

## **ABSTRACT**

Indoor air pollution causes significant health effects – including respiratory illness and disease, asthma attacks, cancer, and premature death. This costs Californians at least \$45 billion each year. These impacts are avoidable: preventive measures and alternatives are available, many at little added cost. Many agencies, professional groups, and organizations have taken actions to reduce indoor pollution, but these have been limited and are not sufficiently effective in preventing indoor air pollution.

### **Significant Health Effects**

Indoor sources emit gases and particles known to trigger asthma attacks and cause cancer, serious heart and lung disease, and irritant effects such as eye and throat irritation. Nearly four million Californians now suffer from asthma; there are numerous indoor asthma and allergy triggers, including some chemicals previously not thought to aggravate asthma. About 230 excess cancers are estimated to occur in California each year due to carcinogens emitted from indoor products and materials, such as formaldehyde from pressed wood building materials. This approaches the 250 estimated cancer cases per year from diesel exhaust particulate matter in outdoor air. Additionally, about 400 excess lung cancers are estimated to occur from exposure to environmental tobacco smoke. Up to 1500 excess lung cancers may occur from exposure to radon; however, the risk from radon is strongly associated with exposure to tobacco smoke, and less than one percent of California homes exceed the recommended mitigation level. Carbon monoxide, nitrogen dioxide, and particles are emitted from indoor combustion sources such as gas- and wood-burning appliances, and can cause serious respiratory and heart disease, sometimes resulting in premature death. Many gaseous compounds from building materials and consumer products occur at elevated levels indoors and exceed health-based guideline levels. Biological contaminants, including allergens, mold, and disease organisms, can cause illness when indoor conditions support their growth or transmission.

### **High Economic Costs**

Indoor pollution is estimated to cost California's economy more than \$45 billion each year due to premature deaths, medical costs, lost worker productivity, and related impacts. The total cost is likely much higher, because the total health impacts are not known.

### **Numerous Indoor Sources of Pollutants**

There are numerous sources of pollutants in indoor environments, and because people spend most of their time indoors, the risk from indoor air pollution is substantial. Californians, like others in industrialized nations, average about 87% of their time indoors. Indoor emissions are partially trapped inside buildings, and people's activities put them very near indoor sources. Consequently, some scientists estimate that pollutants emitted indoors are about 1,000 times more likely to be inhaled than comparable outdoor emissions.

### **Lack of Risk Reduction Program**

Despite the high health and economic impacts and the availability of effective mitigation approaches, indoor pollution does not have the benefit of a focused risk reduction program at the state or federal level. The existing regulations that apply to indoor air quality are scattered across multiple agencies, and focus on workplace exposures and ventilation requirements for non-residential buildings. Laws such as California's Smoke-free Workplace Law (AB 13, 1995) address specific sources or exposures, but leave substantial gaps in the state's ability to reduce

indoor pollution. Additionally, the resources allocated to address indoor air quality are not commensurate with the health risks and economic costs of indoor pollution.

### **Indoor Air Pollution Can Be Prevented**

There are a variety of effective approaches for preventing or reducing indoor pollution. Source control, such as through emission limitations or use of alternative products or materials, is the most effective approach for most indoor pollutants, because emissions and harmful exposures are prevented. A comprehensive risk reduction program could effectively assure acceptable indoor air quality in California homes, schools, and public buildings. A program that stresses emission reductions but includes improved building codes and ventilation, public and professional education, and development of advisory guidelines, is recommended. Mitigation actions that should be taken to reduce indoor pollution include:

- Create a comprehensive management program to assess indoor air problems, identify the best solutions, and develop measures to address them.
- Establish emission limits and require emissions testing, such as for building materials and some consumer products, to reduce emissions from indoor sources.
- Make children's health in schools and homes the top priority. Implement the recommendations of the ARB/DHS California Portable Classrooms Study: in particular, ensure that schools meet workplace standards for ventilation and for the prevention and remediation of moisture intrusion, require low-emitting building materials and furnishings, and require ventilation systems to be quiet.
- Amend building codes to assure adequate ventilation under all circumstances, and to address indoor combustion sources and prevent mold problems.
- Develop indoor air quality guidelines for homes, schools, and institutional buildings, to identify healthful indoor pollutant levels and promote "Best Practices" for all aspects of building design, construction, operation, and maintenance.
- Implement a focused outreach and education program for key professionals such as building managers, doctors, teachers, and others.
- Conduct increased research on all aspects of indoor air quality, and fund indoor clean air technology development and commercialization projects to foster improved indoor mitigation technologies, such as low-noise ventilation technologies.

### **Priority Sources**

High priority categories for mitigation include: indoor air cleaners that purposely emit ozone; building conditions that promote the growth or transmission of biological contaminants; building materials and furnishings; combustion appliances; environmental tobacco smoke; and radon. Those that are less urgent, because they are currently regulated for other purposes which yield benefits to indoor air, include: architectural coatings such as paints and varnishes, consumer products such as cleaning agents and air fresheners, household and office equipment such as printers and copy machines, and some pesticide products. Special priority should be paid to measures that reduce children's exposures.

### **Actions Are Cost-Effective**

Studies have documented the health, productivity, and economic benefits of improving indoor air quality. Many actions can be taken at relatively low cost that would reap large health benefits; others require additional authority or resources. Schools and homes are starting points: these require a high priority effort, because little has been done to improve those indoor environments, and the most sensitive members of the population – children, the elderly, and the infirm – spend most of their time there.