Indoor Air Pollution

While most people realize the health issues associated with outdoor air pollution, many are not aware of the significant health risks caused by poor indoor air quality (IAQ). Indoor air conditions should be a priority, as the Environmental Protection Agency (EPA) has determined that the average person spends up to 90% of their time indoors (3). Much is already known about IAQ by people in the building industry, but the general public needs to be more informed on this issue, as the prevention of poor IAQ is the responsibility of us all.

The ultimate goal of this literature review is to provide you with information to maintain or improve the IAQ of your environment. A more informed public is a safer public, and subsequently, the first two partitions deal with the origins of this issue and the health risks related to poor IAQ. Both the current guidelines for a healthy indoor environment and some methods to improve IAQ are then discussed, because it is unacceptable for health risks due to IAQ to continue on a large scale with the amount of information already known.

Origin of the issue of Indoor Air Quality (IAQ)

To understand the issue of IAQ, you must first understand the origins of poor IAQ. Indoor Air Quality has not always been an issue; rather, it became a problem during the “energy crisis of the 70's when we began to seal up building perimeters, and cut back on the amount of air we had to pay to condition” (2). Infiltration, the exchange of outdoor air and indoor air across the building skin, was a large source of fresh air in buildings until recently. Also, “Pre-World War II buildings typically had high ceilings to help disperse indoor odors (or "ether," as they called it), windows that could be opened and closed as necessary, and windows above the doors to permit cross-ventilation” (4). Not only are today’s buildings more tightly constructed, but they also bring in a smaller amount of fresh outside air. The amount of fresh air, required by code, to be brought into indoor spaces has lowered repeatedly in response to the national desire to conserve natural resources (4). In today’s tightly sealed buildings, with air handling systems that use a small amount of fresh air, pollutants are able to build up indoors. “As on an
airplane, the same air is circulated over and over again and so are the pollutants that air contains” (1).

Not only is their less fresh air in buildings now, but there is also more pollutants as a result of the use of “synthetic fabrics, synthetic building materials, synthetic ‘rubbers,’ plastics, a new generation of synthetic fireproofings and noncombustibles” (4). The EPA (Environmental Protection Agency) has identified both “the use of synthetic building materials and furnishings” and “the use of chemically formulated personal care products, pesticides, and household cleaners” as causes of increased indoor pollutants (3). There are many potential pollutants in buildings today, but most commonly, the parameters evaluated for during an IAQ assessment are carbon dioxide, carbon monoxide, respirable particulate, total volatile organic compounds, biological contamination, radon, temperature and relative humidity (2). In fact, “EPA studies of human exposure to air pollutants indicate that indoor air levels of many pollutants may be 2-5 times, and occasionally, more than 100 times higher than outdoor levels” (3). Today IAQ is an issue because there is the potential of having far more pollutants in a space than the fresh air being brought into that space can sufficiently dilute.

**Health risks associated with poor IAQ**

How serious is the presence of these indoor pollutants? More serious than you would probably assume, considering you may have never been exposed to this issue. According to the EPA and its Science Advisory Board, indoor air pollution has ranked among the “top five environmental risks to public health” in recent years (3).

By far the most prominent illness associated with poor IAQ is Sick Building Syndrome (SBS), “symptoms include headaches, dizziness, sinus congestion, itchy or watery eyes, scratchy throats, nausea, lethargy, and an inability to concentrate” (1). SBS has also been known to aggravate those persons with conditions such as allergies and asthma, as well as leading to respiratory infections. These types of ailments “may negatively impact the work performance of employees and may lead to increased absenteeism” (1).

SBS is not the only concern, cancer is in fact another serious issue. “The incidence and prevalence of cancer in the Western World is increasing in conjunction
with the use of the new order of compounds that humans have no genetic history in purging” (4). There are more foreign compounds in buildings today than one could imagine, for example a compound similar to agent orange has been “bound into electrical products for buildings to reduce arcing” (4). This is an alarming fact considering that “Agent Orange was anti-life; it could be dumped on a triple-canopied rainforest, reducing it to a desolate, lifeless area in a matter of weeks” (4). This may seem an extreme example of the side effects attributed to contemporary substances, but “most of the new compounds inadvertently created contamination and disease (chloroflorcarbons, leaking storage tank contamination of aquifers, pesticides and herbicides washing into and degrading water)” (4).

The cause of these ailments is air-born particles; in fact, “the particles you see in a beam of afternoon sunlight streaming through window only represent about 1% of the airborne contaminants, most of which you can't see” (1). This issue concerns everyone. “It has been estimated that contaminated air results in medical costs of about $1 billion dollars a year and costs employers approximately $60 billion a year in employee sick leave and lost production” (1).

