Training Manual on Pediatric Environmental Health: Putting It Into Practice

Children's Environmental Health Network
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Air Pollution

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Although outdoor air quality in the United States has improved in recent decades, current levels of ambient air pollution continue to contribute to adverse health effects among the most susceptible members of society. In addition, increasing attention is being focused on toxicants in indoor air, which have been associated with increased morbidity and mortality. The purpose of this module is to review current information about hazards found in the air that children breathe. Several case studies and a series of discussion questions are included to assist instructors in teaching this important topic. Also included as an addendum to this module are recommendations that health care providers can discuss with parents to prevent or alleviate health problems.

Learning Objectives

After completing this module, faculty will be able to teach students and residents to:

- Identify sources of indoor and outdoor air pollution
- Identify symptoms associated with exposure to various airborne pollutants
- Recommend environmental interventions to reduce the health risk associated with a given exposure
- Use resources identified in this module to assist families in performing appropriate environmental remediation.

General Principles of Air Pollution

Introduction

Children are not little adults. This statement is particularly true when it comes to assessing the impact of environmental hazards on children's health. Children are experiencing rapid lung development and compared to adults, have different breathing zones, a greater respiration rate, and engage in more physical activity. These factors mean that children may be even more susceptible than adults to the adverse effects of airborne toxicants.

Whether children experience health problems from air pollution depends on predisposing health factors (such as asthma), the duration and intensity of the exposure, and the child's access to medical attention. Effects may be immediate or may surface years after exposure.

The following sections outline sources of the major components of outdoor and indoor air pollutants and the symptoms the pollutants may provoke. Case studies and recommendations are provided for inclusion into your curriculum; doing so will increase your students' awareness of hazards from everyday exposures to environmental toxins. Requiring students to present current case studies and literature reviews will reinforce the importance of examining the patient's environment and its effect on health and well-being.

Your students can refer to the "Recommendations for Parents" (included in the appendix) to explore prevention options with parents.

Outdoor Air

Sources of outdoor pollution include transportation, industry, electrical power generation, refuse disposal, and residential wood combustion, as well as natural sources such as wildfires. The major outdoor air pollutants are carbon monoxide, sulfur oxides, hydrocarbons, ozone, particulate matter, and nitrogen oxides. An extensive body of literature suggests that outdoor air pollution contributes to respiratory and cardiovascular mortality, increases in asthma exacerbations and respiratory symptoms, and eye and throat irritation. Exposure to other agents such as environmental tobacco smoke or allergens may exacerbate the effect of outdoor air pollution.

Among children, the health effects from exposure to outdoor air pollution are primarily respiratory. Chronic exposure has been associated with increased bronchitis and decreased pulmonary function in children. Other effects include the increases in school absenteeism and hospital admissions that coincide with acute episodes of air pollution as measured by increases in ozone (O_3), total suspended particles (TSP), sulfur dioxide (SO_2), sulfuric acid (H_2SO_4), fine particulate matter, and aerosol acidity (H^+).

It is important to note that adverse health effects have been found at levels below Environmental Protection Agency (EPA) air quality standards. The elderly and those with chronic pulmonary and cardiovascular disease appear to be at risk for increased mortality from short-term increases in outdoor air pollution. Children with asthma have been found to be a sensitive sub-population for acute responses to outdoor air pollution.

Ozone

Ozone (O_3), a gas with a pungent odor that is often smelled after electrical storms, is bluish in color at higher-than-ambient concentrations. There is much confusion over the difference between "good" ozone and "bad" ozone. "Good" ozone is the diffuse layer of ozone gas in the stratosphere, 10-25 miles above the earth that screens out the sun's most damaging ultraviolet rays. This ozone shield has been damaged by human activities, particularly by chlorofluorocarbons (CFCs), which have been used as refrigerants and aerosol propellants. "Bad" ozone is formed at ground level when reactive hydrocarbons are mixed with nitrogen oxides in the presence of sunlight. This type of ozone is formed only during the daylight hours and is the main photochemical oxidant in smog. April through

September are the months when ground-level ozone is a public health concern in most parts of the United States.

Exposure to ground-level ozone has been found to result in short-term symptoms such as cough, throat irritation, increased mucous production, chest discomfort, malaise and nausea, and headache. Exercise exacerbates the effects of ozone in susceptible individuals. Except in a few recent projects, chronic effects on lung function due to O_3 exposure have not been shown. However, studies have repeatedly demonstrated transient decreases in lung function due to O_3 exposure.

