatile Organic Compounds (VOCs).

Once safe work practices become a way of life for renovators, they are no longer viewed as an annoyance. Just like putting on our seatbelts. I was in my early 20s when the new seatbelt laws were enacted. I rebelled ... like many others, I felt it was the most absurd thing our government had ever suggested, especially when reports came out showing people died in crashes *because* they were wearing seatbelts. After my second seatbelt ticket and the fine associated with it, I gave in and started wearing them. New reports had become convincing that more people die in crashes from not wearing seatbelts than from wearing them. Today, I feel uncomfortable, vulnerable, and at risk if I don't have my seatbelt on. Buckling my seatbelt has become a habit that I do not even think about. Safe work practices during renovations are the same for our company. It's just a way of life.

MATERIAL SELECTION

Material Selection typically takes into consideration design, cost- effectiveness, green sustainability or LEED building certifications, and protection of the indoor air for workers and occupants during the renovations and after completion of the project. Here we will focus on the protection of the indoor air.

Sources of indoor environmental contaminants are interior building materials, furnishings, and equipment. Interior building materials can include flooring, carpets, carpet padding, paints, sealants, caulking, adhesives, floor tiles, ceiling tiles, material used for the construction of cabinets, molding, composite wood

products, etc. These materials can contain off-gas contaminants such as volatile and semi-volatile organic compounds, as well as particulate substances that can irritate the eyes and throats. Many paints, varnishes, adhesives, sealants, coatings, and finishes emit off-gases long after completion. Some of these emissions can also be toxic to sensitive individuals. It is important to select products whose emissions are low and the least hazardous to the future occupants of the renovated area.

From an indoor air quality perspective, the renovator should select materials that require the use of low-VOC adhesives and coatings that emit little or no odor. These materials should be easy to clean and maintain, not susceptible to moisture damage, and not encourage mold growth.

Special attention should be taken on renovation projects that are in spaces where material selection issues are a particular concern, such as children's areas, nurses' office, special education classrooms, etc.

By obtaining the Safety Data Sheet (SDS) and manufacturer data sheets related to each product to be used, the designer can determine the appropriateness of products to be used in each of the renovated areas.
These sheets identify concerns for the workers during renovations and possible concerns for the occupants after renovations.

Materials that renovators should consider from an indoor air quality perspective include:

- Flooring
- Wall materials
- Ceiling materials
- Paints and coatings
- Adhesives
- Sealants
- Engineered wood products
- Cleaning supplies

Understanding Off-gassing

Off-gassing is defined as the release of a gas that was dissolved, trapped, frozen, or absorbed in some material. Off-gassing can be impacted by temperature, humidity, and air changes.

An illustration of why off-gassing can take years to dispel:

Formaldehyde leaves particle board and goes into the air. The layer of formaldehyde remaining beneath the surface migrates to the surface. This layer is then off-gassed into the air. Additional formaldehyde migrates through the material to balance what was removed by migration, and so the process continues. As the surface layer formaldehyde is replaced by formaldehyde from deeper within the material, there is always some emission from the surface. As time goes on, these concentration gradients get smaller, less formaldehyde is emitted, and eventually, as a state of equilibrium is achieved, the emissions become less and less until there are none. This process may take days, months, or years.

Flooring

Carpet offers acoustical and comfort benefits. However, from an indoor environmental perspective, carpet should be the last choice or the choice when acoustical and comfort is one of the ultimate goals. For instance, carpet in a bedroom heightens the comfort level. However, carpet and carpet padding attract and collect biodegradable dusts that are not easily vacuumed and that

may create an environment conducive to the growth of bacteria and mold.

Resilient flooring is an excellent choice for high traffic areas including hallways, classrooms, cafeterias, restrooms, and auditoriums. They are especially appropriate for areas where there is the possibility of liquid spills. Hardwood floors will be discussed under engineered wood products.

Regardless of the type of flooring, regular cleaning and maintenance requirements should be considered when selecting the flooring and flooring finishes. Consideration should also be given to entry mats as well. Entry mats have been recognized as a great tool for trapping soil, pollutants, and moisture keeping them from spreading across the building floor or throughout the building.

Particular consideration should be given to flooring adhesives because of the off-gassing of volatile organic compounds (VOCs) for a period of time after installation. Carpet and hardwood flooring choices should be given an opportunity to air out in a clean, dry area prior to installation.

All flooring installation should occur when the work area and adjacent rooms are unoccupied. A negative air machine(s) should be used to exhaust directly to the outdoors causing the room to be under negative pressure relative to adjacent spaces in the building. Extra ventilation should continue for a minimum of 72 hours after installation.

Walls and Ceiling Materials

Select formaldehyde- and asbestos-free wall and ceiling materials. (Yes, you can purchase material that contains asbestos … see asbestos chapter). Avoid applying VOC-containing materials in spaces with exposed walls and ceilings that may easily absorb off-gassing.

Coordinate placement of lighting and other fixtures to provide easy access for inspection and servicing of interstitial areas, HVAC systems, and other components or mechanical equipment.

Immediately replace and remove from the work area any ceiling tiles that become wet so as to eliminate the possibility of a mold contamination.

Paints and Coatings

Most paint and coating materials off-gas VOCs. Although they may still emit an odor and VOCs, high-quality, low- or no-VOC paint and coating products are available and are a better choice when protecting the quality of the air in indoor environments.

Water-based acrylic latex paints are generally lower in VOCs than other options, are safe to handle, and can be cleaned up with water, reducing the health risks to workers and minimizing hazardous waste.

Review the SDS to confirm that the products contain no lead, mercury, hexavalent chromium or cadmium. Industrial and commercial paints may still contain these components.

Other building materials should be isolated and protected from the off- gassing so as not to absorb the VOCs and emit them back into the air after renovations.

Properly ventilate the area or use negative air machines exhausted to the outdoors during renovations and for a minimum of 72 hours after renovations are completed to minimize any off-gassing or VOCs that may be released in the air.

When sanding building components or painted areas, a respirator should be worn by all workers in the work area.

Work areas and areas adjacent to the work areas should be unoccupied during the application of paint and other coatings. When feasible, consider applying coatings to building components off-site prior to installation.

Prior to application of paints and coatings on-site, cover all surrounding surfaces with poly sheeting to minimize damage and absorption of off- gases.

Follow manufacturers' recommendations and instruction for application, cleanup, storage, and disposal.

Keep paint and coating containers covered as much as possible to minimize the amount of off-gassing.

Adhesives and Sealants

Many adhesives, sealants, and related products off-gas large amounts of VOCs. Use low-VOC products.

Engineered Wood Products

Engineered wood products such as pressed wood, plywood, particleboard, and fiberboard are used in the manufacture of hardwood flooring, subflooring, wall paneling, doors, cabinetry, shelving, cabinet tops, shelving, trim, and furniture.

These materials can be obtained with lower formaldehyde off-gassing and low-VOC. Pre-treatments, barrier coatings, and sealants can be used to reduce all off-gassing. Recognize, though, that these coatings and sealants may produce off-gassing as well, so proper selection is important.

Adequate ventilation or employing a negative air machine(s) will minimize the impact of off-gassing. This safe work practice should be maintained during the renovations and for a minimum of 72 hours after renovations are completed.

Substitutes for engineered products would include gypsum board, solid wood or metal, waferboard, and no-VOC plywood.

Occupants Sensitive to Environmental Hazards

When performing renovations in an area occupied by someone with sensitivities, take time to test paints and varnishes. To test, apply the paint or varnish to a scrap piece of wood, allow to dry, then have the person place their nose up close to the painted area. They will know almost immediately if this particular compound is going to make them ill.

Keep in mind that people have different sensitivities to different building components, compounds, cleaning fluids, etc. Just because it does not bother one person does not mean it will not bother another person. Odors that come from these materials, supplies, and products are caused by off- gassing. It can take some time for the off-gassing to finish its process. Off- gassing can be sped up by creating airflow in the work area, such as through the use of a negative

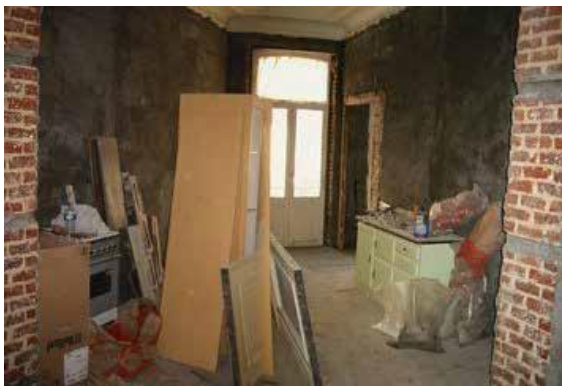
air machine or by placing two fans in the work area– one to pull fresh air in and the other to exhaust air out.

RENOVATION WORK PLAN

Indoor air quality is protected through a well-thought out work plan that implement safe work practices throughout. The odors associated with off-gassing are one of the major indoor air quality complaints after the completion of a renovation project. Through careful material selection, minimizing the use of materials that off-gas, and a work plan that encompasses strategic engineering controls for proper ventilation, we can greatly reduce or eliminate odors.

Generally, a work plan will include:

- Selection of materials
- Process of airing out materials when needed
- Containment of the work area
- Engineering controls to properly ventilate the work area
- Abatement of hazardous materials, such as asbestos or lead, including



clean-up procedures
- Demolition of remaining building components
- Clean-up of work area
- Building new design of renovation area
- Final renovation clean-up

Certain building components and supplies will off-gas for shorter durations after manufacture or installation. This off-gas can be absorbed by other building components, particularly porous materials. When possible, building components that off-gas for shorter durations should be installed before the building components that tend to absorb off-gasses.

If the materials being used are the type that tend to emit off-gases, consider "airing them out" prior to bringing them to the work site. Remove them from their packaging and unroll or space them out in a well-ventilated space, such as a warehouse, so fresh air can easily flow in and around them. If furnishings or cabinetry, open the drawers and doors. If electronics, turn them on and allow them to heat up and burn off the pollutants. Doing so minimizes the concern for workers during installation and the concern for absorption into other materials in the work area. In cases where there are heavy emissions of off-gases, force large amounts of outdoor air into the warehouse area for a period of days so the majority of pollutant emissions is removed.

Engineering controls should be established to protect adjacent areas, including containment and proper ventilation. Containment or isolating a work area from adjacent rooms is crucial. If construction dust, paint fumes, or a contaminant release occurs, we want to isolate it to one area. Poly barriers can be hung over doorways and taped around windows.

Tacky mats will limit the spread of dust and other contaminants by workers' shoes. Booties are also ideal for wearing in containment areas and removing before leaving containment areas to avoid cross-contaminating areas outside the work area. Wearing booties when entering a property will keep soil from being dropped by worker shoes/boots as well.

Drop cloths below work areas can catch debris and construction dust. They should be changed regularly so as not to spread contaminants.

The HVAC unit should be shut down during renovations, because biodegradable or allergenic dust can be sucked into the returns and spread throughout the property. Covering all vents is also crucial to protect the HVAC duct work from contamination. Other mechanical systems should also be shut down. Radiators and baseboard heaters should also not be in operations and should be covered. Otherwise, when turned on, contaminants can burn and cause hazardous vapors. If necessary, portable units can be used to keep workers warm or cool.

Considerations on HVAC Ductwork

A space quite often forgotten and left unprotected during renovations is the HVAC ductwork or mechanical equipment. Sawdust is biodegradable. If it gets into the ductwork, it can become moist making it the perfect nutrient for mold growth. When the HVAC unit kicks on, it spreads the mold spores throughout the building.

If replacing the ductwork, avoid duct board and flex duct. When duct board becomes moist, mold will root into to it. The best option to remove the mold is to remove the duct board so the roots are eliminated. Flexible ducts are not easily cleaned. Solid metal ducts are the best option.

Properly insulate ductwork in attics and crawlspaces. Otherwise, condensation may occur when there are changes in temperature. Moisture and dust in the ductwork create a perfect environment for the propagation of mold. Ductwork should be insulated on the outside of the ductwork, not the inside. Otherwise, it cannot be adequately cleaned.

Use filters recommended by the manufacturer. Initially, filters should be checked monthly to determine the replacement timing required for the

building. All buildings will be slightly different depending on the use and occupancy of the building.

Before re-occupancy after renovations, consideration should be taken to have the HVAC system professionally cleaned.

Many IAQ investigations end in the identification of poor indoor air because of dirty or contaminated ductwork. Protecting the ductwork during renovations is crucial.

The amount of ventilation will be determined by the size of the area being renovated and the amount of construction dust and off-gassing that will occur. It is crucial to have the air pulled from the area and exhausted to the outdoors rather than forcing fresh air into the work area. Doing so will cause polluted air to enter areas adjacent to the work area. Return to the chapters on asbestos and lead to learn more about proper containments.

Cleaning should occur daily along with a deep cleaning after the demolition and a final deep cleaning upon completion of all construction and renovation. Proper deep cleaning must be employed, including HEPA vacuuming, damp wiping, and a final HEPA vacuuming, and when applicable, cleaning of the ductwork.

Material encapsulation is the process of placing a barrier between the material of concern and the indoor air. This reduces the amount of gases or particles emitted into the indoor air from the building component or the products used to perform their installation. Although some encapsulation occurs automatically as a result of the work plan, it is usually safer to specify the use of materials that do not off-gas or that are low-VOC instead of attempting to encapsulate all surfaces.

Encapsulants typically include high-pressure plastic laminates, factory applied coatings or films, and coats of water-based polyurethane lacquer.

IMPROVEMENTS TO DAMP AREAS

Improvements to bathrooms, kitchens, laundry rooms, basements, and areas that tend to experience moments of dampness should include designs to assist in keeping the areas dry and contaminant-free.

Both during and after renovations, odors should never be ignored. Odors are indicators of the existence of a contaminant or the growth of mold.

While renovations are in progress, odors may be released during the demolition process, such as when walls or floors are being removed. Work should be stopped, and the source of the odors should be investigated and addressed. Otherwise, the new renovations may cover up an issue that could cause major problems in the future.

Extra design items should be included in areas that tend to get damp, such as the installation of exhaust fans above stoves and in bathrooms. These exhaust fans should exhaust to the exterior. If exhausted into a building chase or the attic, moisture can become trapped. One mold spore can cause a full-blown mold contamination in these areas in the future. The controls to the exhaust fans should be separate from the lighting or other electrical components so that the occupants can allow them to run until all moisture has been eliminated from the area.

Renovations are the perfect time to clean all appliances, furnishings, and building components that are going to remain. Kitchens and bathrooms tend to be more humid than the other rooms, allowing for small mold colonies to accumulate. Remember that the best cleaning method is to HEPA vacuum, damp wipe, HEPA vacuum.

Consider applying a sealant to the interior of cabinets to ease cleaning in the future.

All plumbing should be checked for leaks and repaired.

Any cracks in the plumbing areas, countertops, backsplashes, wall, or floor tiles should be repaired in such a way that they cannot collect or retain water or moisture. If they retain water or moisture, the building components around it will become degraded or mold growth can occur without any initial visibility or warning.

Carpeting should never be installed in humid environments such as kitchens, bathrooms, laundry rooms, and basements. Carpets easily collect biodegradable dust. If the biodegradable dust becomes damp, it is the perfect nutrient to feed mold growth.

A **DEHUMIDIER** is your best friend in damp areas or areas at risk of water intrusion. A dehumidifier can be positioned in the containment during renovations and should be a part of the design for humid areas. When conditions linger above 50-60% relative humidity for extended periods of time, mold and bacteria growth is stimulated. Damp areas also contribute to the cupping of wood floors and the deterioration of floor joists, beams, sub-flooring, insulation, and electrical-mechanical systems.

KEEPING OUR CHILDREN SAFE DURING RENOVATIONS

If any of the building occupants during renovations are children, special considerations must be taken to protect them. Indoor environmental contaminants have a greater impact on children, especially those under six, because their body is still developing. During development, children's bodies absorb air and all its components into their bloodstream. If any of those components are contaminants, their body can be poisoned, impacting their mental and physical development.

Keeping our children safe during renovations is not as simple as it sounds. Their natural curiosity will draw them to the renovation work area. The first step, then, in protecting them is educating them at their level on the safety concerns.

Secondly, changing some of the routines around the home or building can be beneficial. Alternative areas to fulfill basic needs should be implemented. Where are the children going to sleep, go to the bathroom, eat? Make arrangements for all activities to be clearly outside of the work areas.

Workers will need to be notified that children are in the area. Work areas will need to be blocked off. Tools and building components are attractive to many children. Workers will need to take extra caution to make sure that nothing is left outside the work area. Tools, equipment, supplies, and waste must be secured away from the paths or access of children.

Parents must take responsibility to keep the children out of the work area and not leave their children alone in any areas adjacent to the work area. Workers must take responsibility to keep their tools, equipment, supplies and waste inside the work area where children will not have access to them.

CONCLUSION: IN THE NEWS

STATE WORKERS VACATE OFFICES AFTER DISCOVERY OF LEAD DUST CONTAMINATION MAY BE THE RESULT OF RENOVATION
by William F. Zorzi Jr THE BALTIMORE SUN 5/1/1996

Seventy employees of the Maryland Division of Parole and Probation were ordered out of their offices this week after state safety officials discovered lead contamination, apparently from the current renovation of the downtown building.

W. Roland Knapp, director of parole and probation, told the employees to vacate the offices Monday when a state safety officer, acting on a complaint, found them to be contaminated with high levels of lead dust, officials confirmed yesterday.

The offices are on the sixth and seventh floors of the largely vacant American Building, 231 E. Baltimore St.

The state workers were told to see their physicians and have their blood tested for evidence of lead, said Leonard A. Sipes Jr., spokesman for the Public Safety and Correctional Services Department. "Who's to pick up the tab for this is unknown at this point," Mr. Sipes said.

The workers are being reassigned temporarily to other parole and probation offices, he said.

The Division of Parole and Probation leases 9,000 square feet on two floors of the 14- story building for a regional field office, an investigations office and the Drinking Driver Monitor Program.

The 114-year-old building is owned by Orion Properties LLC, a Laurel construction concern that is spending about $4 million to upgrade it for continued office use. The company bought the building at auction in 1994 for $265,000.

Efforts to reach company officials were unsuccessful yesterday.

The Maryland Occupational Safety and Health agency has launched an investigation into the contamination and to determine whether any regulations governing the handling of lead had been broken, officials said.

Richard F. Pecora, deputy secretary of the Department of General Services, which oversees state buildings and leased properties, said dust with high concentrations of lead was found on carpets, file cabinets and desks.

He said it had not yet been determined if that dust was linked to the building renovation or whether it had accumulated over time.

Employees were told not to take anything with them when they were ordered to leave.

While adults are not as susceptible as children to lead poisoning, those who inhale or swallow lead dust or fumes can suffer anemia and damage to kidneys and the nervous system. Lead poisoning has been linked to high blood pressure and sterility in adults.

Research indicates lead also can cause birth defects. At least one state employee in the building was pregnant, two sources said.

