

5.1 SOURCES, TYPES AND CONTROL OF INDOOR AIR POLLUTANTS

According to EPA, scientific evidence has indicated that the air within homes and other buildings can be more seriously polluted than the outdoor air in even the largest and most industrialized cities. Other research indicates that people spend approximately 90 percent of their time indoors. Thus, for many people, the risks to health may be greater due to exposure to air pollution indoors than outdoors.

Effects may show up after a single exposure or repeated exposures. These include irritation of the eyes, nose and throat, headaches, dizziness, and fatigue. Such immediate effects are usually short-term and treatable. Sometimes the treatment is simply eliminating the person's exposure to the source of the pollution, if it can be identified.

- Other health effects may show up either years after exposure has occurred or only after long or repeated periods of exposure.
- These effects, which include some respiratory diseases, heart disease and cancer, can be severely debilitating or fatal.
- It is important to try to improve the indoor air quality in your home even if symptoms are not noticeable.

1. Asbestos

Asbestos is a mineral fiber that occurs in rock and soil. Because of its fiber strength and heat resistance it has been used in a variety of building construction materials for insulation and as a fire-retardant. Asbestos has been used in a wide range of manufactured goods, mostly in:

- Building materials
 - ✚ Roofing shingles
 - ✚ Ceiling and floor tiles
 - ✚ Paper products
 - ✚ Asbestos cement products
- Friction products

- ✚ Automobile clutch
- ✚ Automobile brake
- ✚ Transmission parts

- Heat-resistant fabrics
- Packaging
- Gaskets
- Coatings

Elevated concentrations of airborne asbestos can occur after asbestos-containing materials are disturbed by cutting, sanding or other remodeling activities. Improper attempts to remove these materials can release asbestos fibers into the air in homes, increasing asbestos levels and endangering people living in those homes.

2. Biological contaminants

- Some biological contaminants trigger allergic reactions, including:
 - Hypersensitivity Pneumonitis
 - Allergic rhinitis
 - Some types of asthma
- Infectious illnesses, such as influenza, measles and chicken pox are transmitted through the air. Molds and mildews release disease-causing toxins.
- Symptoms of health problems caused by biological pollutants include:
 - Sneezing
 - Watery eyes
 - Coughing
 - Shortness of breath
 - Dizziness
 - Lethargy
 - Fever
 - Digestive problems

Allergic reactions occur only after repeated exposure to a specific biological allergen. However, that reaction may occur immediately upon re-exposure or after

multiple exposures over time. As a result, people who have noticed only mild allergic reactions, or no reactions at all, may suddenly find themselves very sensitive to particular allergens.

Some diseases, like humidifier fever, are associated with exposure to toxins from microorganisms that can grow in large building ventilation systems. However, these diseases can also be traced to microorganisms that grow in home heating and cooling systems and humidifiers.

Children, elderly people and people with breathing problems, allergies, and lung diseases are particularly susceptible to disease-causing biological agents in the indoor air.

Mold, dust mites, pet dander and pest droppings or body parts can trigger asthma. Biological contaminants, including molds and pollens can cause allergic reactions for a significant portion of the population. Tuberculosis, measles, staphylococcus infections, Legionella and influenza are known to be transmitted by air.

Reducing Exposure to Biological Contaminants:

General good housekeeping, and maintenance of heating and air conditioning equipment, are very important. Adequate ventilation and good air distribution also help. The key to mold control is moisture control. If mold is a problem, clean up the mold and get rid of excess water or moisture. Maintaining the relative humidity between 30% - 60% will help control mold, dust mites and cockroaches. Employ integrated pest management to control insect and animal allergens. Cooling tower treatment procedures exist to reduce levels of Legionella and other organisms.

- **Install and use exhaust fans that are vented to the outdoors in kitchens and bathrooms and vent clothes dryers out doors.**

These actions can eliminate much of the moisture that builds up from everyday activities. There are exhaust fans on the market that produce little noise, an important consideration for some people. Another benefit to using kitchen and bathroom exhaust fans is that they can reduce levels of organic pollutants that vaporize from hot water used in showers and dishwashers.

➤ **Ventilate the attic and crawl spaces to prevent moisture build-up.**

Keeping humidity levels in these areas below 50 percent can prevent water condensation on building materials.