Sulfur Dioxide

Sulfur dioxide (SO_2) is a colorless, water-soluble gas. It is derived from the combustion of sulfur-containing fossil fuels such as brown coal and oil. Other sources include the smelting of sulfur-containing ores, volcanic eruptions, and the commercial drying of fruits. Ninety percent of SO_2 is absorbed in the upper respiratory tract, with only slight penetration in the lower respiratory tract. Numerous studies have shown that SO_2 exposure is associated with decreases in lung function and increases in hospitalization. This effect is independent from that of particulate air pollution.

Although SO_2 levels have decreased in major U.S. cities, SO_2 exposure is still of concern in children with asthma, who may be more susceptible to the bronchoconstrictive effects of SO_2.

Acid Aerosols

Acid rain occurs when SO_2 and oxides of nitrogen (NO_x) react with water, oxygen, sunlight, and oxidants in the atmosphere to form acidic aerosols. Acid manufacturing plants and fertilizer and pigment factories are primary sources of acid aerosols. These compounds are also formed when SO_2 or SO_3 come into contact with mucous membranes; excess hospital admissions for respiratory diseases and increases in asthma exacerbations have been associated with airborne sulfate (SO_3) levels.

Particulate Matter (PM)

There are a number of terms for particulate matter (PM): black smoke, TSP (total suspended particles), and PM_{10} (particulate matter with an aerodynamic diameter of less than 10 microns). Increasing attention is being paid to smaller “fine” particles ($PM_{2.5}$), which are deposited more deeply in the lung, and can potentially damage the lower airways and alveoli.

The primary sources of particulate matter are vehicular traffic (gasoline and diesel engines), power plants, industrial incinerators, volcanoes, road dust, dust storms, and residential wood combustion. Particulate matter has been associated with increases in the prevalence of chronic bronchitis, respiratory symptoms, and reductions in peak expiratory flow (PEF). Adverse health effects have been found in

time-series studies of daily counts of respiratory morbidity and mortality, primarily among persons with respiratory and cardiovascular conditions.

Oxides of Nitrogen (NO_x)

NO and NO_2 are formed during the burning of fossil fuels, particularly by motor vehicle engines. NO_2 contributes to the formation of ground-level ozone and may contribute significantly to indoor levels of this compound. In the presence of NO_2, bronchial mucosa may become more permeable to allergens, decreasing the threshold necessary for sensitization and increasing the incidence of allergic asthma. Increased airway responsiveness has been linked to exposure to high levels of ambient NO_2. In general, however, NO_2 is more of a concern as an indoor rather than outdoor pollutant, and will be further explored below.

Indoor Air

In contrast to outdoor air pollution, indoor air pollution has increased over the past half-century. Wall-to-wall carpeting came into vogue after World War II, increasing the reservoir of mold and dust mites in the home. The energy crisis of the 1970s led to an increased use of wood stoves for heating, while home construction methods to improve heating and cooling efficiency resulted in more tightly sealed buildings with reduced ventilation rates. Resulting higher humidity and temperatures have also contributed to elevated mold and dust mite allergen levels. The increase in synthetics and chemically formulated products for home furniture, cleaning, and personal care has compounded the problems of inadequate ventilation.

Combustion sources (wood stoves, fireplaces, kerosene heaters, gas cooking stoves, tobacco products), asbestos, water-damaged carpeting and furniture, and furniture made of pressed wood products are just a few of the sources of indoor air pollution. Remediation may require removal or control of the source, increased ventilation, and air cleaning devices.

The typical American spends 90% of his or her time indoors. Consequently, concerns have been raised that polluted air within homes and other buildings may pose serious health risks. Short-term effects include eye and throat irritation, headaches, dizziness, and fatigue. Symptoms may appear quickly, as in the case of asthma and humidifier fever, a condition with influenza-like symptoms caused by exposure to bioaerosols from contaminated humidifiers. Longer term effects, such as respiratory or heart disease, lung cancer, and even death, have also been documented. Effects may be most severe among those who spend the most time indoors—the young, the elderly, and those with chronic respiratory and cardiovascular conditions.