Union officials who represent some of the state employees affected said they were outraged by the situation.

"No one should have to work in a dangerous environment," said Ray Lenzi, director of field services for the Maryland Classified Employees Association.

STATE ENVIRONMENT AGENCY INVESTIGATING ASBESTOS CONTAMINATION AT NEW ORLEANS SCHOOL
By Marta Jewson The Lens October 23, 2018

The Julius Rosenwald Elementary building was supposed to open its doors as Rosenwald Collegiate Academy in August 2018. But air quality tests performed by the charter school showed problematic levels of airborne asbestos. The school is the third in Orleans Parish to undergo an asbestos clean-up this year.

The Louisiana Department of Environmental Quality wants to know what went wrong at the Rosenwald school building, where contractors will be doing a $1.3 million asbestos clean-up.

This is the third asbestos clean-up required at an Orleans Parish public school this year. State and local school officials note no students were present at Rosenwald when the cancer-causing material was detected in an air quality test in early May. Still, an expert at DEQ told The Lens that the contamination never should have happened.

Senior Environmental Scientist Dwight Bradshaw oversees asbestos work for LDEQ in New Orleans.

“If you’re following the regulations you should not have had this contamination throughout the building,” Bradshaw said. “It shouldn’t have happened.”—Dwight Bradshaw, Louisiana Department of Environmental Quality

State officials say work at the building was performed in line with its asbestos management plan. The state-run Recovery School District, the Orleans Parish school district and a charter school network all had access to the building in the spring. But no one is taking responsibility for the problem.

Now, Bradshaw is looking for answers.

“We’re still investigating,” he said on the phone Monday. “What was done and who did it — it’s not clear yet. We’re getting different answers from different people.”

Asbestos, a commonly used building material until the 1980s, is dangerous when its fibers become airborne. Many old schools may contain the fire-retardant material in floor tiles and adhesive, ceiling tiles and pipe insulation. It is generally safe unless renovations or other activities disturb the material.

The state-run Recovery School District, which formerly controlled the 46-year-old building, returned it to the Orleans Parish School Board on April 1. But the RSD still had construction projects underway at the time.

According to an RSD project outline, several tile replacement projects were on the state agency's list of things to do.

Louisiana Department of Education Chief Operating Officer Bridget Devlin said RSD work was ongoing in May when an air quality test came back positive for asbestos.

"Their work then halted," she said.

However, Devlin said RSD wasn't the only agency overseeing work.

"There were projects in addition to those overseen by the RSD also occurring at that time and it unclear which project may have caused the airborne asbestos," Devlin said.

"The Orleans Parish School Board did not manage the Rosenwald building or the work performed in the building until April 1 of 2018," spokeswoman Dominique Ellis wrote in an email.

The Orleans Parish school district had also given Collegiate Academies, the charter network that planned to open a school there in August, access to the building. Collegiate's spokeswoman Zoey Reed said the network "did not perform construction at any time or make any modifications to the facility."

Collegiate had obtained a bid for a "non asbestos" tile project, which eventually led to the airborne asbestos discovery.

Collegiate's tests on certain tile sections came back clean but the testing agency recommended the charter network test the air too. A few days later, Collegiate's consultant emailed Adam Reed, the charter school network's director of facilities, saying that "asbestos fibers were identified above the required clearance standard in multiple air samples."

Zoey Reed said the network flagged the district. "OPSB then took control of the building and all abatement work required to make the facility safe."

Collegiate's new high school, which was supposed to go in the Rosenwald building, is operating at a temporary site this school year.
Asbestos on site

On May 3, Adam Reed expressed concerns about the state of floor tile in the building.

"We have a large amount of blue/green flooring that seems to be from a replacement job years ago," he wrote in an email to Orleans district officials. "The replacement flooring is popping up due to heat and moisture and the building not having air flow due to the HVAC system being down or shut off from the past."

"The floor also is popping up because of improper installation," he continued, noting flooring vendors guessed either the previous workers used the wrong glue or didn't clean thoroughly before laying the tile.

The building was known to have material that contained asbestos. It is in some floor tile and the glue attaching it in several parts of the building, according to an asbestos management plan, a document required for schools.

The air quality test, showing an asbestos release, came back on May 5.

It's unclear where exactly work was done. DEQ officials weren't informed of any work plans before renovations began. That would be required for any job where at least 64 square feet of floor tile that either contained asbestos or was glued down with an asbestos-containing mastic was being removed, Bradshaw said.

"We didn't get any notification on floor tile removal," he said. "We didn't get anything about inspection about tile prior to removal."

Bradshaw said he hasn't gotten any answers about how much tile was removed, and whether it was enough to trigger a notification to DEQ. Regardless, any contractor should have known about the presence of asbestos, Bradshaw said, and should have taken precautions to avoid an asbestos release.

"Before you do a renovation, you either assume it's asbestos or you sample it," he said.

Devlin, the state education department's chief of operations, said work was done in accordance with the management plan.

But if that's the case, Bradshaw said, there shouldn't have been any contamination. Since he began his investigation, Bradshaw has had little luck getting records — specifically, the construction contracts — to pinpoint what went wrong and why.

"We're looking for answers. Who did it, how they did it, and who knew what when. People don't want to be honest when they know they're going to be in big trouble."— Dwight Bradshaw, Louisiana Department of Environmental Quality

He said the last time the state reviewed the school's asbestos management plan was in 2012, and it found no issues. The document would be consulted by any contractor performing work on the building.

Two other New Orleans schools have had asbestos problems this year. On a previous job, a Recovery School District contractor mishandled asbestos. As a result Lafayette Academy searching for a new school building this summer. Its new home, the old McDonogh 35 building, also required asbestos abatement after an Orleans Parish School Board contractor caused an asbestos release.

Earlier this month, the Orleans Parish School Board approved the $1.3 million clean-up contract for Rosenwald. They also increased their contract with an environmental services firm, which manages asbestos and other environmental testing in schools.

"There's multiple layers of responsibility in this thing," Bradshaw said. "Somebody will be referred to enforcement."

POTENTIAL HEALTH RISKS OF REMODELING AN OLDER HOME
By RE Resources Team February 10, 2017 at 3:38 PM

If you've recently purchased a fixer-upper and a home remodel is on your agenda, beware of potential health risks. Older homes are notorious for harboring numerous hazards like lead, asbestos, radon and Volatile Organic Compounds (VOC). Mold and mildew is often another problem when opening up walls during demolition, which allows dangerous pollutants to fill the air you and your family breath. Respiratory problems (or worse) can become serious health issues when you don't manage these pollutants properly. However, if you're aware of the risks, you can take measures to minimize the effects these hazards might have both during and after your home remodel. Start by learning what hazards to look for and where they might hide in older houses.

Lead Paint

Lead paint is one of the two most well-known hazards. Prior to the ban of lead paint in 1978, lead was used as a pigment and drying agent for painting homes. Thus, you can assume any house built before the ban probably has lead paint present, though it may be hidden underneath several layers of lead-free paint.

Lead paint was actually banned in Staten Island and throughout New York City in 1960. NY authorities caution homeowners not to remove paint by dry scraping or sanding in homes older than 1960, because dust from lead-based paint is the most common cause of lead poisoning in children.

Certification by the Environmental Protection Agency (EPA) is required of any firm performing a home remodel where lead-based paint will be disturbed. Each renovator must also be certified and taught by EPA-approved trainers. Rules for properly disposing of lead-based paint debris varies by municipality, so contact local authorities before disturbing old paint.

Asbestos

Asbestos is the other most well-known hazard and another common problem in older homes. You may find asbestos in old insulation, pipes, floor coverings, cement siding, roofing, ceiling tiles, spackling compound, adhesives and more. Again, contractors or renovators must have EPA accreditation and be fully trained and qualified in the safe removal of asbestos.

The greatest danger from this pollutant is when it becomes airborne, which can happen if you disturb it during a home remodel. Inhaled or ingested asbestos particles can cause lung disease and various cancers, and the symptoms might not even surface for years.
Insulation and pipe coverings are often the most likely and most dangerous source of asbestos in older homes, because the dried material crumbles easily and releases asbestos freely. While asbestos in floor tiles and roof shingles is less likely to become airborne, they should still be handled appropriately.

Keep Dust Down

In most home remodel projects, dust isn't just the biggest nuisance, it's also one thing both lead and asbestos have in common. Both pollutants become harmful or even toxic when disturbed and their dust particles present the most danger. It's important you and your contractor have a dust control plan for every project that produces dust. This could include isolating the area you're working on from the rest of the house, removing or covering furnishings and sealing all doors and air ducts. While dust is a natural part of the renovation process, capture and minimize dust as much as possible to protect you, your workers and family members.

Avoid Mold Growth

Damp or wet conditions can lead to mold growth. Older homes have had numerous opportunities for various water-related incidents. Leaking roofs, busted pipes, broken water heaters, backed up drains and flood water all leave behind moisture. If each drenching wasn't properly cleaned up, mold could lurk underneath carpets or other flooring, in the attic or basement and/or behind walls.

Removing flooring or opening up walls with mold contamination can release harmful mold spores into the air. The most toxic is black mold, which is greenish-black and typically slimy, but can appear powdery when it dries out. Respiratory problems and irritation to the mucous membranes are common when you're exposed to black mold, but it could lead to worse health issues.

Many of the potential health risks associated with remodeling an older home can be serious, chronic or even fatal. Hazardous materials you might encounter could cause balance and coordination issues, breathing difficulties, central nervous system problems, eye irritation, fatigue, frequent cough, frequent headaches, lead poisoning, liver and kidney damage, lung cancer, Mesothelioma, nausea, nose and throat irritation, skin rash and more. Approach any home remodel with caution and order appropriate testing of substances you're unsure whether they pose a potential threat to your health,
because you never know what might be lurking in your home.

PLANNING A HOME REMODEL? A MINI-GUIDE TO POISON-SAFE REMODELING
Rose Ann Gould Soloway, RN, BSN, MSEd, DABAT Clinical Toxicologist

The Bottom Line

So many poison prevention stories are about children, but when it comes to home remodeling, adults are at risk, too. Children, adults, and pets can become sick if home renovations are not carried out carefully.

Lead poisoning: Homes built before 1978 are likely to contain lead-based paint. Lead is a dangerous poison for everyone, but especially for young children and fetuses. Lead is released into the air when leaded paint is sanded or heated. We absorb lead by inhaling or swallowing lead dust and inhaling fumes. Once absorbed, lead moves to the bones. Small amounts are regularly released into our bloodstream, but enough lead remains in bones to last a lifetime. Our bodies have no need for lead and limited ability to remove it, so many body organs are affected.

In children, lead damages the still-developing brain and nervous system, causing lowered IQ, learning difficulties, and behavior problems. It also affects a number of other body systems, causing a host of physical problems from hearing damage to stomach distress. At high enough levels, lead poisoning can cause seizures, coma, and death. Unfortunately, children have become critically ill because home renovations exposed them to large amounts of lead.

High levels of lead in adults can cause high blood pressure, kidney disease, and nervous system problems. Homeowners who didn't understand how important it is to remove lead safely have developed serious lead poisoning. (And pets can become lead-poisoned, too).

These are dire effects. How can they be prevented? Before an older home is renovated, paint should be tested for lead content. There are lead-test kits approved by the U.S. Environmental Protection Agency (EPA) available at hardware stores, but for a major renovation it might be best to have a certified contractor perform the tests. If lead paint is present, and is intact, the best option is usually to cover it up so that it can't flake or deteriorate. If renovations are needed, a certified contractor should remove it. Effective April 2010, contractors who remove lead-based paint are required to be certified; homeowners should request a copy of the certification.

Paints: Use only paints intended for indoor use inside your home. Some outdoor paints contain fungicides; these may not be safe to breathe indoors.

In the past, some paints contained mercury as a fungicide; young children developed mercury poisoning from breathing in the fumes. This is an example of why it's important to dispose of old construction products safely, according to your community guidelines.

Some people are sensitive to, or prefer not to be exposed to, volatile organic solvents, or "VOC"s. These types of paint fumes may cause irritation of the eyes, nose, and lungs. Questions have been raised about their safety, as well. It is now possible to buy indoor paints labeled "low VOCs" or "zero VOCs". Discuss this with the retailer when buying new indoor paint for your home.
Carbon monoxide poisoning: Fuel-burning appliances and cars are the usual sources of carbon monoxide poisoning. There are other carbon monoxide poisoning threats when doing renovation projects.

Paint strippers and solvents: A number of chemicals are used to dissolve paint. One of the most common is methylene chloride. Using it safely, according to label directions is critical. Methylene chloride is absorbed into the body by inhaling the fumes or getting it on your skin. The body changes some of the methylene chloride into carbon monoxide – and no one expects carbon monoxide poisoning from a solvent! Effects can range from dizziness and shortness of breath to a heart attack.

Generators: When used indoors, generators used to power lights and tools can release carbon monoxide fumes into the air. Carbon monoxide gas is colorless, odorless, and tasteless. It is possible to be poisoned without even realizing that you're breathing in carbon monoxide. Symptoms are vague at first: headache, upset stomach, and drowsiness. If you continue to breathe in carbon monoxide, you can become unconscious, develop seizures, and die. If a generator is needed for a home improvement project, be sure that it is placed outside, not in a garage or under an open window. A carbon monoxide alarm in the workspace can provide a warning if carbon monoxide gas begins to accumulate, despite your precautions.

Chemical poisoning: Many types of products are used in typical home improvement and renovation projects. It's important to follow label safety instructions about protective equipment (goggles, gloves, respiratory protection) and ventilation.

During renovations, adults AND children have been poisoned by solvents, polishes, cleaning solutions, and other chemicals. This often happens when a

product is transferred from its original container into a food or beverage container. Recently, an adult died when he drank from a soda bottle that someone had put a strong cleaning product into. Children are poisoned when a product is left on the floor, chair, or low table, instead of being stored high, locked in a safe place. Ideally, children and pets should be elsewhere while you are working on your project.

Plan your project safely. If you think someone has touched, swallowed, or breathed in a poison, call **Poison Control** right away at **1-800-222-1222**. Poison specialists will ask you about what happened and then tell you exactly what to do. They will help you 24 hours a day, seven days a week.

Chapter Seven
BYOB – What's in Our Drinking Water?

Published July 2019

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- **DRINKING WATER: MYTHS & FACTS**
- **SAFE DRINKING WATER ACT**
- **COMMON SOURCES OF DRINKING WATER POLLUTION**
- **DISEASES CAUSED BY CONTAMINATED WATER**
- **THE WATER ROUTE**
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- **WATER SAMPLING**
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INTRODUCTION

As I was growing up, I have no recollection of ever thinking twice before turning on the tap, filling a glass with water, and chugging it down. When building our home, my husband and I insisted on a Reverse Osmosis System on a separate tap next to our regular faucet. When outside of our home, I will only drink bottled water. In all the world, the U.S. enjoys one of the best supplies of drinking water. However, like me, many folks hesitate before drinking from a tap. Our mindset about drinking healthy water has substantially changed over the last five decades.

As humans we need water to stay hydrated and healthy. Water is a nutrient that is essential for good health. Our body needs us to replace water that is lost through sweating, breathing, and using the toilet. Without enough water, we will become dehydrated. And, we all know that the best prescription for an afternoon headache, weakness or dizziness is a tall glass of water.

DRINKING WATER: MYTHS & FACTS

MYTH: There's plenty of water on earth for all of us.
FACT: Only 1% of all the world's water can be used for drinking. Nearly 97% of the world's water is salty and therefore undrinkable, and 2% is locked in glaciers.

MYTH: The earth is provided with more water every time it rains.
FACT: Our water is recycled through rain. We are literally drinking the same water the dinosaurs drank millions of years ago.

MYTH: Americans use most of their water for drinking and cooking.
FACT: Each American household uses approximately 107,000 gallons of water per year. However, 50-70% of our water is used for watering lawns and gardens, and as much as 14% of our water is flushed down the drain or is wasted through pipe leaks.

MYTH: All Americans use public water systems that are regulated by the EPA.
FACT: There are approximately 150,000 public water systems in the U.S. that provide drinking water, leaving about 10% of Americans relying on water from private wells.

MYTH: Public Water Systems are always safe.
FACT: Because Public Water Systems can become contaminated, municipalities are required to test their water at least once a year.

MYTH: There are drinks that are much more beneficial to the body than water.
FACT: Drinking water is essential to a healthy diet. Hydration contributes to energy levels and brain functions. Drinking water also flushes body wastes.

MYTH: Bottled water is the safest water to drink.
FACT: About 25% of bottled water is tap water. Luckily, the U.S. enjoys one of the world's most reliable and safest supplies of drinking water.

SAFE DRINKING WATER ACT

The Safe Drinking Water Act (SDWA) was passed by Congress in 1974 and is administered by the Environmental Protection Agency (EPA). It was established to protect public health by both regulating the nation's public drinking water supply and protecting sources of drinking water.

The EPA requires regular testing of public water systems, annual reporting on water quality through a Consumer Confidence Report, public notifications of water system violations, and is authorized to set health standards for contaminants in drinking water. This Act also includes provisions designed to produce underground sources of drinking water, requires regular assessments of all drinking water sources, and requires disinfection of surface water supplies.

Water Systems Regulated by the SWDA

- The basic water systems in the U.S. include Public Water Systems (PWS), Community Water Systems (CWS), Non-Community Water Systems, and Private Water Supplies.
- A Public Water System is one that serves piped water to at least 25 persons or 15 service connections for at least 60 days each year. There are approximately 161,000 Public Water Systems in the U.S.
- A Private Water System serves no more than 25 persons for at least 60 days a year and has no more than 15 service connections. There are no provisions in the SDWA regulating these water systems.
- A Community Water System is a Public Water System that serves people year-round in their homes. There are approximately 108,000 Community Water Systems serving approximately 268 million Americans.
- There are two types of Non-Community Water Systems, a Non-Transient Non-Community Water System and a Transient Non-community Water System. A Non-Transient Non-Community Water System serves the same people more than six months a year, but not year-round (such as a school with their own water supply). There are approximately 19,000 of these systems in the U.S. A Transient Non-Community Water System is a public water system that provides water in places such as campgrounds,

restaurants, and gas stations, where people do not remain for long. There are approximately 89,000 Transient Non-Community Water Systems in the U.S.

Requirements for Reacting to Problems

Provisions for pollutant-specific minimum testing has been established by the EPA as well as testing schedules for public water systems. The EPA has identified and established legal limits for over 90 contaminants to protect human healthy. Every five years the EPA reviews its list of contaminants and revises as needed.

When a problem has been detected with a water system, the system is to be immediately retested and strict instructions have been set forth to make the public aware of any issues. Retesting must continue until such time as the problem has been addressed.

COMMON SOURCES OF DRINKING WATER POLLUTION

When our drinking water becomes contaminated, the typical source of the contamination comes from naturally occurring contributories in the environment and through human activity. Naturally occurring contributions can range from microorganisms, radionuclides, nitrates, nitrites, heavy metals, and fluoride. Contributions from human activities can include bacteria, nitrates, heavy metals, fertilizers, pesticides, industrial products, industrial and

household wastes, lead, copper and water treatment chemicals.

