

Environmental Hazards in the Home Janet McCabe¹

1. Background

Pre-school children spend 85% of their time at home. There are a number of environmental hazards that exist or may exist in the home environment that can lead to childhood disease or injury. Whether the housing is old or new, well-cared for or neglected, influences the type and severity of potential hazards, but even the newest, most well-cared for home can pose environmental hazards to the children who live and visit there. That said, it is also clear that if a child is poor, or if a child is African-american or Hispanic, he or she is more likely to be exposed to dangerous conditions in their homes.² And although local, state and federal law address some of these hazards and although safe and healthy housing is a goal of many assistance programs, much more needs to be done to protect children from these hazards.

1.1. Lead Hazards

What Is the Health Risk? Exposure to lead dust, lead paint chips, lead in soil and lead from other sources such as certain consumer products can cause potentially severe and permanent neurological damage to children younger than 7. Children ages 1-2 are at greatest risk of ingesting lead because they are on the floor where the dust is most likely to be found and engage in normal hand to mouth activity. Although blood lead levels will decrease once the source of exposure is removed, lead already in the body will have done irreversible damage to brain cells, which can result in lowered IQ scores, learning disabilities that may not show up for years, behavioral disorders such as anger management, antisocial behaviors, and impaired hearing.³

What Data Do We Have?

- 1) Data on blood lead levels. State law requires that laboratories and physicians provide results of blood lead tests to the Indiana State Department of Health (ISDH) and that these data be shared with local Health Departments, the Indiana Department of Family and Social Services (FSSA) and other agencies concerned with childhood lead poisoning.⁴ The law also requires ISDH to produce a report each year that summarizes the number of children who have had a lead test, the number of tests over the threshold level of concern (10 micrograms/deciliter of blood) and other pertinent information, including the number of housing units in which lead hazard risk assessments were performed. ISDH is making significant improvements in data collection, sharing and reporting, but much remains to be done. Certain data are available at www.in.gov/isdh/programs/lead/, but the website is not regularly updated. The 2006 report is available through www.ikecoalition.org/Lead/Legislative_report_2005_Final.doc. Some of the local Health Departments make summary information available. In addition, the Indiana Office of Medicaid keeps track of the numbers of Medicaid-eligible children who receive the required lead screening.⁵ That agency, also, is improving its data collection methodology and is working closely with ISDH as it does so. It produces a monthly report card on screening rates.⁶ The United States Centers for Disease Control and Prevention (CDC) also maintains statistics on childhood lead poisoning, which it collects through the National Health and Nutrition Examination Survey (NHANES).⁷ Certain data may not be made publicly available because of the privacy protections of the Health Insurance Portability and Accountability Act of 1996 (HIPAA).

Indiana does not have data on lead poisoning in older children.⁸

Indiana does not have a system for registering or recording homes with respect to their lead status.⁹

What Is the Extent of the Problem in Indiana?

- 1) Children. According to ISDH's 2005 Report to the Indiana Legislature, 43,120 children were reported as having at least one lead test and of that number, 548 (1.27%) had a confirmed blood lead level of 10 micrograms/deciliter or higher.¹⁰ CDC's data indicate that 1.6% of all US children under age 6 had

- elevated blood levels.¹¹ The CDC estimates that 13,400 children statewide are likely to be lead poisoned.^{12, 13}
- 2) Homes. Lead-based paint was banned from residential use in 1978, though its use had been decreasing since the 1950's. USEPA estimates that approximately 87% of homes built before 1940; 69% of homes built between 1940 and 1959; and 24% of homes built between 1960 and 1978 have lead paint. According to the 2000 Census, 41% of Indiana's housing units were built before 1960 (1,048,069 units). There is no centralized database of homes that have been inspected for lead hazards or homes that have had lead hazards remediated or lead paint abated, though ISDH is working with the Indiana Department of Environmental Management and the Indiana Lead Safe Task Force to develop this tool. Data collected by ISDH indicates that there are at least 3000 properties that have been responsible for poisoning more than one child.^{14, 15}
 - 3) Other sources of lead exposure. Lead regularly shows up in consumer products, some of which are specifically designed for children's use. These items include toy jewelry; children's furniture and toys; imported spices, cosmetics and candy; and dinnerware. The United States Consumer Product Safety Commission (CPSC) issues product recalls and maintains a list of recalled products on its website.¹⁶

What Are the Risk Factors?

CDC and ISDH have established a set of risk factors for children for lead poisoning. A child is at risk if he or she (1) lives in or regularly visits a house or other structure built before 1978; (2) has a sibling or playmate who has been lead poisoned; (3) has frequent contact with an adult who works in an industry or has a hobby that uses lead; (4) is an immigrant, refugee, or has recently lived abroad; (5) is a member of a minority group;¹⁷ (6) is a Medicaid recipient; (7) uses medicines or cosmetics containing lead; or (8) lives in a geographic area that increases the child's probability of exposure to lead.

What Are the Applicable Laws and Regs? Lead is heavily regulated by federal and state law, which require disclosure of known or potential lead risks to buyers or renters of housing; abatement or remediation in housing that is federally owned or subsidized, and ban lead uses in certain products (residential paint, gasoline). State laws and regulations cover lead abatement activities, local health department responsibilities for case management once a child has been found with an elevated blood lead level, and prohibit dangerous work practices.¹⁸ State law also prohibits lead hazards in licensed child care facilities,¹⁹ but there is no such prohibition in unlicensed (often home-based) or ministry-based child care facilities.²⁰

What Are Other Considerations?

Indiana has adopted a comprehensive Lead Elimination Plan to eliminate lead poisoning by 2010 with numerous activities to reach that goal through primary and secondary prevention. As with most areas, the focus has historically been more on secondary prevention. ISDH established the Lead Elimination Plan Advisory Committee that works through subcommittees to assist state and local agencies seek the funding, seek the legal authority (where necessary) and implement the activities in the Plan.²¹ The Indiana Department of Environmental Management administers a Childcare Five Star program²² that requires the facility to be free of lead hazards and take other precautions with respect to lead.

What Are the Challenges/Recommendations?