➤ **If using cool mist or ultrasonic humidifiers, clean appliances according to manufacturer's instructions and refill with fresh water daily.**

Because these humidifiers can become breeding grounds for biological contaminants, they have the potential for causing diseases such as hypersensitivity pneumonitis and humidifier fever. Evaporation trays in air conditioners, dehumidifiers and refrigerators should also be cleaned frequently.

➤ **Thoroughly clean and dry water-damaged carpets and building materials (within 24 hours if possible) or consider removal and replacement.**

Water-damaged carpets and building materials can harbor mold and bacteria. It is very difficult to completely rid such materials of biological contaminants.

➤ **Keep the house clean. House dust mites, pollens, animal dander and other allergy-causing agents can be reduced, although not eliminated, through regular cleaning.**

People who are allergic to these pollutants should use allergen-proof mattress encasements, wash bedding in hot (130° F) water and avoid room furnishings that accumulate dust, especially if they cannot be washed in hot water. Allergic individuals should also leave the house while it is being vacuumed because vacuuming can actually increase airborne levels of mite allergens and other biological contaminants. Using central vacuum systems that are vented to the outdoors or vacuums with high efficiency filters may also be of help.

➤ **Take steps to minimize biological pollutants in basements.**

Clean and disinfect the basement floor drain regularly. Do not finish a basement below ground level unless all water leaks are patched and outdoor ventilation and adequate heat to prevent condensation are provided. Operate a dehumidifier in the basement if needed to keep relative humidity levels between 30 - 50 percent.

3. Carbon Monoxide

Sources of CO include:

- + Unvented kerosene and gas space heaters
- + Leaking chimneys and furnaces
- + Back-drafting from furnaces, gas water heaters, wood stoves and fireplaces
- + Gas stoves
- + Generators and other gasoline powered equipment
- + Automobile exhaust from attached garages
- + Tobacco smoke
- + Auto, truck, or bus exhaust from attached garages, nearby roads, or parking areas
- + Incomplete oxidation during combustion in gas ranges, and unvented gas or kerosene heaters
- + Worn or poorly adjusted and maintained combustion devices (e.g., boilers, furnaces)
- + If the flue is improperly sized, blocked or disconnected
- + If the flue is leaking

Health Effects Associated with Carbon Monoxide :

- At low concentrations:
 - + Fatigue in healthy people
 - + Chest pain in people with heart disease
- At moderate concentrations:
 - + Angina
 - + Impaired vision
 - + Reduced brain function
- At higher concentrations:
 - + Impaired vision and coordination
 - + Headaches
 - + Dizziness

- ✚ Confusion
- ✚ Nausea
- ✚ Flu-like symptoms that clear up after leaving home
- ✚ Fatal at very high concentrations

Acute effects are due to the formation of carboxyhemoglobin in the blood, which inhibits oxygen intake.

At low concentrations, fatigue in healthy people and chest pain in people with heart disease. At higher concentrations, impaired vision and coordination; headaches; dizziness; confusion; nausea. Can cause flu-like symptoms that clear up after leaving home. Fatal at very high concentrations. Acute effects are due to the formation of carboxyhemoglobin in the blood, which inhibits oxygen intake. At moderate concentrations, angina, impaired vision, and reduced brain function may result. At higher concentrations, CO exposure can be fatal.

Steps to Reduce Exposure to Carbon Monoxide

It is most important to be sure combustion equipment is maintained and properly adjusted. Vehicular use should be carefully managed adjacent to buildings and in vocational programs. Additional ventilation can be used as a temporary measure when high levels of CO are expected for short periods of time.

- ✚ Keep gas appliances properly adjusted.
- ✚ Consider purchasing a vented space heater when replacing an unvented one.
- ✚ Use proper fuel in kerosene space heaters.
- ✚ Install and use an exhaust fan vented to outdoors over gas stoves.
- ✚ Open flues when fireplaces are in use.
- ✚ Choose properly sized wood stoves that are certified to meet EPA emission standards. Make certain that doors on all wood stoves fit tightly.
- ✚ Have a trained professional inspect, clean and tune-up central heating system (furnaces, flues and chimneys) annually.
- ✚ Repair any leaks promptly.

- ✚ Do not idle the car inside garage.