How are these contributions made? Quite often it is the soil that gets contaminated. Then the pressure from rain and surface water moves it to our water supplies. Examples of contaminants could include waste from both animals and humans, or improper disposal of chemicals.

PFAS (polyfluoroalkyl substances) is a great example of how our water becomes contaminated. PFAS is a group of synthetic chemicals that the U.S. began using in the 1940s. Used in over 3,000 man-made compounds until 2015 when the United stated ceased its use, low levels of PFAS have been found in soil and water samples as well as in human blood samples. They continue to be largely found in the soil around the industrial sites where they were produced, in landfills, and in wastewater treatment plants. Rainwater moves the PFAS from the soil and into the streams and rivers that feed our water supplies.

Lead is another example of a contaminant that seeps into our water system. Lead was used in our paints, plumbing, solders and many other components because of its resistance to deterioration. Although it holds up better than many other components, it still deteriorates and enters our drinking water. As our water runs through lead pipes, faucets, and fixtures, as it runs through service lines and other plumbing materials, it corrodes and contaminates our drinking water. There is no safe level of lead in the blood and lead is particularly harmful to children (see the chapter entitled *GET THE LEAD OUT*).

DISEASES CAUSED BY CONTAMINATED WATER

Cryptosporidiosis is gastrointestinal disease caused by cryptosporidium, a pathogen. Symptoms include cramps, vomiting, and diarrhea. Persons most vulnerable to this disease are those with compromised immune systems. In 1993 in Milwaukee, Wisconsin, 400,000 people were infected with this disease with approximately 50 people dying. It was the largest recorded outbreak of a waterborne disease in the history of the U.S. Cryptosporidium is a pathogen commonly found in human and animal feces. It enters streams, rivers, and lakes and is very resistant to filtration systems and disinfecting methods.

E. coli is a type of fecal coliform bacteria commonly found in the intestines of animals and humans. Symptoms include abdominal cramps, regular diarrhea, and bloody diarrhea. Typically, E.coli in drinking water is an indication that sewage has seeped into the drinking water supply. Although most strains are harmless, some strains produce toxins that can cause severe illness and may be life-threatening.

Blue Baby Syndrome poses an immediate threat to infants and is typically caused by nitrates in drinking water. Nitrates are chemicals used in fertilizers, animal waste, or human waste leaching from poor septic tanks or cesspools. The nitrates convert to nitrites when in the intestines, then gets absorbed into the bloodstream. These nitrites prevent hemoglobin from transporting oxygen through the body.

***Note**: Boiling water does not remove nitrites from water.*

Lead Poisoning can come from natural deposits in the soil or from leaching of the plumbing and service lines. Quite often there are no immediate symptoms. For children, exposure can cause delays in physical and mental development, as well as deficient learning abilities. Adults can develop high blood pressure and kidney problems. Note: Boiling water does not remove lead from water.

Disinfectants and their byproducts have also been found to be common contaminants in drinking water. Again, there are no immediate symptoms; however, they have been linked to bladder, rectal, and colon cancers.

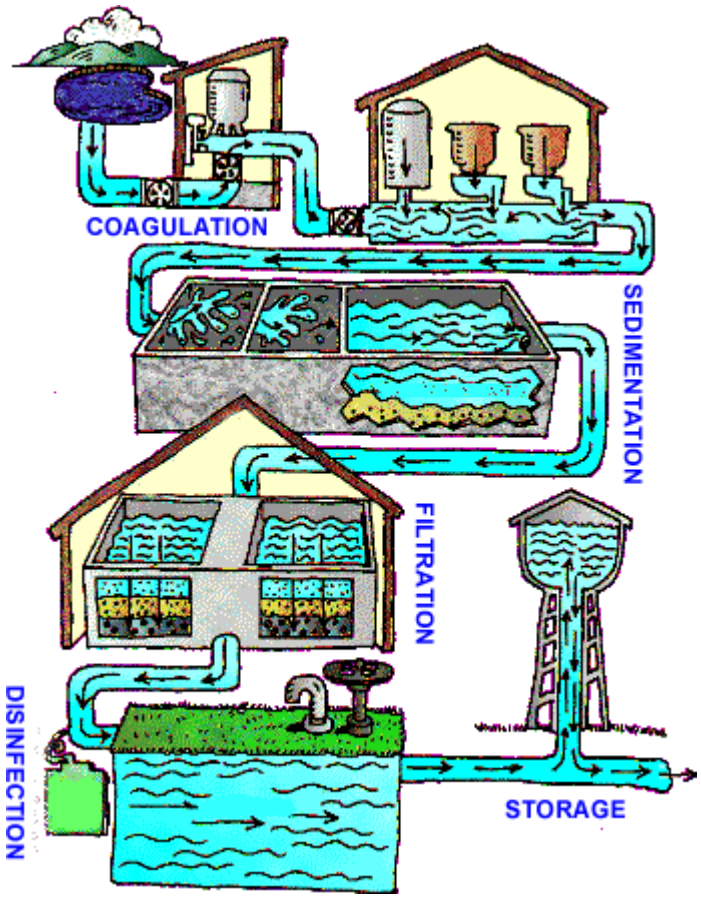
THE WATER ROUTE

Our drinking water comes from surface water or ground water. Surface water comes from sources such as rivers, lakes, and reservoirs, that are exposed to the environment and climate. Ground water is pumped from underground wells or aquifers. We transport this water through an underground network of pipes from the water source to our taps.

Because surface water is exposed to the atmosphere and its pollution, it requires more treatment than ground water systems. The most common treatment process used by water suppliers include coagulation, filtration, and disinfection. Ion exchange and absorption may also be used. Once the water supply has been tested, the water supplier can determine the best treatment

combination that will eliminate any contaminants found in the source of water.

Coagulation and flocculation remove dirt and other particles from the water. Alum and iron salts are added to the water. They then form sticky particles called “floc”. The floc attracts the dirt particles. This causes them to be heavy and become sedimentation, settling naturally out of the water.



Water Filtration is a process that occurs when suspended matter adhere to the surface of, or in the pore of, an absorbent medium. Filtration removes particulates from the water, which enhances the effectiveness of disinfection.

Disinfection involves either adding chlorine, chlorinates, and/or chlorine dioxides to the water, or using ozone, ultra-violet light or electronic radiation. Typically, this is done prior to entering the distribution system. By adding it before it enters the distribution system, any dangerous microbial contaminants are dead prior to entering the system and residual concentrations of disinfectant will be maintained in the system.

PRIVATE WELLS

Approximately 10-15% of drinking water supplies are pumped from private wells. The EPA does not regulate these wells, so it is the responsibility of the owner to care for and maintain the water supply. Any risk depends on how the well was built, where it is located, how well it is maintained, the quality of the aquifer from which the water is drawn and the human activities surrounding the location of the well in the environment.

Those responsible for a private source of water can protect the water supply by identifying any potential problem sources and taking action to remedy these problem sources immediately. Having a regular testing and maintenance schedule is crucial to identifying and addressing possible contaminations. Testing should be performed annually, when the environment near the well is impacted (such as construction or flooding), or anytime there is a change in the color, smell, or taste of the water.

Testing can be performed by a specialist. The advantage of using a professional water testing specialist is the availability of information and recommendations if there were to be a problem. However, test kits can be ordered from a laboratory, and successful testing can be performed if the instructions that come with the kit are strictly followed.

Besides testing, regular maintenance should include inspections of all exposed parts of the well, maintaining the landscape in the area of the well to drain surface water away from the well, installation of a well cap or sanitary seal to prevent unauthorized access to the well, and disinfection of the water supply at least once a year. Accurate records should be maintained of all regular maintenance and repairs to the well and water supply. Hazardous materials, pesticides, fertilizers, and other pollutants should not be used or disposed of near the well.

Water treatment systems for private water supplies and wells could include filtration, microfiltration, reverse osmosis systems, distillation systems,

ultraviolet treatment systems, or water softeners. Depending on the system and its design, it can be installed at either the “point of use”, which typically treats water in batches and delivers the water to a single tap, or at the “point of entry”, which typically treats most of the water entering the building.

Pretreatment processes may be used prior to the water filtration system to protect the filtration membrane surface. This could include coagulants, powdered activated carbon, or adjustments to the pH or chlorine levels.

Filtration, a process that occurs when suspended matter adheres to the surface of, or in the pore of, the filtration medium, removes particulates from the water, which enhances the effectiveness of disinfection. Whether or not a filtration system is employed depends on the amount, size and type of potential contaminants.

Microfiltration is a filtration system with a pore size much smaller than a regular filtration system, typically 0.1 micron in size. Microfiltration is highly effective in removing protozoa and cryptosporidium.

In a Reverse Osmosis System, the water passes from a more concentrated solution to a more dilute solution and through a semi-permeable membrane. The pore size of the semi-permeable membrane is approximately 0.0001 microns. It is not only effective in removing protozoa and cryptosporidium, it is also effective in removing bacteria, viruses and common chemical contaminants.

Distillation Systems heat the water to the boiling point, collecting the water vapor as it condenses, leaving many of the contaminants behind. It is highly effective in removing protozoa, cryptosporidium, bacteria, viruses, and common chemical contaminants.

In Ultraviolet Treatment Systems ultraviolet light is used to disinfect the water. A pre-filtration system is typically used in the pathway prior to the ultraviolet system. It is highly effective in removing protozoa, cryptosporidium, bacteria and viruses; but is not effective in the removal of common chemical contaminants.

Water softeners use ion exchange or ion removal to reduce the amount of hardness in the water. Hardness is caused by excessive calcium and magnesium in the water. Although water softeners do not protect against protozoa, cryptosporidium, bacteria, and viruses, it can be designed to remove iron, manganese, heavy metals, nitrates, arsenic, chromium, selenium and sulfate.

WATER TESTING PROGRAMS

A written water testing program is an excellent tool for those responsible for a building and its occupants. It not only fulfills any mandatory requirements; it also provides a plan for consistent reporting and shows occupants a commitment to a healthy environment. Important elements of a water testing program include:

- Communication Historical Information
- Maintenance of testing records Maintenance of repair records
- Establishment of partnerships with local water authorities
- Establishment of partnerships with laboratories
- Plan for routine testing
- Plan for routine disinfecting
- Plan for maintenance of filters
- Plan for routine flushing of water system
- Plan for regular testing of water

Communication with the building community, whether it is staff, residents, students, faculty, or general occupants, should occur as early and as often as possible. Communication reveals a commitment to protecting those drinking the water and builds confidence in the building community. So, the first step to

a good water testing program should be a plan for good communication.

A water testing program should also include the gathering of historical information, the maintenance of testing and repair records, establishment of partnerships with local authorities and laboratories, and a plan for routine practices, such as testing, disinfecting, maintaining filters, and routine flushing.

The water sampling plan should lay out all the locations from which water is distributed to the facility, and then the same lay out should be used each time testing is performed.

A plan should be in place on what actions will be immediately taken if lead or contaminants are identified in the water supply. Once those immediate actions are taken, a long-term remediation plan should be implemented, including a schedule of follow-up and ongoing sampling of the water supply.

WATER SAMPLING

If a professional water testing technician is not employed for the water testing, it is crucial that the person assigned to collect water samples follows the laboratory's instructions. The bottles supplied with the water sample kits should not be rinsed out since the bottles may be lined with important sample preservatives. Water samples should be immediately refrigerated or shipped on ice to the laboratory. For the sake of accuracy, it is important for each section of the chain of custody to be filled out with precise and accurate data. Each sample must be identified with a unique number that can easily be found on the layout of the water supply entry points mentioned above. Someone should be able to look at the layout of the sample plan, the chain of custody, and the report from the lab, and be able to easily identify where the samples were taken.

Sampling should start at the closest entry point or main line first, which is usually on the first floor and should work away from the main line. Aerators should not be removed from the taps prior to sampling since they could be a source of lead or microbial contamination. The water should not be flushed prior to sampling because this could cause the laboratory results to misrepresent the true contamination levels. NOTE: Sample results from one

outlet is not sufficient to diagnose an entire water supply system.

The immediate response to contamination issues could include shutting off the contaminated outlets, posting signs at the problem outlets, and communicating the test results to the building community. Until a permanent remediation can be implemented, short-term controls can be put in place. Short-term measures could include providing filtration at the problem entry-points or taps, flushing taps prior to use, and providing a separate water supply such as bottled water.

Permanent remediation plans will vary depending on the contamination that was identified. Problem outlets may need to be replaced. Pipes may need replaced. Filters may need installed. The plumbing may need to be reconfigured or replaced.

MORE INFORMATION

More information related to a particular situation can be obtained from the Water Quality Association, a not-for-profit international trade association that represents residential, commercial, industrial, and small community water treatment industries at www.wqa.org.

For more information on a Community Water System, refer to the Water Quality Reports or Consumer Confidence Reports which should be posted annually at www.epa.gov/safewater/dwinfo.htm, on the state's Department of Health or Department of Environment website, or call the Safe Drinking Water Hotline at 1-800-426-7491.

The Water Systems Council has developed a complete library of well-water care information sheets and a Well Owner's Manual that is available as an online download at www.watersystemscouncil.org.

CONCLUSION: IN THE NEWS

Pennsylvania to test water systems across the state for contamination

THE MORNING CALL

APR 16, 2019 | 6:05 PM

Pennsylvania will work to create its own regulations for chemicals that have seeped into drinking water in nearly two dozen towns in Bucks and Montgomery counties, and will test about 360 drinking water systems across the state to determine whether the contamination is more widespread than is known, state officials said.

"Our approach on this had been wanting to see action at the federal level," Patrick McDonnell, secretary of the Pennsylvania Department of Environmental Protection, said Monday before meeting with residents at Abington Senior High School. "But the place we are today is that we don't want to wait anymore."

But those regulations — long requested by residents worried about their water and their health — could take at least a few years to come to fruition.

Many of the dozens of residents who gathered for Monday's public meeting voiced frustration with the state's response and the slow pace of the bureaucratic process.

"We just want speed, we want urgency, and we want results," Gregory Nesbitt, president of the Horsham Township Council, told state officials. His remarks drew applause from the audience.

Pennsylvania's steps to deal with drinking water contaminated by PFAS, or per- and polyfluoroalkyl substances, come as several other states are in the process of regulating the chemicals. New Jersey unveiled a proposal this month for regulations for two PFAS chemicals that would set one of the most stringent enforceable limits in the country.

The U.S. Environmental Protection Agency announced in February that it will work towards a nationwide drinking water limit for types of PFAS, but that process will take years and has been criticized by some activists as not moving quickly enough.

PFAS were in firefighting foams used for decades on military bases in Willow Grove and Warminster. At least 22 towns in Bucks and Montgomery counties have some level of contamination in their drinking water from PFAS. The chemicals are also found in everyday items such as nonstick cookware and pizza boxes, and have been linked to cancer, reproductive issues, and other health problems.

Residents of Horsham, Warrington, and Warminster have been dealing with water contamination for years, and blood tests found that residents of those towns had elevated levels of PFAS in their blood compared with the general
U.S. population.

To determine how many other Pennsylvania communities may be affected, officials will test about 360 drinking water systems across the state, said Lisa Daniels, director of the state's Bureau of Safe Drinking Water. Those systems were selected for their proximity to military bases, fire training schools, airports, landfills, and manufacturing facilities where PFAS could have seeped into soil and water.

The first phase of testing could begin as early as May and will "really help us figure out how big of a problem we might have in Pennsylvania," Daniels said. Chris Crockett, chief environmental officer for Aqua Pennsylvania, which supplies water to several towns in Southeastern Pennsylvania, urged officials to sample every water system in the state, not just those closest to potential sources of contamination.

"There is no simple and accurate way to determine a vulnerable system," Crockett said. "All systems statewide need sampling."

Rick Rogers, associate director of drinking water and source water protection at the EPA, told residents at Monday's meeting that the agency intends to move forward with a federal maximum contaminant level for PFAS and would make an official determination to move forward in 2020. After that, it "would take another several years of input and process" before regulations were final, Rogers said.

Pennsylvania has never set its own state maximum contaminant level for a substance in drinking water, McDonnell said. The state is working to hire a toxicologist to advise the state on this process by reviewing scientific research and other states' regulations. The sampling plan results will also affect the regulations, McDonnell said.

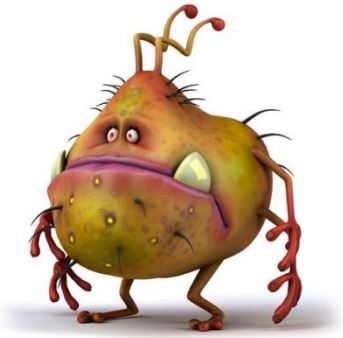
"The regulatory process itself, once we have those data sets, is typically around two years," he said. "We're hoping we can do it more quickly than that, but that's the benchmark we would look at."

For each of the several residents who had a chance to speak to state officials Monday night, that timeline is not fast enough.

"I guess what I'm asking for tonight is more expediency in the process," said Michael Thompson, an Abington Township commissioner. "How can we streamline the process?"

Chapter Eight
Indoor Environmental Quality & Our Children

Published August 2019



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- **THE FACTS**
- **LESSONS FROM RECENT HISTORY**
- **THE PATHWAY FROM ENVIRONMENTAL HAZARD TO HEALTH IMPACTS**
- **WHY ARE CHILDREN AT A GREATER RISK?**
- **SCHOOLS & OUR CHILDREN**
- **HOMES & OUR CHILDREN**
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Breathe Healthy
A Guide for Those Responsible for Indoor Environments

INTRODUCTION

When I enrolled my daughter into first grade at a local private school, I had so many questions.

- Who will her teacher(s) be?
- How long have they been teaching?
- What time does she need to be at school?
- Is there after-school care?
- Who is allowed to pick her up?
- What will the curriculum be?
- What if she is more advanced than the current curriculum?
- Is there a lunch program or do we pack her lunch?
- What school supplies should she have with her the first day?

I was as excited about her first day of school as she was . . . one of the big steps in a child's journey to adulthood.

I never once questioned anything about the school building or facilities. In my mind it was not old, it was quaint and historical. In preparing this chapter, I did my research and found that the first building was opened in 1874 as both the convent and the school. The school was thoroughly renovated in 1980.

After 30 years of business and thousands of remediation and abatement projects in facilities from school buildings to offices to hospitals, I know that it should be one of the questions that I as a parent should ask. The school facilities are as important as the curriculum since it impacts our students' health, thinking, and performance.

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

Dr. Joseph G. Allen in his report, "Schools for Health: Foundations for Student Success," reveals evidence that environmental exposures can impact the student's health, positively or negatively. Most children will spend the majority of their indoor hours in their home. The second largest amount of their indoor time will be spent in their school. Dr. Allen finds the school building an opportunity to intervene and protect the health of children. Our homes and our schools should be a healthy haven for our children, who are our most vulnerable citizens.