- 1) Public education/increasing awareness so parents will have their children screened;
- 2) Education and \$\$\$ to fix older homes (rentals, owner occupied). Remediation can be costly;
- 3) There is no requirement for property owners to do risk assessments and/or lead inspections, just to disclose anything known upon sale or rental (this is actually a disincentive to finding out);
- 4) There is no requirement to remediate or abate even if housing has caused elevated blood lead levels (though new state case management regulations outlined in 410 IAC require local health departments to be more proactive when a child has been found to have an elevated blood lead level);
- 5) Construction/renovation activities can disturb dust—most contractors are not trained in lead safe work practices and do not provide required warnings to occupants. USEPA has not finalized required regulations on this issue;
- 6) IKE's Secret Shopper Project shows that many hardware/paint stores are giving poor advice about how to handle lead-based paint safely;²³
- 7) There is no way for a consumer to know which consumer products may have lead that is accessible and dangerous to children unless CPSC has issued a recall or it has otherwise been brought to the public's attention (often a child has to be poisoned before this happens).

- 8) Local Health and Housing Departments lack authority, resources or willingness to deal aggressively and proactively with landlords of poorly maintained property.
- 9) Doctors need to be educated to make sure that they are aware of the continuing threat of lead poisoning, the most current information about health effects and blood lead levels of concern and screen children as appropriate.
- 10) A disincentive currently exists for homeowners to seek assistance from local health departments because of the fear that they will be cited for code violations.

1.2.Radon

What Is the Health Risk?

Radon is a colorless, odorless, tasteless, naturally occurring gas formed from the natural decay of uranium in the ground that has been associated with lung cancer. Studies on underground miners exposed to radon in the mines have demonstrated an increased risk of lung cancer. There have been several studies, in the US and Europe, on the risks of residential exposure to radon. On the basis of these studies, USEPA states that radon is the number one cause of lung cancer among non-smokers and overall, the second leading cause of lung cancer. Radon is responsible for about 21,000 lung cancer deaths every year nationally. About 2,900 of these deaths occur among people who have never smoked.²⁴ USEPA and other agencies and organizations have determined that a level of 4 picocuries per liter of air as the level at which mitigation is advised.²⁵ The average level of radon in outdoor air is 0.4 picocuries per liter.²⁶

What Data Do We Have?

There have been no studies in Indiana about lung cancer and radon, to the best of our knowledge. The US Environmental Protection Agency and the US Geological Survey evaluated the radon potential across the country and developed a map of Indiana indicating counties' likelihood of radon. See Appendix A.

Increasingly, homeowners are performing (or hiring certified radon testers to perform) radon tests. Certified radon testers and laboratories must provide copies of their test results to the Indiana State Department of Health, which administers the radon tester and mitigator licensing program (410 IAC 5.1-1-28(f); however, ISDH does not post those data to their website or compile it into a report. The public may request it, but ISDH will provide it by zip code, not by individual address. Certified mitigators must also provide an annual summary to the ISDH of all mitigation jobs performed. *Id.* In 2006-7, a project was undertaken in Indianapolis to test at least 50 rental properties in a low-income neighborhood on the east side of town. Although that study is not yet complete (and 50 properties is a very small sample size), preliminary results are consistent with the statement that approximately one out of three homes is likely to have radon levels above 4 picocuries/liter.²⁷

What Is the Extent of the Problem in Indiana?

A review of existing data (i.e. test results submitted to ISDH) would help define the extent of the problem. ISDH reviewed over 2000 Indiana radon test [when??] and found that approximately 25% of the homes had levels above 4 picocuries/liter.²⁸ According to USEPA's map, it appears that about 30% of homes in Zone 1 (see map in App. A) will have readings in excess of USEPA's action threshold of 4 picocuries/liter. The counties in Zone 1 with the highest population would have risk to the greatest number of people. The southwest and northwest corners of the state appear to have the lowest risk, based on the map developed by the USEPA and USGS.

What Are the Risk Factors?

There appears to be no particular type of home construction that is more or less susceptible to radon (for example, crawl space vs. slab vs. basement). Nor does the age of the home correlate with radon levels. Homes in the high radon zones can have very low levels and homes in the low radon levels can have high levels. Homes with significant living space in the basement pose a higher risk to the residents than homes where little time is spent in the basement. Radon can build up to higher levels during the winter when windows and door are closed. The greatest risk factor for increasing the chance of lung cancer is smoking. The risk of lung cancer from radon exposure is estimated to be 10 times greater for smokers than for nonsmokers.²⁹ There are no studies that show that children are at greater risk than adults.³⁰

What Are the Applicable Laws and Regs?

No enforceable regulations exist to control indoor radon levels—only guidelines and a national goal. EPA based its guidelines not only on risk considerations, but also on technical feasibility. The national goal, as stated in the Indoor Radon Abatement Act, is for indoor radon levels to be no higher than outdoor levels, which are estimated at 0.4 picocuries/liter. USEPA has established an action level of 4 picocuries/liter of air where they advise property owners to mitigate the radon. Indiana cites that recommendation, but it is advisory only. Indiana law requires anyone who does radon testing or mitigation for hire to be trained and certified by the ISDH.³¹ Indiana law requires sellers of residential property to disclose any known information about radon on the premises to a prospective buyer.³²

What Are the Challenges/Recommendations?

- 1) Lack of public awareness and concern. Having a radon test done prior to buying a home is becoming more and more routine (because the nature of the financial relationship, the ease of the test, and the relatively low cost of mitigation makes it a suitable issue for negotiation prior to a sale). However, as a general matter, the public does not appear to see radon as a significant health issue.
- 2) Since data on every radon test and every mitigation project are submitted to the ISDH, a comprehensive database of housing could be developed that would provide useful information to home buyers, realtors, researchers, and public health officials.
- 3) Rental property is particularly challenging. Tenants may not expect to live there very long so will not put pressure on landlords to mitigate. Landlords have many other things to do—this is not a high priority.

1.3 Asthma triggers

What Is the Health Risk?