Carbon Monoxide (CO)

Carbon monoxide (CO)—"the silent killer"—is an odorless, tasteless, colorless gas produced during incomplete combustion. Sources commonly found in the home include kerosene heaters, auto exhaust, oil heaters, gas stoves, cigarettes, and wood stoves. Recreational sources of CO include ice-resurfacing machines used at ice skating rinks (i.e. Zambonies) and indoor truck and tractor events.

Carbon monoxide is one of the most common causes of poisoning death, with an average of 900 unintentional poisonings occurring each year in the United States. Fetuses, infants, the elderly, and people with anemia or a history of heart or respiratory disease are especially susceptible. Symptoms depend on the fraction of hemoglobin converted to carboxyhemoglobin, and range from headache to flu-like symptoms (dizziness, weakness, and vomiting), to deep coma with depressed or absent reflexes, to rapid death from respiratory arrest. Diagnosis can be confirmed by carboxyhemoglobin levels.

Nitrogen Dioxide

Nitrogen dioxide (NO_2), an orange to reddish-brown gas with a pungent odor, causes eye, nose, and throat irritation. Episodes of shortness of breath and even death have been reported at high exposures, especially among asthmatics and children. NO_2 has been associated with delayed-onset bronchiolitis obliterans, while cases of pulmonary edema have been reported among high school hockey players exposed to high levels of NO_2 from ice resurfacing machine (Zamboni) emissions. Some studies have reported that high levels of NO_2 in homes were associated with increased respiratory symptoms and decreased pulmonary function. There is some suggestion that NO_2 enhances airway responses to inhaled allergens in people with asthma. Gas stoves - particularly stoves that are not vented to the outdoors or those with pilot lights - are the primary indoor source of NO_2. Kerosene and gas space heaters also contribute to indoor levels of NO_2 and should not be used without proper ventilation.

Environmental Tobacco Smoke (ETS)

More than 10 million American children under the age of five are exposed to cigarette smoke in their homes. A 1992 EPA report concluded that ETS (or second-hand smoke) is responsible for approximately 3,000 lung cancer deaths each year in non-smoking adults and impairment of respiratory health in hundreds of thousands of children. ETS causes 30 times as many lung cancer deaths as all regulated air pollutants combined. Children's exposure to ETS has been linked to an increased risk of chronic respiratory symptoms, bronchitis, pneumonia, chronic middle ear effusions, increased prevalence and severity of asthma, sudden infant death syndrome (SIDS), decrements in pulmonary function, and increased susceptibility to serious infectious diseases such as meningitis.

Asbestos

Asbestos is the name used for several magnesium silicate minerals that are incombustible, provide insulation against heat, cold and noise, and have great tensile strength. The U.S. Environmental Protection Agency and Consumer Product Safety Commission have banned several asbestos products, and therefore the material is primarily found in older buildings, usually in duct and furnace insulation or in ceiling surfacing materials. Asbestos may also be found in shingles, millboard, textured paints, and floor tiles. Unintentional release of fibers may

occur during remodeling, or sanding or cutting these materials. Wood-stove door gaskets and some brands of play-sand made from crushed marble may also contain asbestos.

There are no known, short-term health effects or symptoms from exposure to asbestos; however, long-term health effects in adults include increased risk of pleural effusion, lung cancer, mesothelioma, and asbestosis. Smokers are at a substantially higher risk of asbestos-induced lung cancer. Exposure most often occurs in occupational settings; however, children may become exposed from clothing and materials brought home from work sites.

Radon

Radon is a colorless, odorless, radioactive gas which enters homes through dirt floors, cracks in concrete walls and floors, floor drains and sumps, and sometimes through well water. The greatest concern associated with radon is an increased risk of lung cancer from inhaling the gas. Smaller risks of gastric cancer and leukemia have been associated with drinking water with high radon levels. The EPA estimates that radon causes between 7,000 and 30,000 deaths per year. Radon increases the risk of developing lung cancer in smokers and those exposed to ETS. The federal government recommends that all homes be tested for radon. Inexpensive home testing kits are available in many hardware stores.