4. Lead

Lead has long been recognized as a harmful environmental pollutant. Lead is particularly dangerous to children because their growing bodies absorb more lead than adults do and their brains and nervous systems are more sensitive to the damaging effects of lead. Babies and young children can also be more highly exposed to lead because they often put their hands and other objects that can have lead from dust or soil on them into their mouths. Children may also be exposed to lead by eating and drinking food or water containing lead or from dishes or glasses that contain lead, inhaling lead dust from lead-based paint or lead-contaminated soil or from playing with toys with lead paint. Before it was known how harmful lead could be, it was used in paint, gasoline, water pipes, and many other products.

Old lead-based paint is the most significant source of lead exposure in the U.S. today. Harmful exposures to lead can be created when lead-based paint is improperly removed from surfaces by dry scraping, sanding, or open-flame burning. High concentrations of airborne lead particles in homes can also result from lead dust from outdoor sources, including contaminated soil tracked inside, and use of lead in certain indoor activities such as soldering and stained-glass making.

5. Nitrogen Dioxide:

Sources of Nitrogen Dioxide

- The primary sources indoors are combustion processes, such as:
 - ✚ Unvented combustion appliances, e.g. gas stoves
 - ✚ Vented appliances with defective installations
 - ✚ Welding
 - ✚ Tobacco smoke
 - ✚ Kerosene heaters.

Health Effects Associated with Nitrogen Dioxide :

- NO₂ acts mainly as an irritant affecting the mucosa of the eyes, nose, throat and respiratory tract.
- Extremely high-dose exposure (as in a building fire) to NO₂ may result in pulmonary edema and diffuse lung injury.
- Continued exposure to high NO₂ levels can contribute to the development of acute or chronic bronchitis.
- Low level NO₂ exposure may cause:
 - ✚ Increased bronchial reactivity in some asthmatics
 - ✚ Decreased lung function in patients with chronic obstructive pulmonary disease
 - ✚ Increased risk of respiratory infections, especially in young children

Steps to Reduce Exposure :

- ✚ Venting the NO₂ sources to the outdoors, and assuring that combustion appliances are correctly installed, used and maintained are the most effective measures to reduce exposures.
- ✚ (These are the same steps as those used to reduce exposure to carbon monoxide).
- ✚ Keep gas appliances properly adjusted.
- ✚ Consider purchasing a vented space heater when replacing an un-vented one.
- ✚ Use proper fuel in kerosene space heaters.
- ✚ Install and use an exhaust fan vented to outdoors over gas stoves.
- ✚ Open flues when fireplaces are in use.
- ✚ Choose properly sized wood stoves that are certified to meet EPA emission standards. Make certain that doors on all wood stoves fit tightly.
- ✚ Have a trained professional inspect, clean and tune-up central heating system (furnaces, flues and chimneys) annually. Repair any leaks promptly.

✚ Do not idle the car inside garage.

6. Pesticides

Pesticides are chemicals that are used to kill or control pests which include bacteria, fungi and other organisms, in addition to insects and rodents. Pesticides are inherently toxic.

According to a recent survey, 75 percent of U.S. households used at least one pesticide product indoors during the past year. Products used most often are insecticides and disinfectants. Another study suggests that 80 percent of most people's exposure to pesticides occurs indoors and that measurable levels of up to a dozen pesticides have been found in the air inside homes.

The amount of pesticides found in homes appears to be greater than can be explained by recent pesticide use in those households; other possible sources include:

- ❖ Contaminated soil or dust that floats or is tracked in from outside
- ❖ Stored pesticide containers
- ❖ Household surfaces that collect and then release the pesticides
- ❖ Pesticides used in and around the home include products to control:
 - ✚ Insects (insecticides)
 - ✚ Termites (termiticides)
 - ✚ Rodents (rodenticides)
 - ✚ Fungi (fungicides)
 - ✚ Microbes (disinfectants)

They are sold as sprays, liquids, sticks, powders, crystals, balls and foggers.

Sources of Pesticides :

- ✚ Products used to kill household pests (insecticides, termiticides and disinfectants)
- ✚ Products used on lawns and gardens that drift or are tracked inside the house
- ✚ Pesticides are classed as semi-volatile organic compounds and include a variety of chemicals in various forms.