THE FACTS

- Significant lead-based paint hazards have been identified in 24 million buildings in the U.S.
- Lead poisoning effects 535,000 children ages 1-5 in the U.S. Lead poisoning can permanently damage the nervous system, including the brain. It can cause permanent learning and behavior problems in children.
- Annually there are 18,000 deaths that are related to injuries in the home in the U.S.
- Annually 12 million nonfatal injuries occur in homes in the U.S.
- 6.8 million homes have radon exposures above the current EPA action level.
- Lung cancer from radon exposure causes 21,000 deaths/year in the U.S.
- More than 7 million children in the U.S. have asthma. Another 40 to 50 million people have allergies.
- The leading causes of death and injury in homes are from falls, poisoning, fires or burns, blocked airways, drowning, and weapons.
- School building conditions such as ventilation, indoor air quality, thermal comfort, lighting, and noise play an important role in a student's ability to focus, process new information, and feel engaged in school.

LESSONS FROM RECENT HISTORY

August 2019: The Progress reports, "DuBois Area High School closed 'until further notice' due to air quality concerns …"

July 2019: Baltimore Sun reports, "Mold was found in 35 Howard County public schools during the 2018-19 academic year, with a range of growth samples found on drywall to the chin straps of athletic helmets…"

March 2019: Pittsburgh Post Gazette reports "A statewide advocacy group has given Pennsylvania a failing grade for lead in school drinking water . . . For the second time in roughly as many years, the organization PennEnvironment has given an "F" to the state in its "Get the Lead Out" report for not requiring lead testing of water in schools…."

October 2018: Eyewitness News WCHS ABC 8 reports, "Nine classrooms have air-quality concerns at Cedar Grove schools . . ."

September 2018: Herald Media reports "Coming off an especially moist summer, several schools in Pennsylvania have delayed their opening day or canceled classes due to mold issues…."

August 2018: US News and World Report reports, "Mold has been found in at least 25 rooms of a West Virginia High school just two weeks before classes start…"

March 2017: NBCWashington.com reports, "Prince George's County investigating complaints about air quality at elementary school…."

March 2015: A Dallas, TX, elementary school closed for several days after an environmental team found elevated carbon monoxide levels in the boiler room."

Dr. Allen points out that the chronic impact of poor indoor environmental quality in schools does not get the same attention or concern as these acute challenges that tend to hit the newspaper. The links between a building's health and the health of the occupants are very subtle. Symptoms of poor indoor

environmental quality may not evidence themselves until after long-term exposure.

THE PATHWAY: ENVIRONMENTAL HAZARD TO IMPACT ON HEALTH

Many adults in today's society are living with health issues such as asthma and compromised immune systems that could be traced back to their childhood environments. Childhood events can be like a pebble thrown in a pond, wide rippling effects.

Lucy is a great "pebble in a pond" example:
Lucy at age four lives in a fairly new home in a nice neighborhood with caring parents. Late one night a horrible thunderstorm comes through her neighborhood, knocking a huge limb off the big maple tree that grows outside her bedroom window. The next day, her father pulls the limb down, cuts it into pieces and gives the firewood to a family member. Then he climbs on the roof and does a quick assessment of the damage. He finds no apparent issues. The damage to the composition of roof shingles, facia and soffit is hidden from view.

A few days later it pours down rain. The water takes the easiest route as it's pulled by gravity. It seeps quietly behind the facia and drips, drips, drips into the insulation between the exterior and interior walls of Lucy's bedroom.

Three months later ,Lucy enjoys building snowmen in the front yard after the area was bombarded with two feet of snow. The snow on the roof and around the facia begins to melt. The melting snow is finding it easier and easier to seep into the wall cavity.

The wall cavity follows the outside atmosphere … dry, damp, wet, damp, dry. As Spring emerges, the tiny mold spores that had been left behind in the wall cavity during construction of the home suck up the moisture. During the wet and damp moments in time, the mold grows, root, and expands. During the dry moments, it sits dormant, appears to be dead. With each moisture event though, it springs back to life.

At age six, Lucy seems to be catching every cold that passes through her classroom at school. At age 7, Lucy is diagnosed with respiratory infections and then asthma. It affects her school attendance, which leads to academic challenges, further limiting her learning and developmental potential. The poor child just can't seem to shake the respiratory issues.

At age ten, Lucy's mom finds some black dots growing on the wall above the baseboard. She wipes them off only for them to return when the humidity is elevated in Lucy's room for the outside rain. Then an odor starts to evolve … Lucy's dad comments that it smells like moist soil in Lucy's room.

The Certified Indoor Environmentalist that Lucy's mom contacted recognized the odor immediately. Rather than collecting air samples, the CIE measured the moisture in the walls, then cuts a four-inch hole in the wall at the area that measured high in moisture.

Imagine the horror when Lucy's parents learned of the terrarium that was growing in the wall cavity of Lucy's room!

WHY ARE CHILDREN AT A GREATER RISK?

When it comes to the impact of poor indoor environments on the human body, children are not little adults. Per pound of body weight, children breathe more air, drink more water, and eat more food than adults. When the air, water, and food are healthy, this is not an issue. However, because their body is in its developmental stage, when the air, water, or food is toxic, they are absorbing more toxins per pound of body weight than an adult would be.

Little people are closer to the ground and spend an immense amount of time crawling on the ground, sucking items, and gnawing items. They have a much higher exposure to environmental pollutants than adults. Since their immune systems are still developing and their lungs are still growing, the impact of inhaling toxic air has a ripple effect into other critical aspects of their lives.

Between 1991 and 1994, nearly 900,000 children in the U.S. had elevated blood lead levels from exposure to lead. How does this happen? Again, children spend a good bit of their time on the floor where lead dust lies … putting their

hands and toys in their mouth where lead dust may be resting. Lead dust exposure may not be evident immediately, but over time children may begin to show symptoms of exposure, from hyperactivity to learning disabilities. Just as in the story about Lucy, lead exposure in children can cause life-long disabilities.

Asthma affects the lives of more than seven million children in America, accounts for millions of lost school days, and is the leading cause of school absenteeism.

Air pollution affects children's brains through several mechanisms. A thin membrane encompasses a child's brain protecting it from toxic substances. Particulate matter can cause inflammation of this membrane. The smaller the pollution particles the higher the risk because the particles can more easily enter the blood stream and then travel to the brain. Because children are in their developmental stage, the dosage of toxins required to damage a child's brain is much lower than that of an adult.

Studies have found a direct association between air pollution and cognitive functions, including reduced verbal and nonverbal IQ, memory, test scores and grade-point average of school children.

When thinking of indoor environmental concerns, another focus should be on safe-living practices. Very young children and older adults are the most likely to be injured in their home or school. Falls, poisoning, fires or burns, blocked airways and drowning are the leading causes of injury and death in homes and schools.

Scientific literature provides overwhelming evidence of the benefits that healthy indoor environments have on our children today and in their future.

SCHOOLS & OUR CHILDREN

Our children spend the majority of their indoor time in our homes. The second greatest span of indoor time is spent in their schools. From about age five to about age 18 a child will have spent approximately 15,600 hours inside school buildings. This is the same time they are experiencing rapid physical growth, hormonal changes, intense education, critical neurological development, and social development. Therefore, it makes sense that research has demonstrated that school facilities influence the health and success of our children as much as any other factor.

As in all buildings, the building materials in our schools and the building components such as carpeting, furniture and school supplies release chemicals into the air and dust. Students exposed to these chemicals through accidental eating, breathing or touching dust can be impacted today and throughout their lifetime. These chemicals include asbestos, PCBs, flame retardants, stain-repellent chemicals, and more.

School districts with extremely good housekeeping practice and preventative maintenance routines find positive impacts on student health and performance. Good indoor air quality can positively affect cognitive function such as decision-making, attention, concentration, and memory.

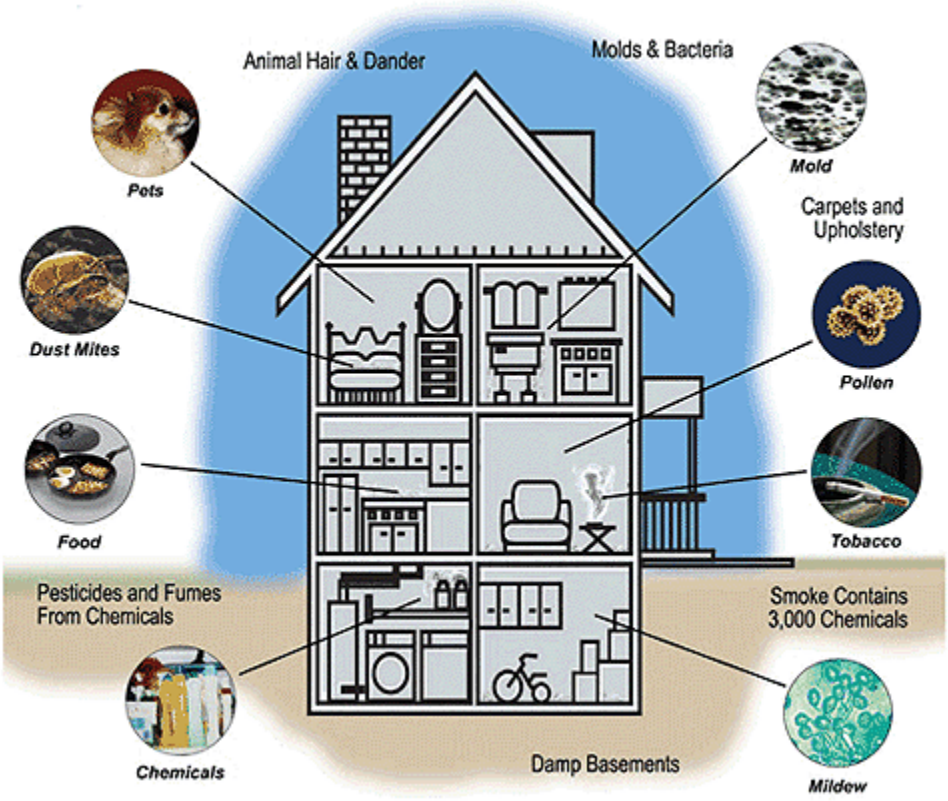
In the November 28, 2017 article of *Education Week*, it was reported that there were 62,600 elementary schools, 18,900 secondary schools, and 2,400 middle schools in the U.S. in 2013. The average age the school buildings at that time were 44 years. The majority of the schools surveyed by the National Center for Education Statistics at that time said school buildings were in good to excellent condition OVERALL. However, sizeable percentages said KEY FACETS of those facilities rated fair to poor. Facets included air conditioning, heating, windows, sidewalks, plumbing and restrooms, roofs, and playgrounds. When these facets of our schools are not properly maintained, they can lead to exposures to mold, poor ventilation, uncomfortable temperatures, inadequate lighting, and other conditions that can impact the health of our children now and possibly impact them for the rest of their lives. The US EPA estimated in

2011 that more than 60,000 schools had environmental conditions that contribute to poor indoor environmental quality.

HOMES & OUR CHILDREN

Lucy's life was tremendously impacted by a limb that fell on her house outside her bedroom window. Obviously healthy homes promote good health in our children. In contrast poor housing conditions contribute to poor health for our children.

Poor indoor air quality, high radon levels, lead dust from damaged paint, clutter, and lack of cleanliness place children at great risk for multiple health problems and chronic diseases. Even newer expensive homes may have hazards lurking within. Creating healthy housing environments promotes healthy growth and development of our children.



KEEPING OUR CHILDREN SAFE

In 2016, Harvard's Healthy Buildings Team released the nine foundations of healthy buildings. These nine foundations to a healthy building influence the health and performance of our children.

Ventilation
Air quality
Thermal health
Moisture
Dust & pests
Safety & security
Water quality
Noise
Lighting & views

As discussed in the Introduction of this e-book, HUD established the eight healthy homes principles:

Keep it dry.
Keep it clean.
Keep it safe.
Keep it well-ventilated.
Keep it pest-free.
Keep it contaminant-free.
Keep it well-maintained.
Keep it thermally controlled.

By employing the Healthy Buildings Check-up discussed Chapter 5, both the nine foundations of healthy buildings and the eight healthy homes principles can be maintained, and in doing so, we can keep our children safe. Let's discuss some of the practices that can be implemented immediately to provide healthy indoor environments for our children, both at home and in our schools.

Daily Practices That Protect Our Children

- Have children wash their hands and face often, especially before eating.
- Clean floors and surfaces with a wet mop or cloths. Dry sweeping or wiping of surfaces spreads dust and potential contaminants.
- Store all medicines, cleaning supplies and poisons in locked cabinets and away from children.
- Store firearms in locked cabinets and away from children.
- Clean up water and puddles from leaking pipes, ceilings or walls, and fix leaks right away.

Reduce Indoor Air Pollution

- Replace harsh bleach-based cleaning products with warm water and liquid soap.
- When using harsh cleaning agents, ventilate or exhaust the air from the work area. Remove children from these work areas so as not to expose them to harsh fumes and VOCs.
- Use pump bottles versus aerosol bottles.
- Use unscented cleaners and personal care items.
- Use roll-on deodorants and soap bars rather than aerosol.
- Avoid nail polish and nail polish remover since both of these contain toxic VOCs.
- Employ indoor air filtration and purifying systems to reduce the amount of indoor air pollution, vapors, and particulates.
- Change the HVAC filters as soon as they show any discoloration or dust accumulation.
- Confirm that each child-occupied area is receiving fresh air and proper ventilation.

- Keep pets away from sleeping areas and off furniture.
- Clean pet beds and litter boxes frequently.
- Avoid air fresheners, incense, and candles.
- Use a dehumidifier in damp or humid areas of the building.
- Keep the humidity in the building at or below 45%.
- Install and use exhaust fans in bathrooms and kitchens.
- Confirm all dryers vent to the outside.
- Have your buildings tested for radon.
- Inspect asbestos-containing building components annually. If evidence of deterioration, address immediately.

Remove Sources of Allergens

- Avoid feathered or furry classroom pets.
- Employ a pest management program that addresses the elimination of pests while reducing the use of pesticides.
- Limit the number of stuffed animals that attracts dust mites. Wash such items often.
- Avoid the use of carpeting.
- Employ vacuums with high-efficiency particulate air (HEPA) filters.
- Decrease clutter which collects dust and make it difficult to clean.
- Wash bedding in hot water and detergent every week.
- Use floor mats by entry doors to reduce brining in dust and other toxins.
- If possible, remove shoes at entry to reduce the entry of dust, soil, and toxins.

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

Prevent Poisoning

- Use non-toxic cleaning products.
- Keep chemicals in their original containers and stored out of reach of children.
- Always follow the instructions on labeling of chemicals.
- Do not mix bleach or ammonia with other chemical products or cleaners.
- Install a carbon monoxide alarm on each floor and near bedrooms. Check the batteries twice a year.

Prevent Trips, Slips, Falls, and Tipping Injuries

- Keep floors clear of anything that could cause someone to trip. Teach our children to do the same.
- Use accessory lighting in dorms, bedrooms, hallways, stairs and bathrooms to increase visibility.
- Do not allow children to use chairs as ladders.
- Use safety gates at stairways.
- Immediately repair damaged stairs.
- Use anti-slip mats at showers and tubs.
- Keep floors clear of electrical cords and clutter.
- Secure furniture such as bookcases and entertainment centers to walls to prevent them from tipping over on children.

Prevent Fires & Burns

- Install smoke and fire alarms on every level of the home or school and near sleeping areas.
- Children should be supervised in kitchens when ovens or stoves are in use.
- Do not allow flammable items on or near stoves.
- Store matches, lighters, and other heat sources out of reach of children.
- Keep a fire extinguisher at every level of the home, school facility or building.

- Only employ portable heaters in open areas away from walk areas and items that may catch fire.
- Talk about fire safety with children.
- Practice fire escapes.

Prevent Choking & Suffocation

- Only allow children to drink in a sitting or standing position.
- Beware of inhaling or swallowing balloons.
- Do not tie toys or pacifiers to children's clothes.
- Keep small toy parts, coins, marbles and other small items out of reach of small children.
- Do not allow small children to wear jewelry.
- Follow the age recommendations on the packaging of children's toys.
- Drawstrings on jackets, hoodies, and sweatshirts should be no longer than three-inches and should not have any attachments.
- Use cordless blinds or tie cords out of reach of children.

Prevent Drowning

- Children should always be supervised when in or near water.
- Lifejackets or vests should be worn by children anytime near a body of water.
- Fences should be installed around pools, hot tubs and spas. These fences should have no openings greater than ¼-inch and should be well-maintained.

NOTE: *Children can drown in as little as two inches of water!*

Prevent Pest Intrusions

- Store food in tightly sealed containers so as not to attract pests.
- Clean up after cooking and eating.
- Seal cracks around exterior doors, windows, pipes, and other holes to the outside.

- Do not leave trash and clutter collect indoors.
- Keep trash cans covered with lids.
- Use closed baits, traps, or gels only.
- If pesticides are necessary, avoid bug bombs. Read and follow the labels carefully.
- Install pest-proof screens in vents, especially those in attics and crawlspaces.
- Keep mulch, garden debris, and litter away from the foundation of the building.

Practice Preventative Maintenance

- Test your drinking water.
- If the property was built before 1978, test the paint for lead. If lead-based paint is identified, confirm it is intact and if not, address immediately. Do not remodel, renovate, or repair without implementing lead-safe practices.
- Prevent water from entering buildings through leaks in roofing systems.
- Keep landscaping sloped so water drains away from the building.
- Check for and address plumbing leaks immediately.
- Control the source of dust and contaminants.
- Reduce clutter.
- Use effective wet-cleaning methods versus dry sweeping.
- Store poisons out of the reach of children and with proper labels.
- Secure loose rugs.
- Install smoke and carbon monoxide detectors.
- Adequately ventilate bathrooms and kitchens.
- Maintain fresh air supplies to reduce the concentration of contaminants.
- Have the heating and air conditioning systems serviced annually by a qualified professional.

***MOST IMPORANT**: Take care of minor repairs and problems before they become large repairs and problems.*

***RECOMMENDATION**: Schedule a HEALTHY BUILDINGS CHECK-UP twice a year. Use Chapter Five's checklist to keep your buildings healthy for occupants, and especially for our children.*

CONCLUSION: IN THE NEWS

Proposed EPA program would give $50-million boost to children's health

03/19/2019
Contact Information:
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NEW YORK – The U.S. Environmental Protection Agency (EPA) is proposing a new $50-million grant program, the *Healthy Schools Grant Program*, to expand the Trump Administration's efforts to protect children where they learn and play. The announcement is part of President Trump's proposed Fiscal Year 2020 budget and supports EPA's ongoing commitment to evaluate and address risks to children's health.

"Protecting children's health is a top priority for EPA, and this new funding would help school's address poor and deteriorating conditions that can harm children's health and stymie academic progress," **said EPA Administrator Andrew Wheeler**. "This grant program would help schools, especially those in underserved communities, reduce exposures to environmental hazards, create healthier learning environments, and ensure children can reach their fullest potential."