Formaldehyde

Formaldehyde is a colorless gas with a distinct pungent odor which has been classified as a probable human carcinogen. Sources include particle board, plywood, urea-formaldehyde foam insulation, carpet and fabrics, mobile homes, and tobacco smoke. Health effects from formaldehyde exposure are well documented, including headache, eye irritation, nausea, upper respiratory irritation, and allergic reactions. Some asthmatics are especially vulnerable to the respiratory effects of formaldehyde. There is a strong association between living in a mobile home for more than 10 years and the development of squamous cell carcinoma of the nasopharynx.

Chemical Solvents in the Home

The use and storage of many household chemicals can lead to dangerously high levels of indoor pollutants. These include vapors from organic solvents found in paints, varnishes, and waxes, as well as cleaning, disinfecting, cosmetic, degreasing, and hobby products. The range of health effects, including carcinogenicity, is not known for all of these products, but solvents have been linked to eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment. Benzene, which is found in paint as well as in tobacco smoke and automobile emissions, is a known human carcinogen. Known animal carcinogens include methylene chloride, which is found in many paint strippers, adhesive removers and aerosol spray paints, and perchloroethylene, which is used in the dry-cleaning process. Volatile organic compounds (VOCs) are suspected of causing symptoms known collectively as “sick building syndrome,” characterized by headache, dizziness, and eye irritation.

Bioaerosols

The indoor environment contains a complex mix of biological contaminants that may contribute to a wide range of health effects. Substances such as bacteria, viruses, molds and spores, and proteins found in animal dander may produce infectious diseases, allergic conditions, irritant and toxic responses, as well as non-specific complaints such as headache, difficulty in concentrating, and drowsiness. Inadequate ventilation often contributes to the growth and accumulation of these indoor pollutants.

Infectious diseases

Outbreaks of Legionnaires' disease and Pontiac fever have been traced to the aerosolization of the bacteria *Legionnella*. Humidifier fever has been attributed to a micro-organism that thrives within ventilation systems. Children, the elderly, and those with respiratory diseases are most susceptible.

Allergens

Allergens are proteins recognized by the immune system as foreign, which prompt the body to mount a specific immune response. These proteins may come from plant and animal sources such as rubber plants (latex), molds, animal dander, cat saliva, house dust mites, cockroaches, and pollen. Some allergens can become airborne and contribute to a wide range of respiratory symptoms, skin irritation, and in severe cases, even death. Increases in the prevalence of indoor allergen sensitization and asthma have been linked to tightly sealed energy-efficient homes that restrict the range of temperature and humidity.

Irritant and toxic responses

Fungi may release volatile metabolites, causing a moldy smell typically associated with damp basements. Fungi may also release mycotoxins, which are among the most potent carcinogens known and which can have other severe acute and chronic effects in humans. Although airborne exposure to mycotoxin is rare, exposure in occupational settings has resulted in severe health effects. A cluster of 10 cases of pulmonary hemorrhage and hemosiderosis among infants living in moldy and water-damaged homes was linked to exposure to toxigenic *Stachybotrys atra* and other fungi. Endotoxin, found in the outer membrane of Gram-negative bacteria, can also produce toxic effects. Upon inhalation, endotoxin may cause fever and malaise, changes in white blood cell counts, respiratory tract inflammation and bronchoconstriction, shock, and death. Endotoxin exposure has also been linked with increased severity of asthma. The primary non-occupational source of exposure is contaminated room humidifiers, but indoor pools and fountains can also harbor endotoxin.

Special Issues at School or Day-Care

Time spent at school or in day-care plays an important role in a child's exposure to toxicants and must be considered in diagnosing health problems. Wide-spread reductions in school budgets have delayed many maintenance projects, resulting, in some cases, in indoor air quality problems. Even buildings with properly functioning

ventilation systems may have an abundance of pollution sources that can adversely impact the health and safety of students and school personnel. Some children may be more vulnerable to these effects, including those who wear contact lenses, have allergies, asthma, sensitivities to chemicals, respiratory diseases or depressed immune systems due to radiation, chemotherapy, or disease.

Outdoor sources of indoor pollution include pollen, dust, and mold spores as well as vehicle and industrial emissions. Underground sources such as radon, pesticides, and leakage from underground storage tanks should be considered. Within a building, microbiological growth in drip pans, ductwork, and humidifiers can contribute to environmental hazards. Emissions from new furnishings and floorings have been documented to cause respiratory symptoms. Sources not often considered include science laboratories, vocational arts area, food preparation areas, smoking lounges, cleaning materials, emissions from trash, odors and volatile organic compounds from paint, chalk and adhesives, dry-erase markers, and personal care products. Live sources include pets, insects, and occupants with communicable diseases.