Health Effects

- Exposure to pesticides may result in
 - ✚ Irritation to eye, nose and throat
 - ✚ Damage to central nervous system and kidney
 - ✚ Increased risk of cancer
- Symptoms may include
 - ✚ Headache
 - ✚ Dizziness
 - ✚ Muscular weakness
 - ✚ Nausea
- Chronic exposure to some pesticides can result in damage to the:
 - ✚ Liver
 - ✚ Kidneys
 - ✚ Endocrine and nervous systems

Both the active and inert ingredients in pesticides can be organic compounds; therefore, both could add to the levels of airborne organics inside homes. Both types of ingredients can cause the type of effects discussed in Household Chemicals/Products. However, as with other household products, there is insufficient understanding at present about what pesticide concentrations are necessary to produce these effects.

Exposure to high levels of cyclodiene pesticides, commonly associated with misapplication, has produced various symptoms, including:

- Headaches
- Dizziness
- Muscle twitching
- Weakness
- Tingling sensations
- Nausea

In addition, EPA is concerned that cyclodienes might cause long-term damage to the liver and the central nervous system, as well as an increased risk of cancer.

There is no further sale or commercial use permitted for the following cyclodiene or related pesticides: chlordane, aldrin, dieldrin and heptachlor. The only exception is the use of heptachlor by utility companies to control fire ants in underground cable boxes.

Steps to Reduce Exposure :

- Use strictly according to manufacturer's directions.
- Mix or dilute outdoors.
- Apply only in recommended quantities.
- Increase ventilation when using indoors. Take plants or pets outdoors when applying pesticides/flea and tick treatments.
- Use non-chemical methods of pest control where possible.
- If you use a pest control company, select it carefully.
- Do not store unneeded pesticides inside home; dispose of unwanted containers safely.
- Store clothes with moth repellents in separately ventilated areas, if possible.
- Keep indoor spaces clean, dry and well ventilated to avoid pest and odor problems.

(A)Ventilate the area well after pesticide use.

Mix or dilute pesticides outdoors or in a well-ventilated area and only in the amounts that will be immediately needed. If possible, take plants and pets outside when applying pesticides/flea and tick treatments.

(B)Use non-chemical methods of pest control when possible.

Since pesticides can be found far from the site of their original application, it is prudent to reduce the use of chemical pesticides outdoors as well as indoors. Depending on the site and pest to be controlled, one or more of the following steps can be effective:

- ❖ Use of biological pesticides, such as *Bacillus thuringiensis*, for the control of gypsy moths
- ❖ Selection of disease-resistant plants

❖ Frequent washing of indoor plants and pets

Termite damage can be reduced or prevented by making certain that wooden building materials do not come into direct contact with the soil and by storing firewood away from the home. By appropriately fertilizing, watering and aerating lawns, the need for chemical pesticide treatments of lawns can be dramatically reduced.

(C)If you decide to use a pest control company, choose one carefully.

Ask for an inspection of your home and get a written control program for evaluation before you sign a contract. The control program should list specific names of pests to be controlled and chemicals to be used; it should also reflect any of your safety concerns. Insist on a proven record of competence and customer satisfaction.

(D)Dispose of unwanted pesticides safely.

If you have unused or partially used pesticide containers you want to get rid of, dispose of them according to the directions on the label or on special household hazardous waste collection days. If there are no such collection days in your community, work with others to organize them.

(E)Keep exposure to moth repellents to a minimum.

One pesticide often found in the home is paradichlorobenzene, a commonly used active ingredient in moth repellents. This chemical is known to cause cancer in animals, but substantial scientific uncertainty exists over the effects, if any, of long-term human exposure to paradichlorobenzene. EPA requires that products containing paradichlorobenzene bear warnings such as "avoid breathing vapors" to warn users of potential short-term toxic effects. Where possible, paradichlorobenzene and items to be protected against moths, should be placed in trunks or other containers that can be stored in areas that are separately ventilated from the home, such as attics and detached garages. Paradichlorobenzene is also the key active ingredient in many air fresheners (in fact, some labels for moth repellents recommend that these same products be used as air fresheners or deodorants). Proper ventilation and basic household cleanliness will go a long way toward preventing unpleasant odors.