Asthma is a chronic disease of the airways. The airways in the lungs become blocked or narrowed. During an asthma attack, the sides of the airways of the lungs become inflamed and swollen, causing the muscles to tighten around the airways. This decreases air passing in and out of the lungs. Also, excess mucus forms and enters the airways so less air passes in and out. The attack can cause wheezing, breathlessness, chest tightness, coughing, and other symptoms. Usually, asthma symptoms can be treated with medication, though sometimes a visit to the doctor will be required or, more rarely, to the emergency room. The incidence of asthma-related death among American children is rare.³³ What causes a person to have asthma is unclear (though heredity plays a part), however a variety of environmental triggers can cause an asthma attack. There are numerous common environmental triggers found in the home that can cause an asthma attack.³⁴

What Data Do We Have?

1) Data on Asthma Prevalence. Statistics on the prevalence of asthma in Indiana come primarily from the Behavioral Risk Factor Surveillance System (BRFSS). This is an ongoing data collection program administered annually by the CDC, through the states. Children under the age of 18 are not included in the BRFSS survey, however, the Indiana Asthma Burden report states that according to the 2002 BRFSS survey, 15.7% of Indiana households had at least one child who has ever been diagnosed with asthma. Of those households, 71.8% reported at least one child who had asthma at the time of the survey.³⁵

Data about childhood asthma have been gathered through the National Survey of Children's Health (NSCH).³⁶ Questions on lifetime and current asthma prevalence in the NSCH are identical to that found in the Behavioral Risk Factor Surveillance System.³⁷ This survey found a lifetime prevalence of asthma among Indiana children under 18 of 13.1% (compared to a nationwide rate of 12.4%) and a current prevalence of 10.9% (compared to 8.8% nationally). The survey also found the following:

- The prevalence among boys is greater than girls (10.1% compared to 6.7%);³⁸
- Children ages 5-17 have the highest prevalence of any age group;
- Prevalence among black children ages 5-17 is greater than among white (11.7% compared to 8.9%).³⁹

Another key source of data on asthma among Indiana's children is from the Medicaid program.⁴⁰ According to Indiana Medicaid data from 2003, the statewide prevalence of asthma in children ages 0-17 years was 10.4%.⁴¹

2) Data on other issues related to asthma. The Indiana Joint Asthma Coalition has conducted two surveys related to asthma awareness, one of people engaged in the home renovation and home construction trades⁴² and the other of school personnel.⁴³

What Is the Extent of the Problem in Indiana?

Asthma is the number one chronic disease for children in Indiana, and the fastest growing. It is the leading cause of missed school days. Asthma is more prevalent among Indiana children than the national average.

What Are the Risk Factors?

Risk factors for asthma include genetic disposition and exposure to environmental triggers. According to findings by the Institute of Medicine, there is sufficient evidence of a causal link between asthma and cats, environmental tobacco smoke (for preschool age children), cockroaches and dust mites; there is sufficient evidence of an association between asthma and dogs, nitrogen oxides, and mold; and limited or suggestive evidence of an association between asthma and domestic birds, fragrances, environmental tobacco smoke (in older children) and formaldehyde. See Appendix B for these findings.

What Are the Applicable Laws and Regs?

- **Outdoor Air Quality.** The 1990 federal Clean Air Act sets forth an extensive set of requirements to reduce air pollution in our country to levels USEPA has determined will protect the public health.⁴⁴ Some programs are administered directly by USEPA (such as the motor vehicle engine and fuel standards). Programs to reduce emissions from industrial and other business sources are more often implemented at the state or local level. The Clean Air Act does not regulate indoor air quality.
- **Tobacco Smoke.** Local governments are increasingly adopting Smoke Free ordinances prohibiting smoking in most, or all, public places.
- **Poor Housing Conditions.** Housing laws and local health codes that require housing be safe and habitable often explicitly mention pests and mold or water damage. Local governments have varying degrees of success in enforcing housing/health codes. The Indiana Residential Real Estate Disclosure Form does ask whether there have been “moisture and/or water problems in the basement, crawl space area, or any other area” but does not ask about specifically about mold.⁴⁵
- **Pesticides.** See more detailed discussion in Pests and Pesticides Section below.

What Are Other Considerations?

In December 2004, the State of Indiana adopted a Strategic Plan for Addressing Asthma in Indiana.⁴⁶ The Plan was prepared by the Indiana Joint Asthma Coalition (INJAC),⁴⁷ working with ISDH and IDEM. The plan contains many activities and programs that state agencies and others will be pursuing in upcoming years to address asthma in Indiana. INJAC is continuing its efforts, both implementing various pieces of the State Plan and taking other actions.⁴⁸

In addition to laws and regulations, there are policies and programs that are geared towards reducing the health risk to asthmatics. For example, it is now fairly common to find pollen counts and air quality index warnings in local print, TV and radio news. Some local governments and IDEM call “Air Pollution Action Days” when weather and pollution conditions are expected to make breathing difficult. These programs are geared more towards outdoor activity.

Another consideration is the existence of a number of organizations that educate and provide direct services related to asthma. These include the American Lung Association of Indiana and Asthma Coalitions in communities throughout the state, such as the Indianapolis Asthma Alliance.⁴⁹

Mold. Mold can be a serious problem in the home. There are mold spores everywhere, but they need a damp environment in which to grow. There can be numerous opportunities in the home for damp conditions to exist (leaky appliances or plumbing, poor drainage away from the foundation, roof or gutter problems, etc.).

What Are the Challenges/Recommendations?

1) Asthma can often be triggered by personal behaviors such as smoking, choosing to have pets, use of scented candles and the like. It is difficult, if not impossible, to regulate such behaviors especially when adults are creating

the triggers and children are the ones affected. Education of parents must be constant and come from all possible sources—doctors, government, school and the media.

2) Air Pollution Alert programs are positive, and surveys conducted by the Indianapolis Office of Environmental Services indicate that more and more people are aware of the effects of air pollution on health and the Action Day warnings. It is not clear that all people who need to be made aware are, or that they know what to do as a result of the warnings, however.

3) Many triggers are the result of poorly maintained housing (pests, mold) or poorly constructed housing (mold), a serious problem in a state with significant amounts of older, rental housing. Keeping old and poorly maintained housing clean enough for an asthmatic can be extremely difficult.

4) It is critical that children with asthma have an “asthma management plan” that identifies the situations that may trigger an attack and how attacks will be treated. The goal is to control the child’s asthma so that it interferes with normal life as little as possible. Many children do not have asthma management plans, however. Many Indiana schools do not have a full-time nurse, which means children may not get medication at school when they need it, or may be sent home when it is not necessary.