"Children tend to be at greater risk from environmental hazards than adults because of their greater exposure relative to their body mass and because their developing organs make them more susceptible," **said Dr. Michael Firestone, acting director for EPA's Office of Children's Health Protection**. "This new grant program is aimed at reducing those risks where children spend most of their time learning and playing."

"The Healthy Schools Grant Program envisions a clean and healthy learning environment for our children, free from concerns such as diesel emissions or lead in school drinking water," **said EPA Regional Administrator Pete Lopez.** "This program is an investment in our children today and every child that will go to school in New York, New Jersey, Puerto Rico and the U.S. Virgin Islands in the future."

The *Healthy Schools Grant Program* is a comprehensive environmental health grant program with the goal of identifying and addressing environmental health risks in and around schools that contribute to increased absenteeism and reduced academic performance. The program would provide a total of $50 million for schools to identify, prevent, reduce and resolve environmental hazards including:

- reducing childhood lead exposure;
- reducing asthma triggers;
- promoting integrated pest management; and
- reducing or eliminating childhood exposure to one or more toxic chemicals in schools

Eligible recipients would include state and local governments, federally recognized tribal governments, and non-profit organizations.

Nearly 50 million children attend more than 100,000 K-12 schools every day. Reducing exposures to environmental hazards in schools creates healthier learning environments, which enables children to perform better in the classroom and thereby improve their academic performance and expand their opportunities later in life.

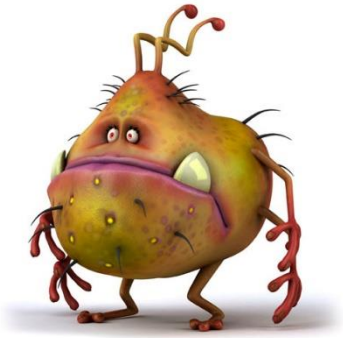
The *Healthy Schools Grant Program* would also support the *Federal Action Plan to Reduce Childhood Lead Exposures and Associated Health Impacts* (*Lead Action Plan*), which was unveiled in December by EPA and 16 other federal departments and offices. The *Lead Action Plan* was developed by the *President's Task Force on Environmental Health Risks and Safety Risks to Children* as a blueprint for reducing lead exposure and associated harms by working with states, tribes and local communities, along with businesses, property owners and parents.

To learn more about what EPA is doing to promote healthy schools, visit www.epa.gov/schools, and to learn about all of EPA's Children's Health programs, visit www.epa.gov/children.

EDITOR'S NOTE: Full details about EPA's proposed FY 2020 budget are available at www.epa.gov/cj.

Chapter Nine
Indoor Pollution

Published September 2019



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- **THE IMPACT OF CLEAN AIR**
- **HOW DOES OUR INDOOR AIR GET POLLUTED?**
- **GERMS: A HIDDEN SOURCE OF INDOOR POLLUTION**
- **COMMON INDOOR POLLUTANTS**
- **WHAT'S THAT SMELL?**
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- **THE POWER OF AIR CIRCULATION AND PROPER VENTILATION**
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- **THE VALUE OF QUALITY INDOOR ENVIRONMENTS**

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

INTRODUCTION

MARGARET'S MIGRAINE?

Margaret blurted through the phone, "You are going to think I am absolutely crazy!" The Certified Indoor Environmentalist on the other end of the phone couldn't tell if she was crying. "My husband thinks I am crazy. Every time I do dishes, I get an agonizing migraine for about three hours. My husband suspects that I am having a reaction to not wanting to do dishes! I have never objected to any kind of work, especially not household chores. But he insists there is something wrong with me!"

This particular Certified Indoor Environmentalist loves mysteries, so he invited himself for a visit, and like a noisy PI snooped through her cupboards. Under the sink he found a collection of all the household products Margaret had used over the last six months. He grabbed the containers and walked them out to the back porch as he listened to Margaret explain that she never put anything under the sink without first making sure the lid was tightly closed.

As he opened the window above the sink, the brisk November air cut through the warm kitchen. After about 10 minutes of conversation, he turned around and closed the window, with a promise to call Margaret back in a couple of days.

Two days later, he placed a call. The embarrassment in Margaret's voice was very evident. No matter how tightly a chemical is sealed, vapors containing Volatile Organic Compounds (VOCs) escape. Margaret may have been personally susceptible to one of those chemicals – or – she was susceptible to the unique toxin that was formed when the vapors from several of the different chemicals mixed.

VOCs are gases that are emitted from solids or liquids and are one of many sources of INDOOR POLLUTION. VOCs are released from paints, varnishes, waxes, cleaning products, disinfectants, cosmetics, fuels, wood preservatives, aerosol sprays, air fresheners, pesticides, and hobby supplies. They can be

released from building materials, furnishings, and active office equipment such as printers and copiers.

The EPA has stated that concentrations of VOCs can be as much as ten times higher indoors than outdoors. Levels of exposures can affect occupants both immediately and long after the use of them has been suspended. Since people are now spending approximately 90% of their time indoors and are breathing between 17,280 and 23,040 breaths each day, protecting our indoor environments become critical to our long-term health.

Symptoms of exposure to VOCs can range from irritation of the eyes, nose, and throat, headaches, loss of coordination, nausea, dizziness, fatigue, and the list goes on. Damage to the liver, kidneys, or central nervous system can occur, depending on the specific concentrations of the VOCs, the level of exposure, the length of exposure, and the individual's personal susceptibility to the VOC. The major clues to whether or not a building suffers from INDOOR POLLUTION are the symptoms experienced by occupants while in the building and the lack of symptoms when away from the building.

Whether it is a migraine like Margaret was experiencing or another symptom of exposure to INDOOR POLLUTION, finding the source and addressing it is crucial to protecting our indoor air! Breathing healthy air every day while indoors has a positive impact on the overall health of the occupants of our homes and buildings.

THE IMPACT OF CLEAN AIR

Breathing clean, fresh, healthy indoor air each and every day has a positive impact on the health of all our building occupants. Did you know that a single person breathes in nine and a half TONS of air each year?

The CDC and a Harvard review both report that Americans are spending approximately 90% of their day indoors. This makes the main source of exposure to air pollution our indoor air. The EPA reports that indoor air often contains four to ten times more pollution than our outdoor air. Think about our typical day … arise from eight hours in our bedroom, breakfast, then head for the car (yes, that is an indoor environment as well), then into our office, school, or work truck. We work, study, eat, drink all in an indoor environment. Then back to our home, where we will only spend 15 minutes to two hours outdoors,

before we head back in the house. From there, another eight hours in our bedroom.

Particulates in the air as small as 2.5 microns have been linked to heart attacks, cardiac arrhythmias, strokes, chronic obstructive pulmonary disease and worsened symptoms of asthma. These particles also increase the risk of respiratory illnesses. According to the World Health Organization, there are 800,000 premature deaths each year due to particulate matter in the air. That makes it the 13th leading cause of death worldwide. Since 1990 the EPA has called Indoor Air Quality one of the top five most urgent environmental risks to the American public.

The National Air Duct Cleaners Association (NADCA) report that as many as one out of four buildings in the U.S. could be classified as experiencing indoor air quality issues. As many as 64 million workers experience eye, nose or throat irritation, headaches or other symptoms associated with Sick Building Syndrome while at work or school. Their research indicates that as much as 20% of all illnesses are aggravated by or caused by poor indoor air quality.

Indoor pollution costs the American economy as much as $168 billion each year. Working adults miss approximately 14 million workdays per year as a result of asthma. Asthma is typically aggravated by indoor air pollution.

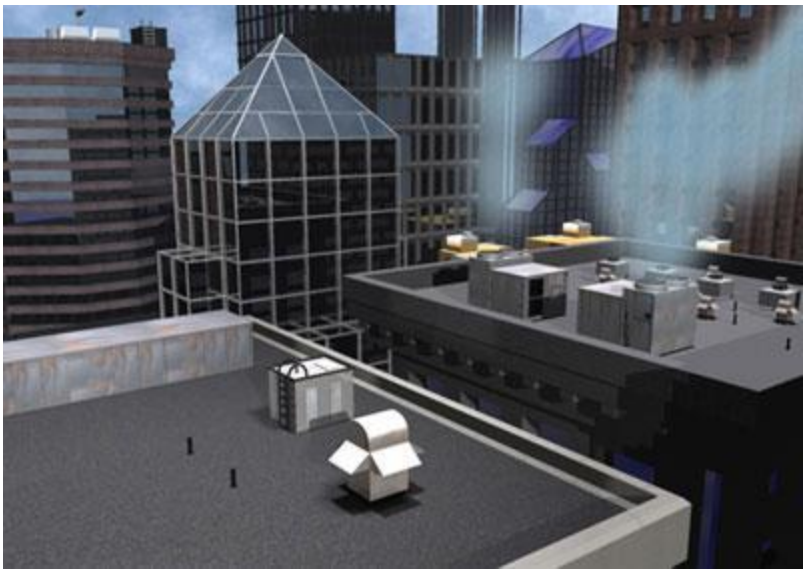
Health effects may be experienced immediately or years later. For those that can be experienced immediately, the major clue that there is an indoor air quality problem is the relief that an occupant experiences when they have left the building or when they are away from the building for a period of time. If the symptoms are experienced upon their return to the building, this is a huge indication that there is an indoor air quality problem.

Both short- and long-term health effects of indoor air pollution depends on the source of the pollutant and its toxicity, the quantity and length of time of the exposure to the pollutant, as well as the personal susceptibility of the person being exposed and their current health.

HOW DOES OUR INDOOR AIR GET POLLUTED?

So many factors can play a part in contributing to a building's indoor air pollution: the site the building is located on and all the sources of pollution that surround it, the building's original design and any renovations that have taken place both inside the building and in the landscaping around it, how well the building and the building systems have or have not been maintained, the occupant density and the activities of the occupants within the building. Even simple daily activities can contribute to indoor pollution, such as the dirt that is carried in on occupant's clothes and feet, cooking, cleaning, smoking. The list can go on and on.

The site the building is located contributes to potential indoor pollution when there are highways or busy thoroughfares nearby. Neighboring buildings that release pollutants that can be pulled into the building's fresh air intake can also be a contributor - if the land had previously been used for industrial purposes where the ground was contaminated or if the water table is high allowing soil contaminants to off-gas into the building.



Breathe Healthy

A Guide for Those Responsible for Indoor Environments

Flaws in building design or construction contributes to poor indoor environments. Examples would include poor foundations, roofs, or building envelopes that allow for air pollution or water intrusion. Poor design or maintenance of the building systems can allow outdoor pollutants to enter the building or cause spaces to be poorly heated or cooled, allowing for dampness or causing poor air circulation.

Poorly planned renovations can cause indoor pollution through a dust contamination or by the off-gassing of construction materials. The dust and the gasses can be circulated through the building by the HVAC system.

When kitchens, bathrooms, showers, trash rooms, copy rooms and other rooms that emit particulate, vapors, gases, etc., are not properly exhausted from the building, the pollutants can become trapped in the building.

Outdoor air enters a building through systems of infiltration, natural ventilation, and mechanical ventilation. Openings in joints, pipe chases, cracks in walls, floors, ceilings and around windows and doors all allow air into a building. Temperature differences and the wind can both force air into a building. When the air handling systems do not remove the indoor air or distribute filtered air properly, or when infiltration and natural ventilation do not cause enough air exchange, pollutant levels in the building or in specific rooms can increase.

Indoor pollution can arise from a single source or a combination of sources. When an Indoor Environmentalist is investigating the possibility of indoor pollution causing an impact on occupants' health, they have to take into consideration the building design and location, possible failure of the building enclosure, the use of the building by occupants, the operation and maintenance of the HVAC systems, the density of the occupancy of the building, moisture and humidity issues, potential biological contaminants, the potential of outside pollutants entering the building, the off-gassing of materials in the building, recent renovations, pollutants being released from cleaning supplies and pesticides, and all the building mechanical system operations.

GERMS: A HIDDEN SOURCE OF INDOOR POLLUTION

Bacteria, biologicals, and germs are everywhere. With over 60,000 different types of germs and each occupant having their own personal susceptibility to different germs, it's important to know where these germs hide so that we can eliminate or reduce exposure to them.

Prevention is the best practice. Limiting contact with germs, cleaning regularly, and the practice of washing our hands prevents much of the potential for exposure. But, knowing where these germs hide help us determine our cleaning practices.

LAUNDRY MACHINES are a great collector of an immense amount of germs. Think of the germs we collect on our clothes every day, from dust and dirt on our outer clothing to E.coli on our undergarments. It's important to wash clothing in hot water and to dry clothing for a minimum of 45 minutes. The table used for folding our clothes should be separate from the table that we sort our dirty clothes on. It's best to wash our undergarments separately from our outer garments so as to prevent cross-contamination. The washer and dryer themselves should be cleaned regularly.

KITCHEN FAUCETS, the handles and the aeration screen, should be disinfected regularly. Germs from our hands and contaminated food can reside on both. The moisture around the faucet and sink allow for the collection of biologicals and bacteria as well as providing both with the nutrients they need to grow.

CAR DASHBOARDS have numerous touch points, including the steering wheel, audio and thermostat controllers, and vents. Germs from our hands are past to these touch points. The air coming from the outdoors through the windows and vents carry with them biologicals and bacteria that stick to the dashboard. Wiping down the dashboard regularly will reduce the number of contaminants we are exposed to.

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

CELL PHONES are constantly being set down in places where we would never think to put our mouth. Yet, we move the phone from those surfaces to our mouth without a thought. Both the surfaces of the phone and the crevices of the phone are perfect hiding places for germs. Cell phones should be disinfected daily.

VACUUM CLEANERS should always be emptied outdoors. We've worked on getting them air-tight or made sure that they were equipped with HEPA filters to remove particulates as small as 2 microns. The last thing we want to do is open the vacuum and release their contents into our indoor environment. They've sucked up hair, food, dust, bacteria, mold spores and all sorts of indoor pollutants. We want those germs outside! Like the wash machine and dryer, the vacuum should be cleaned regularly as well. The attachments, brushes, and the crevices of the vacuum cleaner itself hide millions of germs.

GYM EQUIPMENT, workout gloves, and their polyester fabric gather germs from all who touch them. Wiping down the equipment before and after use can reduce potential exposures. Using hand sanitizers is a wise move as well.

MONEY is the root of all evil. Not sure about that … but it is a strong hoarder of germs.

Coins, dollars, and plastic money pass through hundreds of dirty hands daily. Germs gather on the surfaces, in the crevices of coins, on the fibrous paper money, and in the nooks of plastic. We then stuff them in our wallets making our wallet another hoarder of germs.

Regular cleaning and disinfecting protect us from these hidden sources of germs. Identifying hidden sources of germ retainers allows us to know where we need to focus our cleaning energy. Good and regular cleaning routines will limit exposure to germs and will keep our indoor environment healthy for our occupants healthy.

COMMON INDOOR POLLUTANTS

By identifying the common indoor air pollutants to a specific building, preventative measures can be applied to keep the building healthy. Many of these have been reviewed in previous chapters: radon, asbestos, lead, mold, water contaminants … now let's look at other common contaminants that lead to indoor pollution.

Other contaminants include:

Biological contaminants

Examples:

- Mold
- Dust mites
- Pet dander
- Skin flakes
- Pollen
- Cockroach, rodent and insect parts
- Droppings from pests
- Viruses
- Bacteria

The challenge with this contaminant is that either they or the particulates they release are small enough to be inhaled or swallowed. Sources of biological contaminants are living things, and they typically can be found in areas where there is food and/or moisture. HVAC components such as cooling coils, humidifiers, condensate pans, as well as unvented kitchens and bathrooms can provide enough moisture to attract and house them. Draperies, bedding, and carpet provide a place for these contaminants to accumulate. Anything causing high humidity or dampness, such as water spills, condensation, water leaks or flooding, will attract an accumulation of these contaminants.

The health effects range from asthmas triggers to more serious diseases such as tuberculosis, influenza, and serious infections.

Good housekeeping practices, proper maintenance the HVAC system, adequate ventilation, moisture and humidity control, appropriate pest management

practices all reduce the potential for indoor pollution caused by biological contaminants.

Chemical contaminants

Examples:

- Emissions from products
- Emissions from office equipment
- Emissions from furniture
- Emissions from wall and floor coverings
- Emissions from pesticides
- Emissions from cleaning products
- Emissions from consumer products
- Accidental spills of chemicals
- Carbon monoxide
- Formaldehyde
- Nitrogen dioxide

By using safer, non-toxic cleaning products and by using products as described by the manufacturer the amount of indoor pollution caused by chemical contaminants can be significantly reduced. Chemicals should always be kept in their original container and stored out of the reach of children. Chemicals should never be mixed with one another. Their user should not eat, drink or smoke when using them. All chemicals should be disposed of safely.

Health effects of chemical contaminations range from burns, poisoning, nausea, dizziness, and eye irritation.

Non-biological particulates

Examples:

- Dust
- Dirt
- Outdoor pollutants

Non-biological particulates can be a solid or a liquid that is light enough to be suspended in the air. It is typically produced by activities such as renovations, copying or printing, operating equipment.

Proper ventilation is the best control measure.

Carbon dioxide (CO2) is a colorless, odorless gas produced by the human metabolic processes. Exhaled air is its largest source and typically becomes a problem when a space becomes overcrowded. CO2 is also released through the combustion process of carbon fuels such as cars, trucks, and buses.

High CO2 levels can cause fatigue, headaches, and loss of mental acuity. The best remedy is ventilation that brings in fresh air to dilute the CO2.

Carbon monoxide (CO) is also an odorless, colorless gas. It results from the incomplete oxidation of carbon in combustion processes, such as those found with furnaces, propane heaters, and gas appliances. Vehicle exhausts from attached garages are often a source of indoor CO pollution.

Exposure from an accumulation of CO can impact the brain, exercising muscles and the heart. Initial symptoms mimic the flu and can lead to cognitive impairment or death.

Proper maintenance of combustion appliances, proper exhaust and proper ventilation will control levels of CO in a given space.

Dust and particulate matter (PM) are released from atmospheric pressures, daily activities, and the deterioration of indoor materials.

Examples:

- Soil from our feet
- Clothing degradation
- Paint dust from friction points when opening or closing doors, windows
- Use of appliances, equipment
- Pesticide residues
- Particulate carried by the wind infiltrations
- Particulate carried by unfiltered HVAC fresh air intakes
- Soot released by vehicle emissions
- Soot released by combustion appliances, furnaces, and fueled equipment
- Natural deterioration of building components, such as drywall mud, drywall, paint, ceiling tiles, etc.
- Particulate released from friction activities, such as opening and closing windows and doors, equipment activities, etc.
- Many, many, many different sources

Small particulates, whether a solid or a liquid droplet, will linger in the air and are easily inhaled, capable of passing through our body's defense mechanisms and entering our lungs. Heavier particulate will quickly settle on horizontal surfaces. Where there is an accumulation of heavy particulates on surfaces, it can be assumed that lighter particulates are polluting our indoor air.