7. Particulate matter

Particulate matter (also referred to as PM or particle pollution) is a complex mixture of solid and/or liquid particles suspended in air. These particles can vary in size, shape and composition. EPA is especially concerned about particles that are 10 micrometers in diameter or smaller because these particles are inhalable. Once inhaled, particles can affect the heart and lungs and in some cases cause serious health effects. The human health effects of outdoor PM are well-established and are used to set health-based standards for outdoor air (National Ambient Air Quality Standards, NAAQS). PM is also found in all indoor environments. Indoor PM levels have the potential to exceed outdoor PM levels and the NAAQS. However, less is known about the specific impacts of indoor PM on health.

Health Effects of Inhalable Particles:

Exposure to inhalable particles can affect both your lungs and your heart. Many studies directly link the size of particles to their potential for causing health problems. Small particles (less than 10 micrometers in diameter) can get deep into your lungs, and some may even get into your bloodstream. People with heart or lung diseases such as coronary artery disease, congestive heart failure, and asthma or chronic obstructive pulmonary disease (COPD), children and older adults may be at greater risk from PM exposure. Scientific studies have linked PM exposure to a variety of health impacts, including:

- ❖ Eye, nose and throat irritation
- ❖ Aggravation of coronary and respiratory disease symptoms; and
- ❖ Premature death in people with heart or lung disease.

Indoor PM Sources :

PM found indoors will include particles of outdoor origin that migrate indoors and particles that originate from indoor sources. Indoor PM can be generated through cooking, combustion activities (including burning of candles, use of fireplaces, use of unvented space heaters or kerosene heaters, cigarette smoking) and some hobbies.

Indoor PM can also be of biological origin. For more information on major indoor combustion related sources see also:

- ❖ Stoves, Heaters, Fireplaces and Chimneys
- ❖ Environmental Tobacco Smoke

Steps to Reduce Exposure to Indoor PM :

- + Vent all fuel-fired combustion appliances to the outdoors (including stoves, heaters and furnaces)
- + Install and use exhaust fans vented to the outside when cooking
- + Avoid the use of unvented stoves, fireplaces or space heaters indoors. If you must use unvented appliances follow manufacturers' instructions especially related to ventilation..
- + Choose properly sized woodstoves, certified to meet EPA emission standards; make certain that doors on all woodstoves fit tightly.
- + Use appropriate wood in stoves and fireplaces. Check EPA's BurnWise program for Safe Wood-burning Practices
- + Have a trained professional inspect, clean and tune-up central heating system (furnace, flues and chimneys) annually. Repair any leaks properly.
- + Change filters on central heating and cooling systems and air cleaners according to manufacturer's directions.

8. Secondhand smoke

Secondhand smoke is a mixture of the smoke given off by the burning of tobacco products, such as cigarettes, cigars or pipes and the smoke exhaled by smokers. Secondhand smoke is also called environmental tobacco smoke (ETS). Exposure to secondhand smoke is sometimes called involuntary or passive smoking. Secondhand smoke, classified by EPA as a Group A carcinogen, contains more than 7,000 substances. Secondhand smoke exposure commonly occurs indoors, particularly in homes and cars. Secondhand smoke can move between rooms of a home and between apartment units. Opening a window or increasing ventilation in a home or car is not protective from secondhand smoke.

Health Effects of Secondhand Smoke:

The health effects of secondhand smoke on nonsmoking adults and children are harmful and numerous. Secondhand smoke causes cardiovascular disease (heart disease and stroke), lung cancer, sudden infant death syndrome, more frequent and severe asthma attacks, and other serious health problems. Several landmark health assessments regarding secondhand smoke have been conducted.

- ✚ Secondhand smoke poses particular health risks to children with asthma.
- ✚ Secondhand smoke is a universal asthma trigger and can elicit an asthma attack or make asthma symptoms more severe.
- ✚ Asthma is a chronic disease that affects the airways of the lungs and can lead to coughing, trouble breathing, wheezing and tightness in the chest.
- ✚ Asthma is the most common chronic childhood disease affecting, on average, 1 in 13 school aged children.
- ✚ Exposure to secondhand smoke may cause new cases of asthma in children who have not previously shown symptoms.
- ✚ More than half of US children with asthma are exposed to secondhand smoke (quinto, 2013).

Reduce Exposure to Secondhand Smoke:

Eliminating secondhand smoke in the indoor environment will reduce its harmful health effects, improve the indoor air quality and the comfort or health of occupants. Secondhand smoke exposure can be reduced through mandated or voluntary smoke-free policy implementation. Some workplaces and enclosed public spaces such as bars and restaurants are smoke-free by law. People can establish and enforce smoke-free rules in their own homes and cars. For multifamily housing, smoke-free policy implementation could be mandatory or voluntary, depending on the type of property and location (e.g., ownership and jurisdiction).