1.3.Pests and Pesticides

What Is the Health Risk?

In addition to the risk related to asthma discussed above.....

What Data Do We Have?

An interesting project implemented by Improving Kids’ Environment has gathered data on whether advice being given to homeowners at the hardware store on how to deal with pesticides is 1) legal and 2) safe. [results]

What Is the Extent of the Problem in Indiana?

What Are the Risk Factors?

What Are the Applicable Laws and Regs?

Indiana’s pesticide laws are found at IC 15-3-3.5 (Pesticides) and 3.6 (Pesticide Use and Application), implemented through regulations adopted by the Indiana Pesticide Review Board at 357 IAC 1 and the State Chemist’s Office at 355 IAC 4. Commercial pesticide firms must be trained and certified, as must individuals who wish to use “restricted” pesticides.⁵⁰ Retail personnel are prohibited from giving advice on pesticide application unless they have been trained. However, there is no requirement that property managers or their staff who administer nonrestricted pesticides be trained or certified (for example, the school janitor, the landlord, or the motel employee). Nor is there any requirement that notice be given in advance of a pesticide application, including for community-wide mosquito spraying (though some communities will provide advance notice to residents, either through a general notice or if people have self-identified as wishing to be notified), though lawn applications must be marked after the fact.

What Are Other Considerations?

Integrated Pest Management is a pest control strategy that uses an array of complementary methods: natural predators and parasites, pest-resistant varieties, cultural practices, biological controls, various physical techniques, and pesticides as a last resort. IPM operates on the principle that pests are bad and so are pesticides. There is growing interest in IPM, but the majority of pesticide applications in Indiana are still of the traditional type that emphasizes routine use of pesticides.

In Indiana, it is the Office of the Indiana State Chemist, housed at Purdue University, that administers and enforces the pesticide requirements. Rules are adopted by the Pesticide Review Board. Training and certification are administered through the State Chemist’s office. The Purdue Pesticides Program provides training statewide and publications on a variety of issues related to pests and pesticides.

What Are the Challenges/Recommendations?

- 1) IKE Secret Shopper shows that many store employees giving poor advice;
- 2) The prevailing view is to use chemicals rather than IPM
- 3) No training is required for application of nonrestricted pesticides in schools, rental property, hotels or homes (if done by non-commercial applicators).
- 4) No notice is required to building occupants before pesticides are applied.
- 5) Some pesticides persist in the home long after their effectiveness is gone.
- 6) Consumers are poorly educated about what kind and how much pesticide to use. Products such as foggers are minimally effective against pests but put occupants at risk.

1.4. Injury

Injury is the leading cause of death for Hoosier children.⁵¹ Children are especially at risk for certain kinds of injuries, many of which happen at home.

What Is the Health Risk?

What Data Do We Have?

In December 2005, the Indiana State Department of Health published the first comprehensive report on injuries based on data gathered from.....⁵² The report states that “infants and young children are at increased risk of sustaining injuries from motor vehicle crashes, falls, drowning, fires, and poisoning. Children and adolescents are the victims of motor vehicle crashes, bicycle and pedestrian injuries, suicide and homicide.⁵³ Although the report is limited to injury-related death and injuries that result in hospitalization, it provides an excellent view of the types of serious injuries that affect Hoosier children.

What Is the Extent of the Problem in Indiana?

According to the ISDH report, the leading cause of unintentional injury-related death to children in Indiana is falls. Infants are at greater risk from falls associated with furniture, stairs and baby walkers. Toddlers are at risk from window-related falls, and older children tend to suffer from playground equipment-related falls.⁵⁴ Among very young children (0-4 years old), burns, drowning, and suffocation are the next most common causes of injury and injury-related death. As children get older, traffic-related injury, fireworks-related injury and lawnmower-related injury also become significant.⁵⁵

What Are the Risk Factors?

What Are the Applicable Laws and Regs?

Fireworks may be legally purchased in Indiana by individuals as long as they shoot them off only on their own property (or as part of an approved public display). State law regulates the sale of fireworks and prohibits anyone from using them in a reckless manner.⁵⁶

Regulations are established for residential swimming pools at 675 IAC 20-4-27. Swimming pools must either be surrounded by an enclosure of sufficient height and security or by a power safety cover.

At the federal level, the Consumer Product Safety Commission is responsible for recalling consumer products that are found to pose a risk of death or injury.⁵⁷

What Are Other Considerations?

The Indiana State Department of Health Injury Prevention Program was established in 2002 to develop a core injury prevention focus and a sentinel surveillance system. The program is supported by a cooperative agreement from the Centers of Disease Control and Prevention (CDC). The mission of the program is to aid in the development of strategies for decreasing injury and death among Hoosiers. According to the ISDH, “injuries are no longer considered accidents, but have recently been recognized as preventable by taking a public health approach to prevention.”⁵⁸

Components of a public health model for injury prevention collectively are:

- Collecting and analyzing injury data
- Designing, implementing, and evaluating interventions at multiple levels
- Building a solid infrastructure for injury prevention
- Providing technical support and training
- Working with communities for policy change

The Indiana Violence and Injury Prevention Resource Directory⁵⁹ lists agencies that facilitate programs related to a variety of types of injury, including fall prevention, poisoning prevention, residential fire and burn prevention and drowning prevention.

What Are the Challenges/Recommendations?

- 1) Education and influencing personal behavior,
- 2) Dangerous housing conditions (that increase the likelihood of falls or fires, for example).

1.5 Combustion Products

Improperly used or malfunctioning heating devices are the major source of combustion pollutants in the home. These pollutants can come from gas ranges, improperly vented fireplaces, inefficient or malfunctioning furnaces, wood or coal stoves, clothes dryers, and unvented or improperly vented kerosene or gas space heaters. Common fuels used by these appliances are natural or liquefied petroleum (LP) gas, fuel oil, kerosene, wood, or coal. The key pollutants emitted by these devices are carbon monoxide, nitrogen dioxide, particulate matter and sulfur dioxide. Combustion also produces water vapor, which can create conditions for mold growth in the home.⁶⁰

Another type of product used in the home is an unvented kerosene heater. These are small, portable heaters designed to operate without specific ventilation. They pose a risk of burns, fire and increase the presence of carbon monoxide and other combustion pollutants in indoor air.⁶¹

What Is the Health Risk?