The impact dust and particulate matter has on our health is dependent on the toxins included in the dust. Dust may be just an irritant or it may contain the residue of a toxin, such as lead-based paint, causing life-long impairments. This pollutant can cause shortness of breath and aggravate asthma or lead to heart, respiratory and lung infections or diseases. Children are at a higher risk because they breathe in air at a much higher rate than adults.

There is no better control technique for dust and particulate matter than good housekeeping practices. Dry sweeping should be avoided. The use of damp wiping methods and vacuuming with equipment that employs a HEPA filter is crucial to the control of dust and particulate levels. Changing HVAC filters as soon as they appear to be experiencing an accumulation of debris is important. Employing safe work practices and containment when performing activities

that create dust will protect the building and its occupants from these contaminants.

Tobacco smoke and second-hand tobacco smoke pollute the indoor air with solid particulates, liquid droplets, vapors and gases that contain over 4,000 chemical compounds.

Immediate health symptoms include nasal congestion, irritation of the nose, eyes, and throat, persistent cough, wheezing, headaches, and can lead to respiratory diseases and cancer.

Designated smoking areas should be outdoors and away from air intakes of the HVAC system.

Nitrogen dioxide and nitric oxide are highly toxic gases released from combustion processes such as gas-fueled appliances, welding, vehicles, and equipment. They are also found in tobacco smoke.

Health effects can range from irritation of the eyes, nose, and throat to acute and chronic bronchitis, decreased lung function and respiratory infections.

The best remedy to an indoor environment contaminated with these gases is proper ventilation or additional exhaust systems.

Pests include any unwanted living things in or around our buildings.

Examples:

- Bugs
- Rodents
- Bed bugs
- Mice
- Rats
- Cockroaches

Pests typically infiltrate our indoor environment as they escape from the outdoor environment looking for food, water and shelter. They can enter

through openings in the building envelope or can be carried in on our clothes or pets.

Pests, their droppings, and their debris after death can irritant allergies and asthma, contaminate our food and water, and spread disease. Their bites can lead to irritations and diseases, many of which compromise our immune systems.

Good housekeeping practices and proper storage of food and trash can reduce the impact of these indoor pollutants. Minimizing openings from the outdoors will deter their infiltration. Addressing leaks, water intrusions, and high humidity levels will deter their interest in the indoor environment. Reducing clutter reduces pests hiding places.

Improper application of pesticides can lead to indoor pollution by leaving chemical residues that aggravate allergies.

The use of pesticides should be the final step in pest control. By controlling dirt, dust, moisture, clutter, access to food, and building penetration points, pests will not be attracted to the indoor environment. Baits and traps should be used first. Spraying pesticides should be the last resource in eliminating pests

and the building should only be sprayed where the pests are located. When applying pesticides, the building should be unoccupied and well-ventilated.

Volatile Organic Compounds (VOCs) are gases released from cleaning products, solvents, and building materials as mentioned in the Introduction. By using low-VOC products, releases of this gas into the indoor environment can be avoided. VOCs in the air can be significantly reduced by the introduction of fresh air to dilute it or by use of ventilation that can exhaust the contaminated air to the outdoors.

Dampness, elevated humidity, and moisture not only attract bacteria and biological contaminants but can also exasperate allergies, asthma and respiratory issues. Shortness of breath, wheezing, sinus congestion, and irritation of the eyes, nose, and throat can be indications that an indoor environment is being impacted by dampness, humidity or elevated moisture.

Pet dander are dead skin cells released from the bodies or our household "best friends." Dead skin cells are released during normal activities and are invisible unless viewed under a microscope. They can linger on the bodies of our pets for long periods of time. Once released they can them linger in the air for long periods of time and cling to furniture, building components, HVAC ductwork and our clothing.

Pet hair is a vehicle for allergens, particulates, and dust. Good housekeeping practices, regular changing of HVAC filters, and the use of a HEPA filters on our vacuum cleaner are the best remedies for control of pet dander.

WHAT'S THAT SMELL?

Odors are one of the major indicators of an indoor contamination and indoor pollution. Our nose should be the first tool used to identify the source of an indoor pollution.

Ask: Is this odor persistent or intermittent? If it is a persistent odor, most likely the source is fixed within a specific area. Check the activities being performed by the occupants in that area. Check for water or air intrusions. Check for possible off-gassing of building components or furnishings within that particular area. If it is intermittent, it will most likely be harder to identify.

Typical smells that raise concerns include the famous odors of rotten-eggs, sewer, cigarette or smoke, paint, dirty socks, vomit, urine, mustiness, or soil.

Rotten-egg or sewer-like odors could be indications that a sink or floor drain trap has dried out, sewer pipes have become clogged, or there may be a natural gas leak. Cigarette odors may be an indication of smoking near an HVAC intake or disposing of cigarette butts in an indoor trash container.

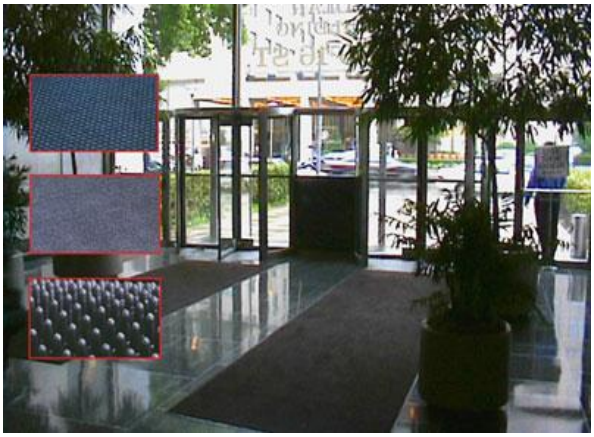
Paint odors can be carried through the ductwork of a building that is being renovated. Dirty-sock odors are usually an indication of issues related to the HVAC system or a biological growth in the HVAC ductwork. Vomit-like odors usually indicate a moisture issues in ceiling tiles or other building materials. Musty, soil-like odors usually indicate a mold contamination or a water leak impacting building components or the HVAC ductwork.

TIPS FOR REDUCING INDOOR POLLUTION

A list of tips for reducing indoor pollution could go on and on. These are just a few that those responsible for indoor environments quite often overlook.

Keep dirt outside! The EPA recommends the use of barrier mats at all entrances to a building. One mat outside the door and a second mat right inside the entrance. The outdoor mat should have a rough texture to catch large

particles being carried on occupants' feet. A medium textured mat inside the entrance and finally a fine textured mat as the final tool to remove small particulates. These mats will accumulate dirt the more it is used, so regular cleaning of the mats is essential to protecting the indoor environment.



Properly operating and maintaining HVAC systems. Two out of three indoor air quality problems involve inefficient HVAC and air duct systems. Signs that indicate there may be a problem with the ventilation system include:

- moisture condensation on windows or walls,
- smelly or stuffy air,
- dirty central heating and air cooling equipment, and/or
- areas where books, shoes, or other items become molding

Having the HVAC ductwork cleaned when the ducts have been contaminated impacts the indoor air quality of all the air spaces in which these ducts supply. The EPA and the NADCA do not recommend regular cleaning of duct work. Dirt adheres to the surfaces of the ductwork and does not necessary enter our breathing space.

Ducts should be cleaned when there is a substantial buildup of debris on hard surfaces, when the HVAC system has experienced a mold contamination, after a fire or water event, and when the ducts have experienced an infestation of rodents, insects or other pests.

When in doubt as to whether or not to have the ductwork cleaned, have a duct cleanliness inspection performed by a professional using one of three methods: visual inspection, a surface comparison test or a vacuum test. A NADCA Certified Duct Cleanliness Inspector will know which method is best for your HVAC system. Keeping the HVAC ductwork clean is essential since the HVAC system can spread a contamination through all the spaces that it provides air to or remove air from.

- Proper use and maintenance of fuel-burning appliances and equipment.
- Use of HEPA filters on HVAC systems (if recommended by manufacturer) and vacuum cleaning systems.
- Use of air filtration systems in spaces that tend to become polluted more easily because of air intrusions or because of the activities in the space.

Filters – FRIEND OR FOE?

Filters are the primary method for cleaning of indoor air. Proper filters on the building's HVAC system, vacuum systems, and air filtration systems will help keep the air our occupants breathe clean. The common mistakes we make with our filters are when we fail to install a filter (surprising how often this happens), when bypasses for air are created around the filter as the system ages, when our HVAC system's runtime is too short (as when an oversized unit is installed), when filters are installed in the wrong place, or when the filter is not sized properly for the system.

Filters remain our friend when properly used and maintained and can have a huge impact on maintaining high standards of air quality.

- Changing filters as soon as there is an indication of an accumulation of particulate on it.
- Using safe work practices and containment systems during construction or renovation activities.

- Controlling moisture and humidity within the building spaces, addressing water leaks and intrusions immediately.
- Encouraging building occupants to practice cleanliness. Personal hygiene affects our indoor environment. Occupants that clean and/or disinfect and maintain their body and personal space contribute to our efforts to reduce or eliminate indoor pollution.
- Regularly planned deep cleaning of a building increases the potential of keeping the indoor environment healthy. During deep-cleaning, areas that are missed during regular cleaning activities can be addressed, such as under appliances, in cupboards, and other areas that tend to harbor dust, dirt, insects and rodents, and their aftermath.
- If fragrance is to be used, avoid candles and manufactured fragrances as they may release VOCs. Use all-natural fragrances such as lavender and vanilla or use essential oils.

One of the biggest tips for maintaining a healthy indoor environment and reducing or eliminating indoor pollution is to establish a Preventative Maintenance Program that includes a Healthy Building Inspection every Spring and Fall. In a situation where a many staff members, occupants, employees or students are impacted, the entire group may need to be involved in different degrees. Having the commitment of management, training of all those involved, the involvement of occupants, and standard protocol for the Preventative Maintenance Program such a program can be very successful. When all those involved in the health and safety of the environment come together through a managed system, the identification of environmental concerns will be respected and can be acted upon with the understanding of all those involved or impacted.

A Preventative Maintenance Plan can address, prevent, and resolve problems with indoor pollution before the health of occupants are impacted and before issues become expensive to remedy. A Preventative Maintenance Plan includes establishing protocol and policies, assessing the current state of the indoor environment, establishing a system to report concerns, address concerns, and protocol for follow-up assessments. We will dive deeper into such a program in Chapter 12.

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

THE POWER OF AIR CIRCULATION AND PROPER VENTILATION

Of all the building systems, the science of proper ventilation, the introduction of fresh air, and air circulation within a building is one of the most important. Like lungs to our body, buildings need to be able to take in fresh air and to push out dirty air. Ventilation keep our indoor air fresh and healthy for our occupants to breathe. When our building systems pull in fresh air, it dilutes any high levels of moisture, gases, dust and other pollutants. When it pushes it out of the building, it reduces levels of moisture, gases, dust and other pollutants. Exhaust fans in strategic places that typically accumulate high levels of pollutants, such as kitchens and bathrooms, also assist in reducing indoor pollutants.

Because the buildings of today are built so airtight, it is crucial to regularly confirm that our ventilation systems are properly balanced. The new 2020 Ventilation Standard lays out the requirements for optimal health, comfort and productivity of fresh air in each space of a building.

For optimal health, comfort and productivity the air in an office should remain:

- Total VOC's - less than 500 ug/cubic meter
- Small particles (2.5 ug)- less than 15 ug/cm
- Relative humidity - 30-45%
- Carbon monoxide - below 9 ppm
- Carbon dioxide - below 750 ppm

Technology exists that can not only monitor these parameters, but can actively control the ventilation rates to maintain high levels of healthy air.

IMPLEMENTING AIR FILTRATION SYSTEMS

Air filtration and cleaning systems are very valuable in removing particulates, gases and indoor air pollution from our indoor environments. Their effectiveness is dependent on how much air they draw through the cleaning or filtering element and how well the cleaning or filtering element accumulates the contaminants.

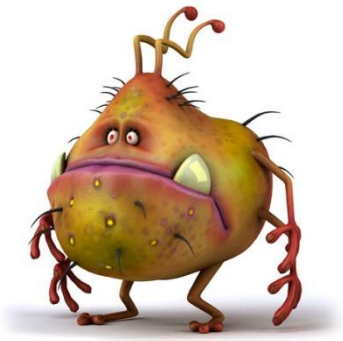
The rate of air drawn into the system is typically expressed in cubic feet per minute, and the amount of pollutants they collect is typically expressed as a percentage efficiency rate. Each air filtration system should be sized to the space it is filtering and should be rated to collect 99% of the airborne particulates down to the size of 0.3 microns.

THE VALUE OF QUALITY INDOOR ENVIRONMENTS

Quality indoor environmental conditions contributes to the productivity of our occupants. Occupants that have a sense of comfort, health, and well-being significantly outproduce occupants whose health is being impacted by indoor pollution. Quality indoor environments reduce rates of symptoms related to poor air quality, reduce illnesses such as colds and influenza, reduce asthmatic symptoms, and reduces stress. Although the EPA and National Air Duct Cleaning Association have set the loss to the American economy of $168 billion per year due to indoor pollution, a price to our health cannot be measured.

Chapter Ten
Wet Basements & Crawl Spaces

Published October 2019



- **INTRODUCTION**
- **CRAWL SPACES**
- **WET ALERT!**
- **SO, WE'VE GOT A WET BASEMENT or CRAWLSPACE. WHERE DO WE START?**
- **WATERPROOFING METHODS**
- **ADDITONAL SAFEGUARDS TO CONSIDER**
- **CLOSING**

INTRODUCTION

When was the last time you were in the crawl space of your building? Do you know what may be lurking through its dark shadows? Could it be water, debris, monsters? See what these folks found in their crawl spaces!

Authorities find accused bail jumper in Yakima Crawlspace
By Donald W. Meyers, Yakima Herald-Republic
December 11, 2019

YAKIMA, Wash. — Authorities arrested a 38-year-old Yakima woman accused of not reporting to serve a prison sentence for drug possession after finding her in a crawl space.

Susan Elizabeth Burnaroos was sentenced to 7 1/2 years in prison on Nov. 7 for theft and multiple drug-possession counts from a 2019 case, along with time for a methamphetamine manufacturing and unlawful firearms possession dating to 2017, according to court documents.

Yakima County Superior Court Judge Richard Bartheld ordered her to begin serving her sentence Nov. 21, giving her time to resolve some family issues, according to court documents. He ordered her placed on electronic monitoring.

On the day she was supposed to surrender, Burnaroos removed her electronic monitor and had a friend return it to the monitoring company, according to court documents. A warrant for her arrest was issued Nov. 22, the documents said.

Burnaroos posted on her Facebook account Dec. 5 that she was on the run, called Bartheld a “dirty judge” and accused a friend of stealing her car, according to a Yakima police probable cause affidavit.

Officers used YPD’s Facebook account to tell her to turn herself in to the nearest police agency and that YPD would take a report on the stolen car.

Officers with the Pacific Northwest Violent Offender Task Force tracked her to a home in the 1400 block of South First Avenue in Yakima Tuesday, where she was found hiding in a crawl space under the house, according to the U.S. Marshal’s Service.

Bartheld set her bail at $50,000 during a preliminary appearance in Yakima County Superior Court.

Knoxville man discovers strangers sneaking into crawl space

By Kristie Crawford, ABC 6 WATE.COM
Nov 26, 2019

KNOXVILLE, Tenn. (WATE) — Imagine sitting at home, minding your own business when you hear a noise. You go to investigate and find a hole in the floor with an eye staring up at you.

Paul Mohlman didn't have to watch a horror film to witness this exact situation in his home. Molhman said he was sitting on his couch Tuesday morning in North Knoxville when he heard a weird noise coming from his roommate's bedroom.

"It sounded like something fell. Something heavy," Mohlman said.

When he went to check it out, Mohlman found a pipe laying on the floor and a hole in the floorboard next to it.

Trying to figure out what happened, Mohlman looked down the hole and, to his surprise, saw a green eye staring right back at him.

"It was a Caucasian dude. He wasn't wearing a shirt; had no shoes on," Mohlman said.

Mohlman said he tried asking the man why he was under there.

"What are you doing down there? Did the landlord call you? Are you hear to work on plumbing," Mohlman asked.

Mohlman said the man mumbled something back and then started to move around slowly, as if he was trying to hide.

He called police and grabbed his .22-caliber rifle.

"I let him know that I have a gun. And I said 'I don't want to shoot you, but what are you doing,' " Mohlman said.

Once police arrived, it took them several minutes to coax the man to come out from under the crawl space.

Mohlman said the man claimed to have spilled acid on himself.

Finally, a man emerged from the crawl space, but it wasn't who Mohlman expected. A black man emerged, wearing a shirt but no pants or shoes.

"At the moment, I sort of forgot about that part and was like, 'Oh they got the guy. I saw it wrong. They got the guy,' " Mohlman said.

Molhman said clothes were sprung around outside near the crawl space door, along with two bottles of muriatic acid, also known as hyrdochloric acid; his watering hose; and insulation.

Thinking the horrific ordeal was over, Mohlman left his home to get a drink at a nearby bar. He was telling the bartender about what had just happened and showed him the picture he snapped of police detaining the black man.

The bartender reportedly told Mohlman that he saw the same man hanging around the bar the night before, but said there was also a white man with him.

The bartender went through surveillance video and found that the two were messing with random items on the outside of the bar.

Molhman said the men in the video looked like the men he saw under his house, including the white man he thought he had saw at first.

He called police again to say he thinks another man might still be underneath.

Molhman said police first saw the surveillance video before heading back to his house.

When they checked the crawl space again, it was empty.

Mohlman said later that night he discovered that the men cut wires controlling the heat, so he had to call for emergency repairs. Mohlman chose not to file charges believing they needed help, possibly medical attention, but not jail.

Knoxville Police said they detained the black man and transported him to UT Medical Center for his erratic and unstable behavior.

Police are not looking for the white man Molhman believes was also under his home.

Molhman said he learned a valuable lesson: Padlock your crawl space doors. His home is about 100 years old and it was just one of many on his street with crawl space doors that are easily accessible on the side of the house.

POINT: All joking aside … Crawl spaces are unique in that owners rarely enter them and are typically unaware of what is lurking between their floor and the ground!

Maintaining the overall health of a basement or crawlspace is crucial to the health of a building. The structural components of a building are equivalent to the bone system of our body - the basement or crawlspace is equivalent to the pelvis and lower back. When the pelvis or lower back are injured or

deteriorating, it affects the body's overall health. The same is true with a basement and crawlspaces. This fact has been confirmed by tracer gas studies, which documented that a building's crawlspace or basement communicates with the occupied spaces above. Approximately 40% of the air in our buildings originates from these areas.

Let's start by recognizing the unique characteristics of a crawl space.

CRAWL SPACE

A CRAWL SPACE is a hollow area found under buildings between the ground and the first floor. It is typically one to three feet high and elevates the building off the ground. It is a space created to contain essential building systems such as plumbing, electrical wiring, HVAC ductwork, and in some cases may house the air conditioning and heating systems.