Case Studies

Case Study #1

Three children, aged 6, 10, and 11, were brought to the emergency room after having been found unresponsive in the back of their parents' pickup truck. The youngsters had been sleeping in the back of the truck while their parents completed an all-night road trip. After the first 50 miles of travel, they had stopped at a service station; the children had been awake and alert at that time and did not complain of headache or other problems. During a second stop after driving an additional 250 miles, the children had appeared to be asleep. On arrival at their destination, following a total drive of 550 miles, the children could not be aroused. Resuscitation attempts were unsuccessful. Autopsy examinations revealed that the three children had carboxyhemoglobin levels of 15-20%, 23-28% and 31-36% and that cerebral edema was present in each. No evidence was found for other causes of death.

Inspection of the 1970 truck found that the muffler had been replaced, but the original tailpipe was not securely joined to the muffler. Several holes in the wall of the truck bed behind the cab allowed fumes leaking from the muffler to enter the enclosed truck bed.

Diagnosis: Fatal carbon monoxide poisoning.

Case Study #2

A 7-month-old boy was transferred to a tertiary care center from a community hospital suffering from respiratory distress. He had been well until four days prior, when he had developed rhinorrhea. The day before arrival at the community hospital, he had developed a fever and begun wheezing, with intermittent coughing and choking spells.

His medical history showed that he had been born at 32 weeks gestation, weighing 1200 grams (2 lbs., 9 oz.). Respiratory distress syndrome was treated with continuous positive airway pressure for the first month of his two-month stay in the premature

nursery. He was discharged to home at 3 months of age on a respiratory monitor because he continued to experience periods of apnea and bradycardia. Significant illnesses since then had included episodes of bronchiolitis at ages 5 months and 6 months, neither of which required hospitalization.

Social history revealed that both the mother and father smoked a pack of cigarettes a day. Neither of them took any special precautions not to smoke around the baby. The father was employed in retail sales; the mother did not work outside the home.

Physical examination revealed a sick-looking infant in respiratory distress. His temperature was 39.9 C (rectal), pulse 144, and respiration 68 and shallow. His weight was in the 5th percentile for his age. No skin rash or cyanosis was present. He had clear rhinorrhea and nasal flaring. Chest examination revealed intercostal and subcostal retractions and bilateral scattered expiratory wheezes. The expiratory phase of breathing was prolonged. The heart and abdomen were normal. X-ray films of the chest revealed bilateral hyperinflation of the lungs with subsegmental atelectasis in both lower lobes as well as the right upper lobe. Fluorescent antibody test for respiratory syncytial virus antigen was positive, as was viral culture for respiratory syncytial virus (RSV).

Diagnosis: Bronchiolitis caused by RSV. Passive exposure to ETS is a primary risk factor for hospital admission for RSV and other lower respiratory tract disease. It has been estimated that there is an annual excess of 22,000 hospitalizations and 1,100 deaths due to RSV bronchiolitis attributable to parental smoking.

Questions For Discussion

The answers below are not comprehensive, but are meant to be a starting point for discussion with your students or residents.

1. What are local air pollution levels and what problems do they present for your patients?
   - Using your own zip code, you can search the following website to find out your local air pollution levels: http://www.epa.gov/enviro/zipcode2.html.
   - Contact your regional EPA office and ask them for local information.

2. If you suspect an environmentally-induced medical problem, what questions should be asked regarding housing characteristics?
   - What is the heating source in the home? (Gas stoves, gas-powered space heaters, and kerosene lamps should not be used for heating.)
   - Are children exposed to environmental tobacco smoke in the home?
   - Has the home recently been renovated? Could the child have been exposed to paints, chemicals, or other likely irritants?
   - Is the home moldy or water-damaged? Have room humidifiers recently been cleaned? (Bioaerosols may be a factor.)
   - Does the child live in a mobile home? Is there new particle board, plywood, carpet or fabrics? (Formaldehyde outgassing may be a factor)
   - Has the home been tested for radon?

3. What resources or referrals can be provided if a family cannot remedy the environmental conditions in the home due to poverty or other problems?
   - Students and residents should familiarize themselves with local housing assistance groups, which can help families with heating, rodent/roach extermination, and landlord interventions to improve ventilation and remove mold or other irritants.