What Data Do We Have?

We are not aware of any data that exists in any reasonable form on these problems. Local health or housing departments would have records of individual inspections that cite property owners for malfunctioning or improperly vented appliances.

What Is the Extent of the Problem in Indiana?

There is no way to know the extent of this problem in Indiana. According to the Consumer Product Safety Commission, “every year, over 200 people in the United States die from CO produced by fuel-burning appliances (furnaces, ranges, water heaters, room heaters). Others die from CO produced while burning charcoal inside a home, garage, vehicle or tent. Still others die from CO produced by cars left running in attached garages. Several thousand people go to hospital emergency rooms for treatment for CO poisoning.”⁶²

What Are the Risk Factors?

What Are the Applicable Laws and Regs?

State law generally requires that housing be safe for human habitation,⁶³ and that landlords provide and maintain in safe working condition heating, ventilating and air conditioning systems, and appliances (if provided with the rental property).⁶⁴ New housing must be built to comply with the State Residential Housing Code.⁶⁵ Local health or housing codes typically address ventilation and the proper working of appliances.⁶⁶

Indiana does not currently have a state requirement that homes be equipped with carbon monoxide detectors.⁶⁷ [do other states?]

What Are Other Considerations?

What Are the Challenges/Recommendations?

As with many of the environmental dangers in the home, combustion products are generally the result of poorly maintained, older, usually rental housing. Residents may not understand how to make sure that their appliances are working properly or are properly vented. Overburdened and under-resourced local governments are challenged to enforce health and housing codes and tenants often have little clout to demand safe housing conditions.

Education to tenants and homeowners

There should be a CO monitor in every dwelling.

1.6 Environmental Tobacco Smoke

Secondhand smoke, or environmental tobacco smoke (ETS), is a mixture of the smoke given off by the burning ends of a cigarette, pipe, or cigar, and the smoke emitted at the mouthpiece and exhaled. The widespread practice of smoking in buildings exposes nonsmoking occupants to combustion by-products under conditions where airborne contaminant removal is slow and uncertain. Over the past two decades, medical science has shown that nonsmokers suffer many of the diseases of active smoking when they breathe secondhand smoke. Environmental Tobacco Smoke contains at least 250 chemicals known to be toxic or cause cancer. Unfortunately, the general public's exposure to secondhand smoke is much higher than most people realize.⁶⁸

What Is the Health Risk?

On June 27, 2006, the Surgeon General released a major new report on involuntary exposure to secondhand smoke, concluding that secondhand smoke causes disease and death in children and nonsmoking adults. The report finds a causal relationship between secondhand smoke exposure and Sudden Infant Death Syndrome (SIDS), and declares that the home is becoming the predominant location for exposure of children and adults to secondhand smoke.⁶⁹

What Data Do We Have?

According to the 2002 Indiana Youth Tobacco Survey:

- Three out of four high school students and 61% of middle school students reported being in the same room with someone smoking during the 7 days prior to the survey.
- Half of high school students and 40% of middle school students reported being in a room with a smoker during 3 or more of the 7 days.
- Approximately 56% of high school students and 48% percent of middle school students reported being in the same car as someone smoking, while a third in each group reported riding with a smoker more than 3 days a week.
- 60% percent of Indiana households prohibit smoking in the home.
- The presence of no-smoking rules was similar in homes with children (59.8%) as they were for households without children present (60.5%). More than half of Indiana households with children are potentially exposed to a known carcinogen.⁷⁰

What Is the Extent of the Problem in Indiana?

What Are the Risk Factors?

What Are the Applicable Laws and Regs?

As of October 2006, thirty communities in Indiana had some kind of smoke-free ordinance in place.

What Are Other Considerations?

What Are the Challenges/Recommendations?

This is another issue of personal behavior and education.

1.7 Volatile organic compounds

Volatile organic compounds (or VOCs) are organic compounds (i.e. they contain carbon) that evaporate readily. One of the most familiar VOCs is gasoline, but we come into contact with many others on a daily basis. Most solvents, inks, paints, formaldehyde, and petrochemical compounds are VOCs. Most VOCs are emitted by the transportation sector, industrial processes, or people's daily activities.

What Is the Health Risk?

Exposure to VOCs (or certain VOCs) can cause irritation of the eyes, nose, throat, nausea, skin reactions, headache, asthma, fatigue and dizziness.⁷¹

What Data Do We Have?

The data about VOCs gathered in Indiana is because of the outdoor air pollution programs.⁷² Industrial sources are required to report their emissions of VOCs annually to IDEM, and those data are available to the public.⁷³ IDEM also estimates emissions of VOCs from motor vehicles and other activities. We are not aware of any data that link exposure to VOCs with adverse health effects.

What Is the Extent of the Problem in Indiana?

What Are the Risk Factors?

What Are the Applicable Laws and Regs?

What Are Other Considerations?

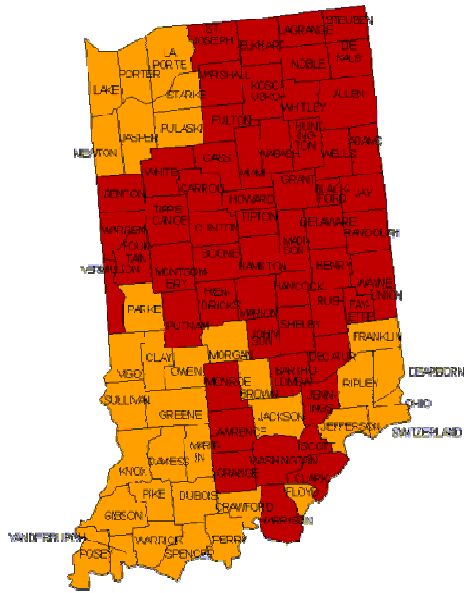
What Are the Challenges/Recommendations?