The crawl space is a great alternative to a basement or slab when a basement is not cost-effective, is in a high water table or high-moisture area, is in an area prone to termites, is in a sandy area or when ground conditions, such as draining or landscaping, is not appropriate. One of the greatest benefits to a crawlspace is the easy access for the maintenance and repair of the building systems.

TO VENT OR NOT TO VENT: One of the continuing arguments of contractors is whether or not a crawl space should be vented or unvented. It really depends on the location, climate, and design of the building. Historically, crawlspaces have been vented. But during the dawn of central air and the ability to control indoor environments, contractors tend to sway away from vented crawl spaces, especially in areas with an extended period of hot, humid weather. A crawl space adds to the stack effect of a building, so if warm moist air from outside is entering a cool vented crawl space, the moisture tends to condense on the cooler surfaces. The condensation leads to high humidity which leads to mold

growth and eventually deterioration of structural materials. In unvented crawlspaces, the climate can be controlled.

For a crawlspace to adequately perform for a building, it is recommended that a vapor barrier be installed around the perimeter foundation and over the floor, isolating the ground from the crawl space area. In the case of vented crawl spaces, the vents should be placed to provide cross-ventilation and ultimately move the air to the exterior. Most building codes require a minimum of 1 square foot of net-free vent area for every 150 square feet of crawl space. Insulation should be placed in the floor above the crawl space. Ducts should be installed in such a way as to eliminate the possibility of condensation. This is attained with proper seals and insulation.

A closed crawl space with no venting allows for a controlled environment. These spaces can be actively conditioned, can be intentionally or passively connected with the conditioned areas of the building, and can include active dehumidification systems.

WET ALERT!

Warning signs that indicate a moisture problem exists in a basement or crawl space should be followed by a full assessment.

WET ALERTS include:

- Humidity over 60%, which may indicate moisture exists but the source may be hidden … a leaking pipe, water lying against the exterior walls, water entering cracks in walls.
- Condensation on structural components or other components within the space, which may indicate that warm moist air is entering the cooled area.

- Peeling paint, which may indicate water is seeping under the paint and causing it to bubble.
- Cracked walls, which may indicate that severe pressure is occurring under the floor or behind the wall. This could lead to structural damage as well.
- Cracked walls, which may indicate that the concrete was not allowed to cure properly or that pockets of air were not properly removed during the initial installation of the foundation. Water will then force its way through the wall.
- A coating of efflorescense on the wall, which indicates that moisture may be seeping through the wall. Efflorenscense is the salt and chemical residue from either the soil or concrete wall.
- Buckling or bowed-in walls, which may indicate severe pressure behind the wall. It may have originally been hydrostatic pressure or water pressure, but over time it could transition to the pressure coming from the weight of the soil pressing against the foundation walls.
- Mold, which may indicate high-humidity events or moisture events.
- Puddles, which may indicate that the footings are too narrow or not laid deep enough, causing them to be susceptible to movement caused by soil erosion.

Although multiple signs seem to become evident all at once, quite often the problems were gradual and unnoticed. Water problems can also originate because of one event such as local dynamiting, a storm that saturates the ground, or recent changes to landscaping. All these events can also change the composition of the ground around the basement or crawl space creating new water entry paths.

SO, WE'VE GOT A WET BASEMENT or CRAWLSPACE. WHERE DO WE START?

Having a full assessment is the wisest move. Stories are rampant of building owners who have paid for extensive and expensive waterproofing systems … only to find that by making other water-control repairs they could have avoided installation of such a system. Needed gutter repairs is a great example: The rainwater pours off the roof, around and through the deteriorating gutter system, down the foundation

wall of the building and right into the newly installed French drains. However, if the gutters had been repaired, the need for the French drains would have been eliminated. In performing a full assessment, all sources of water are being identified, whether they are coming from landscaping issues, issues with the exterior systems of the building, or issues with the interior systems of the building.

A full assessment would start with a visual walk-through of the interior, inspecting any suspect items or areas (like plumbing) that could be a source of water entry, noting areas of concern, and taking pictures where possible. The more information one has the better. All the information will be used in developing a permanent water-control plan. This would then be followed by a visual walk-about of the entire exterior of the building and its surrounding landscape.

Possible concerns noted in a visual walk-through of the interior would include:

- Cracks in the walls and floors.
- Peeling paint and efflorescence.
- Movement in the foundation or footings.
- Water intrusions in the walls and floors.
- Buckled or bowed walls.
- Sump-pump issues.
- Hydrostatic pressure or high-water table indicators.
- Visible mold.
- Leaking pipes.
- Water stains.

The exterior assessment would begin with identifying any issues with landscaping and grading, drainage, gutter, downspout, roofing, or windows.

When performing a full investigation, personal safety should be considered, especially in older buildings were there could be issues with electrical wiring, mechanical systems, deteriorating asbestos-containing material, or hazardous material storage. In all buildings, radon exposure should be a concern as well. In both crawl spaces and unoccupied basements, be weary of animal and insect infestations, feces and other animal waste. Precautions should be taken to protect the person(s) performing the assessment.

All of the information gathered is then reviewed and an action plan is established. The action plan may encompass a process of making repairs and then determining of those repairs were enough to eliminate the water problem. When all repairs have been made and one finds that the water has not been controlled, it is then time to move to a water-control system, aka waterproofing.

WATERPROOFING METHODS

Waterproofing is the use of techniques and materials to prevent water from penetrating the basement or crawl space of a building. The process can include applications of sealants to installation of drains or sump pumps. Water in the soil around a basement or crawlspace causes hydrostatic pressure behind the walls and under the floor. This hydrostatic pressure forces water through cracks, which can cause major structural damage over time. It further leads to mold, building deterioration, foul odors and creates an environment attractive to rodents and other pests.

Waterproofing methods are actually water-control methods! The water, moisture or humidity needs to be controlled either by preventing it from

penetrating the basement foundation or floor, by diverting it away from the building, or by removing the moisture from the air and exhausting it to the outdoors.

The most prevalent basement and crawl space waterproofing solutions include:

- Interior wall and floor sealers
- Interior water drainage
- Exterior water drainage
- Exterior waterproofing coatings
- Box-type waterproofing
- Foundation crack injections
- Dehumidification

Interior wall and floor sealers are effective in cases where the high atmospheric humidity is being absorbed into the porous masonry walls. This moisture event can lead to deterioration of the basement/crawl space walls. This mitigation option could include applying sealers and adding a dehumidification system.

Note that a proper dehumidification system will include a system to capture the water produced and exhaust it to the outside so there is no dependence of building occupants or maintenance personnel to empty the dehumidifier. Between vacations and distractions, the chances are that there would be times when the dehumidifier was not emptied in a timely fashion. Such events would lead to high humidity episodes, which leads to opportunities for mold growth.

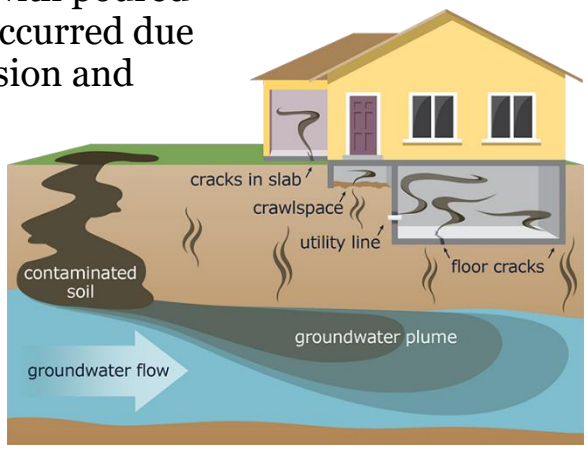
Interior water drainage is effective against both minor and major water intrusions and involves controlling the intrusive water. One mitigation system would include creating a channel under the slab and around the perimeter along the foundation footers. PVC pipe, a French drain, or a patented drainage system is installed in the channel and then covered with cement. Another called a boxed-type system would be a channel at the foot of the basement wall on top of the slab that captures water. Both systems may include wall conduits, such as dimple boards or other membranes, fastened to the foundation wall and extending over the drainage to guide water coming through the wall into

the system, which then drains to a sump pump system. It is wise to install a dehumidification system as well.

Interior water proofing is effective where the source of water is minor and particularly when it is caused by condensation. The mitigation would include applying coatings to the walls and/or floor and adding a dehumidification system that drains to a sump pump system. Usually coatings will not stop major leaks.

Exterior waterproofing is actually the only method the International Building Code recognizes as an adequate prevention of structural damage caused by water intrusion. It is effective in cases where the hydrostatic water pressure is intense or groundwater is high. The mitigation typically involves excavating to the footings, power washing and drying the walls, sealing the walls with a waterproofing membrane, and installing new drainage tiles at the side of the footings. Polymer-based waterproofing products have been developed that last for the lifetime of the building. They are not affected by soil pH and can be sprayed directly on to the wall and are fast drying. One of the benefits to polymer-based waterproofing products is that they are semi-flexible allowing for movement of the basement walls. Adjustments to the landscaping are typically required. Additionally, it is wise to install a sump pump system and a dehumidification system.

Foundation crack injections are effective with poured concrete foundations where cracks have occurred due to settlement of the building or the expansion and contraction of the concrete. The mitigation that addresses structural issues typically involves an epoxy being injected into the cracks. Polyurethane injections can be used to seal cracks to prevent the penetration of moisture or water. A sump-pump system and dehumidification system should be added.



A sump-pump system with an exhaust to the exterior should be a part of any mitigation in which active water is involved. A dehumidification system should be a part of any mitigation in which active water and humidity is involved.

Crawl Space Remediation & Waterproofing

In the case where a crawl space has been infiltrated with water over any period of time, remediation is crucial to bring the area back to a safe condition prior to any waterproofing or mitigation. Most likely, whether visible or not, a mold contamination exists. Remember mold remediation is futile unless the source of the moisture has been addressed. Otherwise, the next high humidity, moisture, or water event will bring the mold right back.

First, the source of the water or moisture must be identified and addressed. All debris should be removed, and the crawl space inspected for damaged insulation, rotten wood joints or framing, and unsealed drain or vent pipes. In the case where there is visible mold or mold is suspected, mold remediation should be performed to the point of full confidence that mold is no longer an issue (*see Chapter 4 on mold)*. Once repairs have been made to all components and mold is eliminated as a concern in the area, conditioning of the area to protect the environment can be pursued.

A 3% grade should be confirmed in the event that there were to be another water intrusion. In a dirt crawl space, a vapor barrier should be installed from sill plate to sill plate, covering the entire wall and ground area, but below the three-inch termite inspection gap. The objective is to isolate the space completely from the ground, moisture, and pesky intruders. Vapor barriers range from six-mil to 24-mil reinforced poly. The most common used range from eight-mil to 12-mil. Seams should be overlapped six to 12 inches and sealed with adhesive spray and four-inch tape made specific for poly vapor barriers. Walls are covered and sealed regardless if they are brick, concrete block, poured concrete, or rock to prevent warm, humid air from entering through cracks into the cool crawlspace allowing for condensation. Each time this vapor barrier is walked or crawled upon for any reason, it should be inspected for penetrations, repaired and sealed again.

Any drainage installed in the crawl space should be under the vapor barrier to the outside of the area or to a sump-pump system that exhaust to the outside of the area. The drains should move water towards the lowest points of the crawl space and the sump-pump system should be located at the lowest point. The crawl space drains should be independent of the foundation or gutter drainage systems.

All appliance discharge pipes and ductwork from the kitchen, baths, laundry rooms, and air handler condensate should be independent of all other building systems and should exhaust to the exterior of the building as well.

It is wise to install a dehumidification system that drains to the exterior of the building or into the sump-pump system that drains to the exterior of the building. It would also be wise to install a remote humidity monitor that can be checked regularly to warn of any water or humidity problems.

ADDITIONAL SAFEGUARDS TO CONSIDER

Critter-proof all basement and crawl space areas. Critters of all types love cool, damp areas. Snakes, rodents, spiders, bugs, armadillos, ground hogs, squirrels (although they prefer attics) are all attracted to basements and crawlspaces. Openings to the outside world should be filled in with concrete or steel wool. Crawl space entrances should be secured with mesh that cannot be chewed through.

If the floor beams are drooping, now is the time to lift those sections of the floor, add additional wood to the beams, or swap wood beams out for concrete blocks or beams, and level the floor. If not now, it will need to be addressed in the future.

The lowest-occupied areas of the building should be tested for radon whether that lowest level is a basement, crawl space or slab. (*See chapter 1 for more information on radon*.) Considerations should be given to other gases that may be prevalent to the area of your building, such as methane.

CLOSING

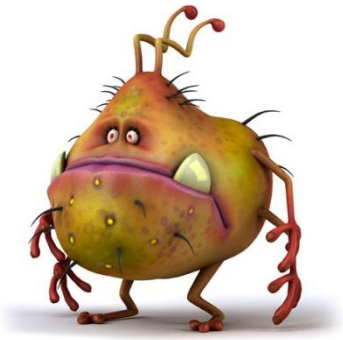
Stories run rampant of discoveries in forgotten basements and crawlspaces. Not just snakes and termite infestations, but cases of human gravesites,

possum families, skeletal remains, a front fender and radiator of a Model T, abandoned furnace and heaters, a refrigerator, porn stashes … the list goes on.

View the 2013 movie ***Crawlspace*** (also known as ***The Attic and Hideaway***) directed by Josh Stolberg. The movie focuses on a family terrorized by the former occupant of their new home. It will make you adamant about knowing and protecting what is going on in the crawl space and basement areas.

Chapter Eleven
Our Indoor Generation

Published November 2019



- **INTRODUCTION**
- **TWO CHALLENGES. TWO ANSWERS.**
- **ANSWER #1: GAIN AN UNDERSTANDINGN OF OUR INDOOR ENVIRONMENT & SHARE IT**
- **ANSWER #2: GET OUTDOORS**

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

INTRODUCTION

Subtle changes led us to our current Indoor Generation. It started with finding shelter in a cave to protect us from the wind, sun, rain, and outdoor monsters. Then we realized that we did not have to settle for the random caves in nature, we could build caves just about anywhere. And, we would call them shelters.

Then, we sought out the perfect location … near the forest so we would not have to travel far to seek out game. Or, near the lake, river, or ocean so we would not have to travel to fish. Once we learned how to grow our own food, we put our shelters on our farmland.

The building envelope as we call it today, evolved over generations. The design, building materials and construction evolved to match the climate of the region and the availability of resources. Construction format changed through experiment, failure, and advancement of knowledge and skill.

We became accustomed to our shelter and started our path to evolving to the INDOOR GENERATION.

Thermal conditioning started with the use of building material that naturally retained heat. Then 1.5 million years ago we discovered fire and could warm ourselves around it. We learned that if we put openings in our shelter, we could ventilate the shelter and move our fires to the indoors. The openings could then serve as ventilation, exhausting the smoke from our fires or bringing in cool fresh air.

Around 800 A.D. crude fireplaces and stoves started to be evidenced, and by the 13th century most of our European neighbors had stoves. Castles could be found with fireplaces and crude chimneys. Records of City Hall in Luneberg, Germany in the 1200s indicate a central warm-air system using three furnaces. History reveals in the 1600s a circulating fireplace and in the 1700s combustion air through a duct. The Industrial Revolution began the catalyst for more advanced heating systems.

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A Guide for Those Responsible for Indoor Environments

We became accustomed to our heated shelters and progressed closer to the INDOOR GENERATION

"In June of 1752, Benjamin Franklin attached a metal key to the bottom of a dampened kite string and flown the kite in a storm-threatened sky. A succession of sparks jumping from the key to the back of his hand showed that lightening was indeed electrical in nature. While the early 19th century had seen rapid progress in electrical science, the late 19th century would see the greatest progress in electrical engineering, turning electricity from a scientific curiosity into an essential tool for modern life. (Wikipedia.org/wiki/Electricity)

Incandescent light bulbs were successfully invented by Joseph Swan in 1878 in Britain and by Thomas Edison in 1879 in the U.S. Swan's house was the world's first to have working light bulbs installed. Thomas Edison began commercial production of the carbon filament bulbs in the U.S. in 1880, making it possible for us to bring electricity and lighting to our homes.

We cherished the ability to light our shelters, allowing us to advance further to becoming an INDOOR GENERATION.

The public baths of Greeks, Roman, Persian, Indian, and Chinese cities are evidence of our first plumbing systems, providing potable water and wastewater removal. In 2700 B.C., the urban settlements of the Indus Valley Civilization developed earthen plumbing pipes with broad flanges making use of asphalt for preventing leakages. The Roman Empire used the word "plumber", developing lead pipes to control rainwater on roofs and other drain systems. From there they expanded into expansive systems of aqueducts, tile wastewater removal, and widespread use of lead pipes. With the fall of the Roman Empire, plumbing virtually disappeared until the 1800s. As epidemics of disease rose through their society, plumbing was developed in densely populated areas to dispose of the waste causing the diseases. Galvanized iron piping and plumbing systems became commonplace in the U.S. in the late 1800s.

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One more convenience added to our shelter and promoting us to an INDOOR GENERATION.

The basic needs of life that took us outdoors were all being met in our indoor shelters. ***WE BECAME THE INDOOR GENERATION.*** Today we spend up to 90% of our day INDOORS. We sleep six to eight hours in our bedroom, rise to a heated breakfast in our kitchen, then jump in our car or grab a bus (yes, that is an indoor environment) to head off to work or school for another eight hours. Jump back into our car or the bus to head back home. We may play catch with our children or dog, but then head back into the comfort of our shelter. We eat our meal that was cooked on a stove, watch some television, read a good book under an electrified light, play a game of cards in a warm, lighted dining room. Then we head to the comfort of our bedroom for another six to eight hours of sleep.

TWO CHALLENGES. TWO ANSWERS

Challenge #1: We made our buildings tight so that energy could be conserved, but now we find ourselves trapped in our buildings with natural and man-made contaminants.

Challenge #2: The benefits of the outdoors now elude us.

ANSWER #1: GAIN AN UNDERSTANDINGN OF OUR INDOOR ENVIRONMENT & SHARE IT

Our scientists, health professionals, indoor environmentalists, architects, engineers, maintenance professionals, and property owners are just beginning to understand the connection between how buildings work and the impact their indoor environments have on human health. As we learn more, we need to share it. As a group, we need to make a commitment to share our knowledge so we can create a healthier humanity. This would include:

- Educating professionals responsible for the occupants of indoor environments on the connection between indoor environmental health and human health.
- Developing trained professionals that can assess and diagnose when a building is performing poorly and is likely to cause health issues for its occupants.
- Educating health care provides on the connection between indoor environmental health and human health.
- Educating contractors, property managers, facilities managers, real estate agents, and home improvement professions on implementing safe work practices in buildings, in their project designs, in building operations and maintenance and in building renovations.

The last chapter of this book will provide as a tool to help us meet this challenge and fulfill ANSWER #1.