4. What medical conditions or characteristics make some children more susceptible to health problems when they are exposed to polluted air?
   - Asthma, allergies, respiratory or cardiovascular conditions, or depressed immune systems.

5. In your area, what common parental occupations and family recreational activities might contribute to air pollution-related health effects for children?
   - Potential parental occupations could include: electrical power generation, refuse disposal, and work with asbestos. Parental occupations involving contact with animals could expose children to animal dander, and agricultural occupations could expose children to pesticides and dust.
   - Potential recreational activities could include: indoor ice-skating, indoor truck and tractor events, camping (burning of a kerosene lantern in a tent), and outdoor exercise near a high-traffic area.

Field Work And Next Steps

- Using the suggestions in the "Environmental History-Taking" module, students could develop air pollution exposure checklists to be used during the clinic or emergency room visit. Questions should be targeted toward parents of children with particular susceptibilities and should include home characteristics and recent renovations, events and conditions at school, and participation in recreational activities.
- Students could also develop checklists, to be given to parents at the time of discharge, that identify specific modifications needed at home and school.
- Incorporating materials such as "You Can Control Your Asthma" from the Asthma and Allergy Foundation of America would provide useful steps for reducing exposures to household allergens and irritants.

Learning Methods

- During Grand Rounds or Journal Club, review current literature on the effects of indoor and outdoor air pollution on children.
- Speakers from regional American Lung Association and EPA offices or local environmental groups can identify hazards that are of major concern in the local community.
- Guest lecturers from the fields of environmental epidemiology and occupational health, as well as a review of Internet web sites (listed in Resources) are efficient methods for keeping up with current findings and recommendations.

Evaluation Methods

- Chart audits or audio-taping during the medical history and discharge processes may be useful in identifying the completeness and accuracy of students' evaluation of air pollution and other environmental factors that may impact illness.
- Patient surveys of what was discussed, what suggestions for remediation were made, and what resources were provided should be included.

Hand-Outs For Parents

Nine Indoor Air Hazards

1. Moisture and biologicals (such as molds, mildew and dust mites). Sources include excessive humidity levels, poorly-maintained humidifiers and air-conditioners, inadequate ventilation, and animal dander.
2. Combustion products, including carbon monoxide. Sources include unvented fossil-fuel space heaters, unvented gas stoves and ovens, and "backdrafting" from furnaces and water heaters.
3. Formaldehyde. Sources include durable press drapes and other textiles, particle-board products (often found in cabinets and furniture), and adhesives.
4. Radon. This is a radioactive gas emitted from soil and rock beneath and around building foundations, ground water wells, and from some building materials.
5. Household products and furnishings. These include volatile organic compounds from paints, solvents, air fresheners, hobby supplies, dry cleaned clothing, aerosol sprays, adhesives, and fabric additives used in carpeting and furniture.
6. Asbestos. Most homes more than 20 years old are likely to contain asbestos. Sources include deteriorating, damaged, or disturbed pipe insulation, fireproofing or acoustical material, and floor tiles.
7. Particulates. Sources include particles released from fireplaces, woodstoves, kerosene heaters, unvented gas space heaters, tobacco smoke, dust, and pollen.
8. Remodeling byproducts. Remodeling can provide the disturbance that releases such hazardous materials as asbestos, lead, and formaldehyde.
9. Environmental tobacco smoke. A mixture of smoke given off by the burning end of a cigarette, pipe or cigar, and the smoke exhaled from the lungs of smokers.

Adapted from the following source: http://www.montana.edu/wwwcxair/#ten

Signs of Possible Home Indoor Air Quality Problems

A major hazard is misinformation. Be informed. Be alert for these signs:

- unusual odors, or stale or stuffy air
- noticeable lack of air movement
- dirty or faulty central heating or air-conditioning equipment
- damaged flue pipes or chimneys
- unvented combustion air sources for fossil fuel appliances

- excessive humidity
- a tightly constructed or remodeled home
- presence of molds and mildew
- health reaction after remodeling, weatherizing, using household or hobby products, using new furniture, or moving into a new home
- feeling noticeably healthier outside the home

Source: http://www.montana.edu/wwwcxair/#ten

Outdoor Air Pollution

Recommendations for Parents

- Check with the local or state air pollution agency to determine if your area has an air pollution problem.
- Pay attention to air quality warnings by restricting exercise and time spent in high traffic areas.
- Participate in car pools or use public transportation since, in many areas, automobiles are the major source of airborne pollutants.
- Discuss concerns about high pollution days with coaches and school health care practitioners to modify children's exposures.
- Ask your child's doctor about increasing asthma medications on high pollution days.
- Air conditioners may help reduce the effect of outdoor air pollution that has penetrated indoors.