Overall Recommendations

- Move to a Healthy Homes holistic approach (keep it clean, keep it dry, keep it pest-free) and equip local government to approach housing issues that way
- Housing courts; more enforcement of local codes

Appendix A

[EPA Map of Radon Zones](#)



Zone 1 (highest potential: > 4 picocuries/liter)

Zone 2 (medium potential: 2-4 picocuries/liter)

Appendix B

Association Between Biological and Chemical Exposures in the Home and			
Development of Asthma in Sensitive Individuals		Exacerbation of Asthma in Sensitive Individuals	
Biological Agents	Chemical Agents	Biological Agents	Chemical Agents
Sufficient Evidence of a Causal Relationship			
<ul style="list-style-type: none"> House dust mite 	<p><i>No agents met this definition</i></p>	<ul style="list-style-type: none"> Cat Cockroach House dust mite 	<ul style="list-style-type: none"> ETS (in preschool-aged children)
Sufficient Evidence of an Association			
<p><i>No agents met this definition</i></p>	<ul style="list-style-type: none"> ETS (in preschool-aged children) 	<ul style="list-style-type: none"> Dog Fungi or molds Rhinovirus 	<ul style="list-style-type: none"> Nitrogen oxides (high-level exposures)¹
Limited or Suggestive Evidence of an Association			
<ul style="list-style-type: none"> Cockroach (in preschool-aged children) Respiratory Syncytial Virus 	<p><i>No agents met this definition</i></p>	<ul style="list-style-type: none"> Domestic birds <i>Chlamydia pneumoniae</i> <i>Mycoplasma pneumoniae</i> Respiratory Syncytial Virus 	<ul style="list-style-type: none"> ETS (in school aged and older children, & adults) Formaldehyde Fragrances
Inadequate or Insufficient Evidence to Determine Whether or Not an Association Exists			
<ul style="list-style-type: none"> Cat, Dog, Domestic Birds Rodents Cockroaches (except for preschool-aged children) Endotoxins Fungi or molds <i>Chlamydia pneumoniae</i> <i>Mycoplasma pneumoniae</i> <i>Chlamydia trachomatis</i> Houseplants Pollen 	<ul style="list-style-type: none"> Nitrogen oxides Pesticides Plasticizers Volatile organic compounds (VOCs) Formaldehyde Fragrances ETS (in older children and adults) 	<ul style="list-style-type: none"> Rodents (as pets or feral animals)² <i>Chlamydia trachomatis</i> Endotoxins Houseplants Pollen exposure in indoor environments Insects other than Cockroaches 	<ul style="list-style-type: none"> Pesticides Plasticizers Volatile organic compounds (VOCs)
Limited or Suggestive Evidence of No Association			
<ul style="list-style-type: none"> Rhinovirus (adults) 	<p><i>No agents met this definition</i></p>	<p><i>No agents met this definition</i></p>	<p><i>No agents met this definition</i></p>

Source: **National Academies Press, 2000. Clearing the Air: Asthma and Indoor Air Exposures. Executive Summary**
 Institute of Medicine. ISBN 0-309-06496-1 See www.nap.edu/books/0309064961/html/.

¹ At concentrations that may occur only when gas appliances are used in poorly ventilated kitchens.

- **Sufficient Evidence of a Causal Relationship:** Evidence fulfills association criteria and in addition satisfies criteria regarding the strength of association, biologic gradient (dose-response effect), consistency of association, biologic plausibility and coherence, and temporality used to assess causality.
- **Sufficient Evidence of an Association:** Association has been observed in studies in which chance, bias, and confounding factors can be ruled out with reasonable confidence (e.g. several small bias free studies showing an association that is consistent in magnitude and direction)
- **Limited or Suggestive Evidence of an Association:** Evidence is suggestive of an association but is limited because chance, bias, and confounding cannot be ruled out with confidence (e.g. one high quality study shows association, but results of other studies are inconsistent)

- **Inadequate or Insufficient Evidence to Determine Whether or Not an Association Exists:** Available studies are of insufficient quality, consistency, or statistical power to permit a conclusion; or no studies exist
- **Limited or Suggestive Evidence of No Association:** Several adequate studies are mutually consistent in not showing an association (but limited to the conditions, level of exposure, and length of observation covered in the study).

Summary of Findings Regarding Association Between Health Outcomes and	
Exposure to Damp Indoor Environments	Presence of Mold or Other Agents in Damp Indoor Environments
<i>Sufficient Evidence of a Causal Relationship</i>	
<i>Sufficient Evidence of an Association</i>	
<ul style="list-style-type: none"> • Upper respiratory (nasal and throat) tract symptoms • Cough • Wheeze • Asthma symptoms in sensitized persons 	<ul style="list-style-type: none"> • Upper respiratory (nasal and throat) tract symptoms • Cough • Hypersensitivity pneumonitis in susceptible persons • Wheeze • Asthma symptoms in sensitized persons
<i>Limited or Suggestive Evidence of an Association</i>	
<ul style="list-style-type: none"> • Dyspnea (shortness of breath) • Lower respiratory illness in otherwise healthy children • Asthma development 	<ul style="list-style-type: none"> • Lower respiratory illness in otherwise healthy children
<i>Inadequate or Insufficient Evidence to Determine Whether or Not an Association Exists</i>	
<ul style="list-style-type: none"> • Airflow obstruction (in otherwise healthy persons) • Skin symptoms • Mucous membrane irritation syndrome • Gastrointestinal tract problems • Chronic obstructive pulmonary disease • Fatigue • Inhalation fevers (nonoccupational exposures) • Neuropsychiatric symptoms • Lower respiratory illness in otherwise healthy adults • Cancer • Acute idiopathic pulmonary hemorrhage in infants • Reproductive effects • Rheumatologic and other immune diseases 	<ul style="list-style-type: none"> • Dyspnea (shortness of breath) • Skin symptoms • Asthma development • Gastrointestinal tract problems • Airflow obstruction (in otherwise healthy persons) • Fatigue • Mucous membrane irritation syndrome • Neuropsychiatric symptoms • Chronic obstructive pulmonary disease • Cancer • Inhalation fevers (nonoccupational exposures) • Reproductive effects • Lower respiratory illness in otherwise healthy adults • Rheumatologic and other immune diseases • Acute idiopathic pulmonary hemorrhage in infants

Source: **National Academies Press, 2004.** *Damp Indoor Spaces and Health. Tables ES-1 and ES-2*
 Institute of Medicine of the National Academies, ISBN 0-309-09246-9.
 See www.nap.edu/books/0309091934/html/.