ANSWER #2: GET OUTDOORS

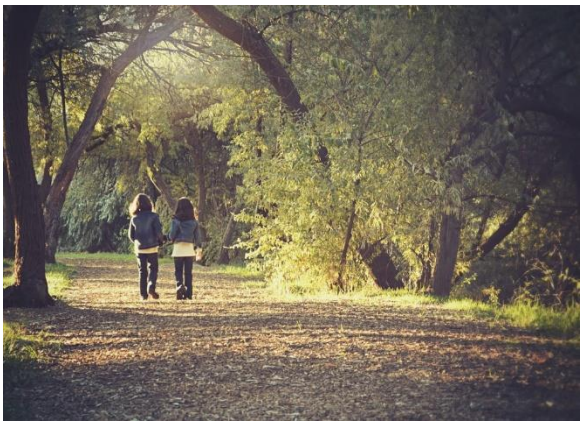
An essential component of a healthier life is to **GET OUTDOORS**! Spending time outdoors has discernible benefits for physical and mental health. Psychologically, indoor living is associated with being sedentary, while outdoor time is associated with activity. For instance, think about children … imagine what they are doing when they are indoors? Imagine what are they doing when they are outdoors? My imagination created an image of children playing video games vs. children playing on playground equipment.

The benefits to getting outdoors seems to be a natural prescription to improve physical, mental, and emotional well-being. If that "outdoor" time is spent in "nature," the benefits are amplified.
Elevates mood: Studies have shown that light tends to elevate people's mood, and there is usually more light outside. Also,

physical activity has shown to elevate mood and being outside has shown to increase physical activity.

Improves concentration: Studies have shown that spending time outdoors is linked to higher levels of concentration. Studies have also shown an increase in creativity and mental clarity.

Increases happiness: Science supports it! Spending time outside makes us happier! Studies have shown that moods take a positive shift when we spend time outside.



Improves memory: Research from the University of Michigan found that spending time outside improves memory. One such project had a group walk through nature and a group walk through the city. Immediately after their walks, the groups took a memory test. Results showed a 20% better performance by the nature walkers. So, when carving time out for being outdoors, try to make it a trip to nature.

Another study on persons suffering from depression found that walks in nature boosted memory more than city walks.

Relieves stress: Studies have shown that heart rate is lowered, blood pressure is lowered, and stress hormones are lowered after spending time outside. Research has also shown that the natural scents found in nature make us feel calmer and more relaxed. Further research with office workers who take breaks in nature found higher productivity rates and higher job satisfaction.

Boosts energy: One study suggests that spending 20 minutes outside gives your brain an energy boost. Another study performed by the University of Rochester indicated that people experienced a burst of energy when participating in outdoor activities.

Strengthens immune system: Vitamin D helps regulate the immune system and is essential for a well-functioning body. So being outside and soaking up some sun, even it is for 15 minutes, can increase our bodies ability to create Vitamin D in our systems.

One study showed that adults who hike two times a day for three days a week increased their white blood cell counts by 40%. White bloods cells also strengthen our immune system. Researchers believe that breathing airborne chemicals produced by plants also increases white blood cells.

Reduces inflammation: A 2012 study found that inflammation was significantly lower in candidates who walked through a forest than those who stayed indoors or walked in a city. Nature seems to reduce pain.

Vitamin D helps with reducing inflammation as well. 90% of our Vitamin D is created from casual exposure to sunlight. In another study, patients recovering from surgery who were exposed to high-intensity sunlight. They then took less pain medication than those who were not.

Improves vision: One study showed that elementary school students who spent time outdoors were less likely to develop nearsightedness.

Lowers overall risk of early death: Common sense tells us that if we improve all the above, we also reduce the risk of an early death. Studies have found that people who live close to or spend a lot of time in nature tend to live longer lives.

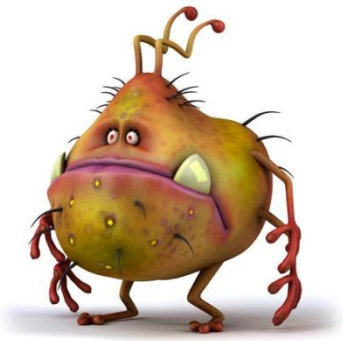
Our society has become an Indoor Generation. However, if we keep our indoor environments healthy and we spend some quality time outside, being an Indoor Generation is not a bad thing!

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

Chapter Twelve
Implementing an IEQ PRogram

Published December 2019



- **INTRODUCTION**
- **REACTIVE vs. PROACTIVE**
- **INTRODUCTION TO PLAN**
- **DEVELOP THE PLAN**
- **AUDIT THE PLAN**

INTRODUCTION

What are the CRISES that can occur without an IEQ Preventative Maintenance Plan

What are the crises that can sneak up on those responsible for the indoor health of occupants when no preventative maintenance plan is in place? Water intrusions, indoor air pollution, deteriorated asbestos, problems with drinking water, lead-dust contamination in doorways and windows, mold contaminations, HVAC ducts with mold or particulate contamination, elevated humidity levels leading to indoor air pollution or mold growth. Not all crises can be avoided. However, with an Indoor Environmental Preventative Maintenance Plan many can.

In the following articles, the authorities responsible for these indoor environments and the occupants could have avoided these crises if an Indoor Environmental Preventative Maintenance Plan with standard routines and protocols had been implemented.

Map: 100 Pa. schools found lead in their drinking water. Here's how they responded.
Pennsylvania Capital Star
By Elizabeth Hardison
January 12, 2020

Public health experts all agree that there's no such thing as a safe level of lead exposure for children.

But new state data show that thousands of children across Pennsylvania have likely been exposed to the toxic metal in their school drinking water.

Water at more than 100 buildings in 32 school systems across Pennsylvania had unsafe levels of lead in the 2018-2019 school year, according to a list the Pennsylvania Department of Education published in late November.

From center city Philadelphia to rural Jefferson County, the test results forced school officials to replace plumbing fixtures, disable drinking fountains, and distribute bottled water to protect students and staff from contamination, according to reports they submitted to the state.

See the full article

"It Smelled Like Death": Reports of Mold Contamination in Prisons and Jails

Prison Legal News
By Panagioti Tsolkas
April 2, 2019

"There was big, dark, gray, blackish mildew around the air vent and that's where the air was coming from … it smelled like death." – Candie Hailey, Rikers Island pre-trial detainee

Over the past several years, Prison Legal News has focused attention on environmental health impacts that prisoners face, including from extreme heat, hurricanes and other natural disasters, and contaminated water. [See, e.g.: PLN,July 2018, p.1;May 2018, p.1; April 2018, p.1]. Exposure to mold infestations is another environmental concern for prisoners.

The chronic presence of mold is frequently a component of what is referred to as Tight Building Syndrome or Sick Building Syndrome – terms that have been coined to describe a relatively new occupational health and safety problem for people who work or spend excessive amounts of time indoors. This is not a new phenomenon; it has been a source of concern for governmental entities such as the Environmental Protection Agency (EPA) and the subject of numerous class-action lawsuits over several decades.

According to the EPA, mold is one of the most common biological contaminants responsible for Sick Building Syndrome (SBS) or Building Related Illness (BRI), both caused in part by "contaminants that may breed in stagnant water accumulated in ducts, humidifiers and drain pans, or where water has collected on ceiling tiles, carpeting, or insulation."

The EPA released a fact sheet as early as 1991 describing SBS as a way to "describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified," and BRI as a term for "when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants."

For those who are serving time in prison or jail, this is sadly familiar.

During much of her three years awaiting trial at the Rikers Island jail complex in New York City, Candie Hailey explained to an Intercept reporter that she was locked in a cell ventilated by a mold-covered air duct. The vent was supposed to pump fresh air into her 6-by-10 foot concrete room, but instead the mold made her life unbearable.

She said a guard even begged her to complain to authorities about the mold problem – as the guard feared she would be punished if she did so herself. Similar situations can be found in dozens of prisons, jails and detention facilities at any given time.

Despite widespread incidents of dangerous mold exposure, there is still confusion about specific health risks associated with mold. For example, there are over 100,000 mold species. While it's extremely difficult to tell what type of mold is present without testing by a certified professional, some species commonly known as "black mold" are Stachybotrys chartarum (aka S. atra) and S.chlorohalonata. These are greenish-black molds that grow on material with a high cellulose and low nitrogen content, such as fiberboard, gypsum board, paper, dust and lint, and are known to release mycotoxins.

See the full article

More tenants affected by asbestos contamination at southeast Colorado Springs apartment complexes
THE GAZETTE
By Jakob Rodgers
December 6, 2019

Roy Griego rips carpet out of a closed building at the Pine Creek Village apartments in Colorado Springs, Thursday, Dec. 27, 2018. (Photo by Kelsey Brunner/The Gazette)

Residents at the Thrive at The Incline, formerly known as the Shannon Glenn Apartments, were informed last night that they have to be out of their apartments by Dec. 14 because of issues with asbestos. The complex gave a packet of information to the residents with suggestions of other complexes. Lauren Mors is not sure what she and her roommate will be doing. Her roommate's husband is deployed and will be home Dec. 18. They were going to get a Christmas tree today, but had to postpone.The hope for a long-sought revival of southeast Colorado Springs, including renovations of some of the city's most notorious apartment complexes, has turned into a nightmare for a slew of tenants who've been ordered out of their homes because of asbestos contamination.

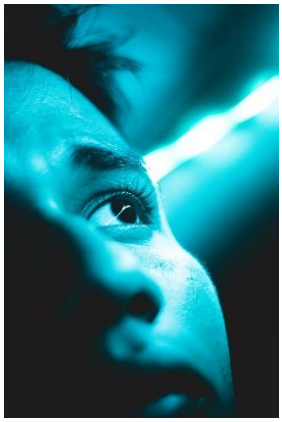
The scope of the asbestos contamination at properties owned by Denver-based Slipstream Properties broadened Friday with the revelation that a second apartment complex was cleared around Thanksgiving and several others in the city are under scrutiny by state regulators, according to the Colorado Department of Public Health and Environment.

See the full article

REACTIVE vs. PROACTIVE

Definition of REACTIVE:

- Showing a response to stimulus, like pupils are reactive to light.
- Acting in response to a situation rather than creating or controlling it.



Definition of PROACTIVE:

- Creating or controlling a situation by causing something to happen rather than responding to it after it has happened.

Definition of PREVENTATIVE:

- Designed to keep something undesirable such as illness, harm, or accidents from occurring.

Human beings love being in control. Except when it requires work upfront. In the field of building science and indoor environmental sustainability, it has been proven over and over again that being preventive in nature and proactive in behavior leads to less disruption in our lives, more productivity, and less expense.

Take fires for example, preventing fires costs money. There are protocols and equipment that need to be put in place.

However, when a fire does take place, the cost of chaos and loss are expensive and far outweigh the cost of preventative measures.

The same rings true for indoor preventative maintenance. There is cost upfront – of time, money, and effort. However, the building community experiences less disruption and expense. And, because the disruption is avoided, there is more productivity. And there is added value of both peace of mind and goodwill. With an Indoor Environmental Preventative Maintenance Plan (which we will call PLAN) in place, the community will recognize that the health of the environment and therefore their own health is valued.

By implementing a PLAN unexpected and unbudgeted failures and repairs of building components and equipment that lead to increased facility operations and maintenance costs, expensive and urgent emergency repairs and premature failure of equipment are avoided. Indoor environments impact the health, comfort, learning, productivity, performance and achievement of the community. The PLAN protects the community.

INTRODUCTION TO THE PLAN

A well-designed, customized Indoor Environmental Preventative Maintenance Plan will enhance the environment for all those involved in the day-to-day operations of the buildings and provide a healthy environment for its occupants. By customizing the PLAN, it can meet the specific needs of the building, its owner, and its occupants.

Regular indoor environmental assessments of the property, the building components, building systems and building equipment, followed by strategic maintenance will reduce the number of emergency situations and the costly expenses associated with them. In most cases, it will also extend the life of the building components, systems and equipment.

The PLAN will include the proper communications and procedures for handling concerns and emergencies which provides peace of mind for those responsible for indoor environments and for the building community. The longer the PLAN is in place the more the owner and the community will experience comfort, efficiency, and reliability of the building and its systems.

The benefits of a PLAN are enormous:

- Fewer emergency repairs.
- Fewer equipment breakdowns.
- Fewer indoor air quality complaints.
- Reduction in operating costs.
- Reduction in energy expense.
- Reduction in investigation or inspection costs.
- Less disruption in day-to-day operations.
- Minor problems are identified prior to becoming major problems.
- Provides a continuous healthy environment for occupants, which increases comfort and productivity.
- Provides peace of mind and goodwill between the building community and the building management.

Implementing a PLAN that promotes a healthy environment is a process. Patience and tenacity will need to be employed. However, if the implementation is organized and communication is consistent, the community will recognize its purpose and value.

DEVELOP THE PLAN

The steps involved will depend on the size of your property, number of buildings, and the numbers of people impacted by the PLAN. Customize the development and implementation of the PLAN to meet the needs of the building operations.

Breathe Healthy

A Guide for Those Responsible for Indoor Environments

Step 1

Identify the TEAM that will establish and maintain the PLAN. TEAM members could include facilities personnel, maintenance personnel, environmental personnel, HVAC technicians, housekeeping and custodial personnel currently on staff. However, including individuals from the building community, tenants and other occupants, can be an asset to the development and implementation of the PLAN.

STEP 2

Establish a TEAM Coordinator. This individual should be someone that embraces the PLAN fully and who will encourage a sense of shared responsibility and a cooperative effort between the TEAM, those responsible for the implementation of the PLAN and the building community. The TEAM Coordinator does not need to be an expert in the field of facilities management, but they should have leadership and organizational ability. They should also be given the authority to make decisions and implement action within the structure of the PLAN.

STEP 3:

Review the remaining steps listed here, then assign responsibilities. These responsibilities could be assigned to individual TEAM members or to committees, depending on the size of the facilities and building community.

STEP 4

Develop a layout of the entire property and blueprints of each building. Assign names to each building, area, or unit of the property so that when the TEAM is discussing the PLAN there is a clear understanding.

STEP 5

Create a binder for each building or unit. The binder would include building history, any inspections or testing that have been performed for asbestos, radon, lead-based paint, pest management, and the like. It should include the identification of any pollutants or potential pollutants, such as Polychlorinated biphenyls (PCBs). It should indicate chemical storage areas. Notes should be included in the binder as to where the SDS (Safety Data Sheets) records related to the Hazard Communication Standard are kept for compliance with OSHA (Occupational Safety and Health Administration). If it is found to be beneficial, it could also include an inventory of equipment and their history of maintenance and repairs. If such records are not kept in these binders, then there should be an indication of where these records can be found when needed. These binders can be used by the TEAM and maintenance personnel as a resource in the future.

STEP 6

Develop Standard Operation Procedures (SOPs) to track new information that will be added to the binders to ensure consistency in data reporting. This includes the integration of current work orders or the development of work orders that can be used when new issues arise. Determine how emergency notifications will be handled. Who will get the notices, how should they be communicated, and who will be responsible for addressing them.

STEP 7

Determine any training that the TEAM members or facilities personnel will need as relates to the implementation of the PLAN.

STEP 8

Develop a communication strategy. It is crucial that the TEAM, building owners, administration, occupants, and the building community are familiar with the PLAN. Everyone will be involved in some way and their support is essential to the success of this program.

Step back and consider all those that will be involved or impacted by the plan and what their current status or role is in the building community. Develop the best strategy to communicate the inception and implementation of the PLAN. Be strategic in when, where and how to relate the PLAN to the building community to enhance buy-in.

Consider information being disseminated through memos, newsletters, staff meetings, briefings, employee orientations and training sessions, on the community website or through social media. Consider placing acknowledgements, reviews and the progress of the PLAN on relevant administration staff agendas.

Create a channel where feedback can be easily communicated to the TEAM. Great feedback will include ideas that the TEAM may not have originally considered and will reveal where future communication is needed to create peace of mind.

STEP 9

Create a baseline for each building. Customize the Healthy Building Tool Kit furnished in Chapter 5 entitled HEALTHY BUILDINGS TOOLKIT and perform an assessment of each building. By performing this assessment your team will be familiar with the property's current status and issues. All needed repairs and cleanliness issues will be identified. The source of potential indoor environmental pollutants will be identified: dirty HVAC filters, odors, improperly stored chemicals, dampness, evidence of water intrusions, and visible mold.

Currently there may be processes, routines, and habits that need changed to enhance and protect the environment. These processes, routines and habits can be identified and documented during this process. Things such as the handling of pets and animals or food storage. Routines may be identified that need to change how occupants keep their areas clean or that exhaust fans need to be run for longer durations after showering. Now is a good time to make notes on any adjustments that could improve the indoor environment.

STEP 10
Using the work order system developed in STEP 6, create a work order for each current issue identified. Then prioritize the issues depending on the degree of hazard or impact on the building and its community.

Establish goals or deadlines for addressing and resolving each issue.

List changes in current routines or habits of building personnel or occupants that may need to be implemented to keep the environment safe and determine how these changes will be addressed and communicated.

STEP 11
Layout a timeline.

The timeline would include when the Healthy Building Toolkit should be revisited. The best strategy would be to revisit the assessment process in the Fall and the Spring of each year, but this may not be practical for all TEAMs.

Place the deadlines for addressing issues in the timeline.

Determine how often the TEAM should meet to gauge the progress of the PLAN and how new concerns will be placed in the timeline.

The timeline should include any current or future renovation or new construction projects so that proper plans can be made to isolate the areas during the projects.

Any long-term Indoor Air Quality improvements should also be placed in the timeline.

Establish Indoor Air Quality issues that need weekly, monthly, or random inspections, such as areas that tend to get damp and grow mold.

STEP 12
Determine what funding will be necessary. Staff to perform the inspections and funds to perform any maintenance identified.

Although there will be upfront costs for establishing the PLAN, the long-term savings will be attained. Great example: The inspection of one building may

take one or two days. But, if a water intrusion goes undetected, the cost of a mold remediation project can break the bank.

STEP 13
Manage the PLAN. Through regular meetings and good communication, the PLAN can progress throughout the year with adjustments being made as needed. PLAN management will include regular progress meetings, budget reporting, documentation, and keeping all relevant parties involved and up-to-date. It may also include adjustments that are found to be needed, such as changes in roles or the incorporation of new local or state regulations.

AUDIT THE PLAN

Consider an audit of the PLAN, by the TEAM, by the community and/or by an outside authority. What's working? What's not working? What enhancements can be made to improve the system? Assess the performance of the TEAM.

Then communicate, communicate, communicate. Build peace of mind and goodwill within the TEAM and the building community by sharing the PLAN's success, the current status of the indoor environment's health, and future plans for buildings' improvement and indoor air quality enhancement. Use the communication to continue to educate the community on the direct link between indoor environmental health and human health. Let the community see the value in the PLAN and its impact on the lives of those in the community.

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U.S. Department of Housing and Urban Development (HUD) Office of Healthy Homes and Lead Hazard Control Washington, DC 20410
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