**Current Guidelines for a Healthy Indoor Environment**

How do you find out if your indoor environment is safe? Due to the possible health risks, guidelines have been established for the acceptable indoor levels of air contaminants. The following is a set of guidelines for a non-industrial work environment generated from the compilation of the lowest published limits for various contaminants (2):

1. Carbon dioxide: 1,000 parts per million parts of air (ppm);
2. Carbon monoxide: 2 ppm;
3. Respirable suspended particulate: 0.05 milligrams per cubic meter;
4. Total volatile organic compounds ~ <1.0 ppm (general rule of thumb);
5. Biological contamination = Evidence of presence, no value established per se;
6. Radon = < 4.0 picoCuries per liter of air;
7. Temperature = 68 - 75 °F (winter), 73 - 79 °F (summer);
8. Relative humidity = 25 - 60 %
These are guidelines that should prevent health issues, and the testing of spaces with no known health complaints will normally show that all these pollutants are well within their proscribed limits (2).

One problem that must be considered is the fact that, “in the human population, sociobiology has placed a few among us who are hypersensitive to toxins” (4). This means some people will have symptoms due to air toxins long before any others in their workplace. For these types of people, stricter guidelines may be needed, but regardless, consideration must always be taken at the complaints of others. Only as good as the resulting conditions, guidelines should be updated whenever observation dictates that necessity.

**Improving Indoor Air Quality**

The whole purpose of understanding issues associated with IAQ is to improve the quality of air in our indoor environments. A major stumbling block towards this goal is the fact that, “the building’s mechanical ventilation systems are typically managed by property managers, and building occupants obviously manage themselves” (2). Both the occupants and property managers must work together to deal with IAQ issues. Testing can easily identify air contaminants causing health risks.

Basically the first thing is to determine the conditions in which you are living and working. Key to this is encouraging a forum for discussion. Complaints must be taken seriously and thoroughly investigated. But it is not reasonable to jump right into elaborate, expensive testing. For this reason a list of the “Big 7” is provided (4):

- **Combustibles** – any possible introduction of carbon monoxide.
- **Moisture** as it may relate to mold; look for growths on drywall.
- **Moisture** as it may relate to airborne infectious agents (standing water and consequent mold and fungi growth).
- **VOCs** – Volatile Organic Compounds, usually cleaning agents or building materials, that may give off unpleasant, sometimes toxic gasses.
- **Formaldehydes** in new carpet, pressed wood, or other building products.
- **Any new or newly exposed particle board** – a virtual "soup" of possible contaminants.
• Applied poisons – pesticides, insecticides, rodenticides, herbicides. These seven causes are recommended as the first to check for as they are both probable and relatively easy to identify. Once a health risk is determined, then it is time to implement a plan of attack.

To improve IAQ without actually bringing in a larger amount of outside air, the recycled air must be filtered. Filters are present in all cooling and heating systems somewhere in the return air vents, those carrying indoor air that will be mixed with some outdoor air and put back into the indoor environment. The most common type of filters used today are **standard cardboard frame filters**. This type of filter is only “about 15% effective in removing dust and particles from the air” and has “no effect on pollen, microorganisms, smoke or other similar pollutants” (1). **Electrostatic filters** are more effective, but they require frequent cleaning to prevent lost efficiency from dirt build up. This type of filter is also more economical, as it is reusable (1).

While filters can be effective, “**Electronic air cleaners produce the best results**” (1). According to ACU Air, Inc., electronic air cleaners “capture up to 95% of all airborne pollutants, including bacteria, dust, animal hair, dust mites, mildew, lint, fungus, smoke, cooking grease, bacteria and even many viruses” (1). Depending on the cause of contamination, there may be many means of alleviating the problem. More fresh air is always a solution, but may be very costly to implement.

**Conclusion**

It should now be clear that the quality of our indoor air should not be taken for granted. There are health risks associated with the low amount of fresh air and the high amount of pollutants in many of today’s buildings, namely Sick Building Syndrome. Some accepted guidelines for contaminants and a few methods of dealing with poor IAQ were also discussed, but the most important goal of this literature review has been to inform you, the public, of the issue of indoor air quality. It is important to recognize signs of an unhealthy environment, and with minimal difficulty spaces can be checked to prevent potential health problems. Once a potential health risk is identified, a specific plan, unique to that situation, can then be formulated.
Works Cited