- **Sufficient Evidence of a Causal Relationship:** Evidence is sufficient to conclude that a causal relationship exists between the agent and the outcome. That is, the evidence fulfills the criteria for “sufficient evidence of an association” and, in addition, satisfies the following criteria: strength of association, biologic gradient, consistency of association, biologic plausibility and coherence, and temporally correct association.
- **Sufficient Evidence of an Association:** Evidence is sufficient to conclude that there is an association. That is, an association between the agent and the outcome has been observed in studies in which chance, bias, and confounding can be ruled out with reasonable confidence.

- **Limited or Suggestive Evidence of an Association:** Evidence is suggestive of an association between the agent and the outcome but is limited because chance, bias, and confounding cannot be ruled out with confidence.
- **Inadequate or Insufficient Evidence to Determine Whether an Association Exists:** The available studies are of insufficient quality, consistency, or statistical power to permit a conclusion regarding the presence of an association. Alternatively, no studies exist that examine the relationship.

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² We do not attempt in this paper to address the ultimate hazard—having no home at all. The Indiana Coalition for Housing and Homelessness states that 9877 people in Indiana were homeless in 2005 (<http://mentalhealth.samhsa.gov/cmhs/homelessness/facts.asp>). According to the National Mental Health Information Center, 38% of the homeless population are families with children. <http://mentalhealth.samhsa.gov/cmhs/homelessness/facts.asp>.

³ “Preventing Lead Poisoning in Young Children,” US Centers for Disease Control and Prevention (August 2005), <http://www.cdc.gov/nceh/lead/publications/PrevLeadPoisoning.pdf>.

⁴ IC 16-41-39.4.

⁵ Medicaid requires that all eligible children be screened once at age 1 and once at age 2 (or at least once before age 6, if the 1 and 2 year old tests are not done).

⁶ http://www.in.gov/fssa/maternal/hoosier_healthwise/reportcard2004.html.

⁷ www.cdc.gov/nchs/about/major/nhanes/datalink.htm.

⁸ By the time a child is in school, his or her blood lead levels are likely to be lower, because they are no longer at as high a risk of exposure as when they were very young. However, permanent brain and other damage has been done. There is no systematic way for school personnel (or law enforcement, since lead poisoning has been associated with antisocial and criminal behavior in young adults) to know whether a particular child was exposed to lead at a young age.

⁹ The need for such a registry is an ongoing topic of discussion with the Lead Elimination Advisory Committee.

¹⁰ Indiana Childhood Lead Poisoning Prevention Program, ISDH, “Report to the Legislature for Calendar Year 2005,” (March 2006), http://www.ikecoalition.org/Lead/Legislative_report_2005_Final.doc.

¹¹ CDC, MMWR 54(20): 513-516 (May 27, 2005).

¹² Indiana Lead Elimination Plan (July 2004) at 2 (<http://www.in.gov/isdh/programs/lead/pdf/FinalChildhoodLeadPoisonElimPlan.pdf>).

¹³ In the 2006 Update to the State of Indiana Consolidated Plan prepared for the Indiana Housing and Community Development Authority, there were two questions about lead in a targeted citizens survey related to housing affordability and quality. (www.ihcda.in.gov/forms/DRAFT2006IndianaConsolidatedPlan.pdf). In answer to the question *Have you or any member of your family been tested for lead?*, the answers were: Yes -- 14%; No – 70%; Don't know – 15%.

¹⁴ Indiana Lead Elimination Plan (July 2004) at 2 (<http://www.in.gov/isdh/programs/lead/pdf/FinalChildhoodLeadPoisonElimPlan.pdf>).

¹⁵ The IHCD survey (see endnote 12) also asked: *Has your house or apartment been treated for lead contamination?* The answers were: Yes – 18%; No – 27%; Don't know – 55%.

¹⁶ <http://www.epsc.gov/epscpub/prerel/prerel.html>.

¹⁷ CDC found that 3.6% of African-American children had elevated blood lead levels, compared to 1.6% of all children.

¹⁸ The laws and regulations that apply in Indiana are summarized in Lead-based Paint: The Law in Indiana (Improving Kids' Environment 2006), available at www.ikecoalition.org/Lead/index.htm.

¹⁹ [470 IAC 3-4.7-100\(c\)](http://www.ikecoalition.org/Lead/index.htm).

²⁰ Child care ministries are subject to a more general requirement of facility sanitation and safety. [470 IAC 3-4.5](http://www.ikecoalition.org/Lead/index.htm).

²¹ Indiana Lead Elimination Plan (July 2004) at 3-5 (<http://www.in.gov/isdh/programs/lead/pdf/FinalChildhoodLeadPoisonElimPlan.pdf>).

²² <http://www.in.gov/idem/compliance/ctap/5star/kids/index.html>

²³ Information about the Secret Shopper program can be found at www.ikecoalition.org/Stores/Toolkit.htm.

²⁴ www.epa.gov/radon/healthrisks.html. Several studies have found an association with lung cancer among non-smokers and radon exposure. Summaries of these studies can be found at www.epa.gov/radon/pdfs/na_rn_pooling.pdf and www.epa.gov/radon/pdfs/euro_rn_pooling.pdf. A 2000 study in Iowa found an increased risk of lung cancer associated with residential radon exposure. See www.afhh.org/dah/dah_radon_docs/iowa_radon_lung_cancer_study.pdf.

²⁵ <http://www.epa.gov/radon/radonqa1.html>.

²⁶ Id.

²⁷ This project is being undertaken by Organization for a New Eastside and Improving Kids' Environment in cooperation with the Alliance for Healthy Homes and the USEPA, which is providing funding.

²⁸ Communication with John Ruyack, ISDH Office of Indoor Air and Radiation March 8, 2007.

²⁹ www.atsdr.cdc.gov/HEC/CSEM/radon/whosat_risk.html.

³⁰ *Id.*

³¹ IC 16-41-38; 410 IAC 5.1.