Preventing Carbon Monoxide Poisoning

Recommendations for Parents

- Buy, install, and maintain a home CO detector.
- Never use a gas oven or range to heat a house. (Note to health care practitioners: If the family lacks the resources to heat the home properly, referrals to social services or heating assistance programs should be offered.)
- Perform routine cleaning of gas or wood stoves, furnaces, and appliances. Ensure that gas or wood-burning appliances are adequately vented to the outside. Most local utility companies will inspect furnaces and stoves to make sure they are safely vented.
- Never operate gasoline-powered engines such as automobiles or lawn mowers in confined spaces such as garages or basements. Car exhaust is the most common form of fatal CO poisoning; do not idle a vehicle, inside a garage.
- Never burn charcoal inside a home, cabin, recreational vehicle or tent.
- Don't use kerosene heaters indoors.
- Repair rust holes or defects in vehicles that could allow exhaust fumes to enter the passenger compartment.
- If you suspect CO poisoning, turn off the source and get into fresh air immediately. Go to an emergency room if you feel ill; a simple blood test can assist in the diagnosis.

Preventing NO_2 Poisoning

Recommendations for Parents

- Never use the oven or gas range to heat a house. (Note to health care practitioners: Families who lack the resources to heat the home properly should be referred to social services or heating assistance programs.)
- A yellow-tipped flame is an indicator of increased pollutant emissions from a gas stove, requiring mechanical adjustment.
- Replace gas-powered space heaters with electric models. If this is not possible, keep doors and windows ajar when using gas-powered space-heaters.
- Current models of gas stoves use a pilotless ignition mechanism. Replace older stoves when possible and install stove hoods with fans that are vented to the outdoors.

Preventing Environmental Tobacco Smoke (ETS) Exposure

Recommendations for Parents

- Do not smoke. If you do smoke, do not smoke in the same room or in the car with your child, especially if the child has asthma, bronchopulmonary dysplasia, or any other chronic respiratory or cardiovascular disease.
- Seek out smoke-free day care settings. Insist that people who care for your children refrain from smoking around them or in rooms in which the children spend time.
- Patronize restaurants and businesses that do not allow smoking in their facilities.

Preventing Asbestos Exposure

Recommendations for Parents

- Asbestos fibers pose no threat unless released and inhaled. Do not disturb asbestos-containing material that is in good condition.
- Repair or removal of asbestos should be performed by a trained professional. Discuss the safer option of sealing, rather than removing the materials.
- Do not sweep or vacuum particles suspected of containing asbestos. Wet-mopping will prevent the particles from becoming airborne.

Preventing Radon Exposure

Recommendations for Parents

- All free-standing homes should be tested for radon. Regional Environmental Protection Agency (EPA) offices can provide lists of EPA-approved test kits.
- If a home's radon level is at or above the EPA's action level, contact the local health department or regional or national EPA office for guidance.

Preventing Formaldehyde Exposure

Recommendations for Parents

- Increase ventilation in rooms with formaldehyde-emitting products.
- Formaldehyde emissions are worse in the first year of use and decrease over time. Coating all surfaces and edges of formaldehyde-containing products with polyurethane may reduce emissions for some period of time.

- Humidity and high temperatures can increase the release of formaldehyde. Dehumidifiers and air conditioners may help reduce emissions.
- Some air cleaners are effective at reducing the formaldehyde content in indoor air.

Preventing Exposure to Organic Solvents from Household Products

Recommendations for Parents

- Avoid storing toxic chemicals. Buy small quantities if the product is to be used for one project or seasonally. Do not store these products where children may be exposed to chemical emissions. Keep chemicals out of the reach of children.
- Before disposing of left-over quantities, call your local refuse disposal company for instructions on toxic household waste disposal.
- Use products outdoors whenever possible. If you must use them indoors, use an exhaust system, open windows, and keep children out of the room.
- Minimize exposure to dry-cleaned clothing and bedding. Do not accept clothing from a dry cleaner if it has a strong chemical odor. Ask the cleaner to make sure the clothing is completely dry before the garments are returned to you.