- The home is becoming the predominant location for the exposure of children and adults to secondhand smoke. (Surgeon General's Report, 2006)
- Households within buildings with smoke-free policies have lower PM_{2.5} compared to buildings without these policies. PM_{2.5} is a unit of measure for small particles in the air and is used as one indication of air quality. High levels of fine particles in the air can lead to negative health impacts. (Russo, 2014)
- Prohibiting smoking indoors is the only way to eliminate secondhand smoke from the indoor environment. Ventilation and filtration techniques can reduce, but not eliminate, secondhand smoke. (Bohoc, 2010)

9. Volatile organic compounds (VOCs)

Volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. VOCs are emitted by a wide array of products numbering in the thousands.

Organic chemicals are widely used as ingredients in household products. Paints, varnishes and wax all contain organic solvents, as do many cleaning, disinfecting, cosmetic, degreasing and hobby products. Fuels are made up of organic chemicals. All of these products can release organic compounds while you are using them, and, to some degree, when they are stored.

Sources of VOCs

Household products, including:

- ✚ Paints, paint strippers and other solvents
- ✚ Wood preservatives
- ✚ Aerosol sprays
- ✚ Cleansers and disinfectants
- ✚ Moth repellents and air fresheners
- ✚ Stored fuels and automotive products

- ✚ Hobby supplies
- ✚ Dry-cleaned clothing
- ✚ Pesticide

Other products, including:

- ✚ Building materials and furnishings
- ✚ Office equipment such as copiers and printers, correction fluids and carbonless copy paper
- ✚ Graphics and craft materials including glues and adhesives, permanent markers and photographic solutions.

Health Effects :

Health effects may include:

- Eye, nose and throat irritation
- Headaches
- Loss of coordination and nausea
- Damage to liver, kidney and central nervous system
- Some organics can cause cancer in animals
- Some are suspected or known to cause cancer in humans.

The ability of organic chemicals to cause health effects varies greatly from those that are highly toxic, to those with no known health effect.

As with other pollutants, the extent and nature of the health effect will depend on many factors including level of exposure and length of time exposed. Among the immediate symptoms that some people have experienced soon after exposure to some organics include:

- Eye and respiratory tract irritation
- Headaches
- Dizziness
- Visual disorders and memory impairment

Steps to Reduce Exposure

- Increase ventilation when using products that emit VOCs.
- Meet or exceed any label precautions.
- Do not store opened containers of unused paints and similar materials within the school.
- Formaldehyde, one of the best known VOCs, is one of the few indoor air pollutants that can be readily measured.
- Identify, and if possible, remove the source.
- If not possible to remove, reduce exposure by using a sealant on all exposed surfaces of paneling and other furnishings.
- Use integrated pest management techniques to reduce the need for pesticides.
- Use household products according to manufacturer's directions.
- Make sure you provide plenty of fresh air when using these products.
- Throw away unused or little-used containers safely; buy in quantities that you will use soon.
- Keep out of reach of children and pets.
- Never mix household care products unless directed on the label.

10. Wood Smoke

Smoke is made up of a complex mixture of gases and fine, microscopic particles produced when wood and other organic matter burn. The biggest health threat from wood smoke comes from fine particles (also called particulate matter). They are small enough to enter the lungs where they can cause bronchitis, pneumonia, asthma, or other serious respiratory diseases. Fine particles can also aggravate chronic heart and lung diseases, and are linked to premature deaths in people with these chronic conditions.

Many old, pot-bellied wood stoves are still functioning to provide warmth and a cooking fire in tribal communities; but they may also be releasing wood smoke that is harmful to the health of everyone exposed to it, especially the young and the old. To avoid these inevitable health risks and gain the greater efficiency and effectiveness of

new, cleaner burning technology wood stoves it is recommended that old stoves be gradually replaced or “changed out.”

Changing out wood stoves requires a financial investment; however, there are programs that provide financial assistance and manufacturers that provide discounts. The results of replacement speak for themselves with improvements in the health of children and community, home safety, visibility, and indoor air quality .