³² IC 32-21-5.

³³ American Lung Association, Asthma and Children Fact Sheet (August 2006), <http://www.lungusa.org/site/pp.asp?c=dvLUK900E&b=44352>.

³⁴ Most environmental triggers have not been found to *cause the development of asthma*, but rather to *trigger an attack* in individuals who have the disease. The exception is dust mites, where there is sufficient evidence of a causal relationship between exposure and development of asthma. There is limited or suggestive evidence of such a connection with exposure to cockroaches among preschool-aged children. Clearing the Air: Asthma and Indoor Air Exposures. National Academies Press, 2000, ISBN 0-309-06496-1.

³⁵ Indiana State Department of Health, Indiana Asthma Burden Report, <http://www.in.gov/isdh/programs/asthma/pdfs/BurdenAsthmaIndiana1-24-05.pdf>.

³⁶ This is a state-based telephone survey of households with children less than 18 years of age that collects information on a variety of physical, emotional, and behavioral health indicators. The respondent was a parent or guardian who knew the most about the selected child's health.

³⁷ American Lung Association, *Trends in Asthma Morbidity and Mortality*, July 2006.

³⁸ Note that this is opposite of the trend among adults, where the prevalence is greater among women than men.

³⁹ American Lung Association, *Trends in Asthma Morbidity and Mortality*, July 2006, p. 5.

⁴⁰ In Indiana in 2003, 478,000 children were enrolled in Medicaid at some time during the year. This number represents 28% of all children. *Id* at 31.

⁴¹ Indiana State Department of Health, Asthma Burden Report, Table 6, page 35.

⁴² http://www.in.gov/isdh/programs/asthma/InJAC/asthma_final_Report_-11-15-06%20_3_.pdf.

⁴³ Results not yet available.

⁴⁴ Those levels, know as National Ambient Air Quality Standards, are established for air pollutants considered to be pervasive (for example: ozone, fine particles, sulfur dioxide and carbon monoxide) and must be set to protect the health of the public (including sensitive individuals, such as asthmatics) with "an adequate margin of safety." [cite to CAA] The Act requires that USEPA review and revise the standards on a regular basis. There is frequently disagreement among stakeholders about whether the standards are sufficiently protective of human health.

⁴⁵ <http://www.in.gov/icpr/webfile/formsdiv/46234.pdf>.

⁴⁶ <http://www.in.gov/isdh/programs/asthma/pdfs/IndianaAsthmaPlan.pdf>.

⁴⁷ INJAC is a coalition of people and organizations concerned about asthma in Indiana and committed to reducing the burden it places on Hoosiers.

⁴⁸ For example, INJAC has recently issued two Resolutions, one supporting local Smoke Free ordinances and the other supporting local Idle Reduction Policies. <http://www.in.gov/isdh/programs/asthma/InJAC/index.htm>

⁴⁹ <http://www.asthmaindy.org/>.

⁵⁰ Although non-certified persons can apply restricted pesticides if they are under the "direct supervision" of a certified person (direct supervision does not require that the certified person be on-site, however). 355 IAC 4-2-3.

⁵¹ *Report on Injury-Related Fatalities and Injuries Resulting in Hospitalization*, ISDH, December 2005, www.in.gov/isdh/programs/injury/pdf/INJURIES_IN_INDIANA_1999-2001_7-05.pdf

⁵² *Id.*

⁵³ *Id.*, at 2.

⁵⁴ http://www.usa.safekids.org/tier3_cd.cfm?folder_id=540&content_item_id=1050.

⁵⁵ These data are contained in tables and narrative within the report. As an example, 53% of all fireworks-related injuries were to children aged 1-18. *Id.* at 8.

⁵⁶ IC 22-11-14-6, www.ai.org/legislative/ic/code/title22/ar11/ch14.html.

⁵⁷ www.cpsc.gov/cpsc/pub/prerel/prerel.html.

⁵⁸ www.in.gov/isdh/programs/injury/content/about.htm.

⁵⁹ Available at www.in.gov/isdh/programs/injury/directory/forward.htm.

⁶⁰ National Safety Council Fact Sheet on Indoor Air Quality and Combustion Appliances, www.nsc.org/ehc/indoor/comb_app.htm;

⁶¹ Unvented Portable Kerosene Heaters—Safety Considerations, David E. Baker, University of Missouri University Extension (October 1993), <http://www.cdc.gov/nasd/docs/d000801-d000900/d000884/d000884.html>.

⁶² www.epsc.gov/cpscpub/pubs/466.html

⁶³ IC 16-41-20

⁶⁴ IC 32-31-8-5, www.in.gov/legislative/ic/code/title32/ar31/ch8.html.

⁶⁵ 475 IAC 13(b) and 14.

⁶⁶ For example, Section 10-602 of the Marion County Health and Hospital Code states that:

(a) All heating devices shall be constructed, installed and operated in such a manner to minimize accidental burns.

(b) Non-electric heating devices, including hot water heating units, must be vented to the outside of the structure in an approved manner and must be supplied with adequate combustion air.

(c) Non-electric unvented portable heaters must be supplied with adequate combustion air and may not cause hazardous levels of elevated carbon monoxide or other hazardous combustion by-products inside the dwelling.

(d) Permanently- installed unvented non-electric room heaters must be equipped with oxygen depletion sensors and otherwise comply with state law. These heaters must be supplied with adequate combustion air and may not cause hazardous levels of elevated carbon monoxide or other hazardous combustion by-products inside the dwelling.

⁶⁷ In 2005, a bill was introduced that would have made this a requirement, but it did not pass.

<http://www.in.gov/legislative/bills/2005/SB/SB0142.2.html>.

⁶⁸ www.cdc.gov/tobacco/ETS_Toolkit/index.htm.

⁶⁹ <http://www.surgeongeneral.gov/library/secondhandsmoke/>.

⁷⁰ www.in.gov/itpc/files/research_202.pdf.

⁷¹ www.aqs.com/iaq/vol_org_compounds.asp.

⁷² VOCs contribute to the formation of ozone, which is an outdoor air pollutant, and regulated by USEPA and the states.

⁷³ <http://www.in.gov/idem/programs/air/emissionreporting/index.html>