Preventing Exposure to Bioaerosols in the Home

Recommendations for Parents

Routine Modifications:

- Decrease the reservoirs of biological agents by eliminating molds, pests, and sources of dampness.
- Wash bedding and stuffed toys in hot water (above 140 degrees F).
- Use a vacuum cleaner with a high-efficiency particulate arresting (HEPA) filter.
- To control cockroaches and other pests, remove as many food and water sources as possible by keeping garbage in closed containers, covering food and cleaning up immediately after meals, and repairing faucets and cracks around sinks and cabinets. Use roach traps and, if possible, hire professional exterminators. Ask exterminators about limited-pesticide pest management to prevent your children's exposure to toxic pesticides.
- Keep relative humidity at 30-50% to minimize the growth of biological agents.
- Remove existing mold by washing with soap and water followed by a rinse solution of 3/4 cup chlorine bleach in 1 gallon water or 1 oz. of 17% Zephiran in 1 gallon of water).
- Discourage the routine use of humidifiers. If they are used, refill with fresh water daily and sterilize frequently according to manufacturer's instructions.
- Improve ventilation by opening windows and using fans and air conditioners.

Modifications for children with allergies or other conditions that make them more susceptible to bioaerosols:

- Use polyurethane-coated casings on mattresses and pillows to decrease exposure to dust mites. Avoid the use of carpeting, stuffed furniture, and stuffed animals, particularly in the bedrooms of children with allergies.
- Wash bedding and stuffed toys weekly in hot water (above 140 degrees F) to kill dust mites.

- Use a vacuum cleaner with a high-efficiency particulate arresting (HEPA) filter and do not vacuum when the child is in the room.
- Reduce the child's exposure to pets and their allergens. It is best to remove pets from the home. If this is not acceptable, do not allow the pet in the child's bedroom.
- Houseplants may be a source of molds and should not be placed in the child's bedroom.

Improving the Environment at School or Day-care

Recommendations for Parents

- The EPA's "Indoor Air Quality - Tools for Schools Action Kit" provides practical instructions for evaluating and maintaining a healthy school environment. For information about ordering this kit, see below under "General Information on Indoor Air Quality".

Resources

General Information on Outdoor Air Quality

Contact your regional EPA office for information on local pollution or search the following website, using your own zip code: http://www.epa.gov/enviro/zipcode_js.html

General Information on Indoor Air Quality

http://www.epa.gov/iaq/pubs/insidest.html

Indoor Air Pollution: An Introduction for Health Professionals

http://www.epa.gov/iaq/aiqinfo.html

EPA Indoor Air Quality Information Clearinghouse

PO Box 37113
Washington, DC 20013-7133
(800) 438-4318
fax (703) 356-5386
iaqinfo@aol.com

Asthma and Allergy Foundation of America

(800) 778-2232

Indoor Air Quality in Schools

http://www.epa.gov/iaq/schools/index.html

IAQ Tools for Schools Action Kit

To order: 1-800-438-4318

Carbon Monoxide Detectors

The Quantum Group, Inc.
11211 Sorrrento Valley Road, Suite D
San Diego, CA 92121
(800) 432-5599
Four models, $9.95 - $59.59

Macurco, Inc.
3946 South Mariposa Street
Englewood, CO 80110
(303) 781-4062
Several models, $78 - $330

Environmental Tobacco Smoke

National American Lung Association Headquarters
1740 Broadway
New York, NY 10019
(800) LUNG-USA

Office on Smoking and Health
Centers for Disease Control and Prevention
4770 Buford Highway, NE (K-50)
Atlanta, GA 30341-3724
(770) 488-5701

Toxic Substances and Asbestos

Toxic Substances Control Act Assistance Information Service
(202) 554-1404, Mon-Fri, 8:30 - 5:00 ET

Radon

Regional EPA office distributes the Citizen's Guide to Radon
1-800-SOS-RADON

Mattress and Pillow Covers

Allergy Control Products
96 Danbury Road
Ridgefield, CT 06877
(800) 422-DUST

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Air quality in schools

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