



Ozone for Improving Indoor Air Quality - Myths and Realities

An Online Continuing Education Course for Engineers

Course Number: BD-4011

Credit: 4 Hours / 4 PDH / 4 CPD

OZONE FOR IMPROVING INDOOR AIR QUALITY – MYTHS & REALITIES

There is a growing concern about the indoor air pollution as more and more people report symptoms or specific diseases in air-conditioned buildings. Depending on which building you work in and in which area of the city you live in "indoor air can be up to 10 times more polluted than outdoor air". Strange, as this may sound, the fact remains that the air we breathe, working or living, 85% of the time in conditioned spaces may be more injurious to health than outdoor air.

Over the last 15 years, our knowledge of environmental risk to public health due to poor air quality has increased dramatically. Science advisory boards have consistently ranked indoor air pollution among the top five environmental risks to public health. Poor indoor air quality leads to an increased incidence of health related symptoms, which in turn can lead to an increase in absenteeism and loss of productivity.

What is Indoor Air Quality?

Indoor Air Quality (IAQ) refers to the nature of conditioned air that circulates throughout the space/area where we work and live, that is, the air we breathe during most of our lives. IAQ refers not only to comfort, which is affected by temperature, humidity and odors, but, also to harmful biological contaminants and chemicals present in the conditioned space.

Most people control the environment in their homes to a degree, which is comfortable and healthy for them. They will open windows if the room feels stuffy and unaired; they will use exhaust fans in the kitchen and bathrooms to clear smoke and odors; they will not use freshly painted rooms until the smell has gone away. Although, by such practices they can avoid immediate adverse effects, they may not have enough awareness of the long-term effects, of the paint removing chemicals used during refurbishing, which may increase the risk of heart or liver disease, or the long term effect of exposure to insecticides being commonly used.

What is easy to accomplish by an automatic behavior at home is much more difficult to accomplish when applied to buildings inhabited by people of widely varying sensitivities and sensibilities. In many modern large commercial structures, for example, occupants have virtually no control over the environment, they cannot open windows; they cannot turn on exhaust fans and cannot leave the room if a colleague has severe cold and cough. They have no control over the atmosphere in a cinema hall, which smells stuffy and unaired when they walk in; restaurants or banquet halls, which smell stale and damp or boardrooms with heavy smoke filled air.

WHAT CAUSES IAQ PROBLEMS IN CONDITIONED SPACES?

Not enough outdoor air, poor air quality or poor air circulation.

In the past few decades, energy conservation measures have resulted in tighter buildings with recirculated air for building ventilation and minimum amounts of fresh air being brought into the buildings. This minimized the amount of air to be heated or cooled and hence conserved on energy but at the same time, since free passage of air is limited, with little or inadequate fresh air ventilation, it produces an indoor air environment with relatively high levels of contaminants, bacteria, fungi and dust. The indoor air will certainly have all of the pollutants of the outdoor or surrounding air and those that are generated within the building by people and their activities like smoking, hair sprays, cleaning products, paint and pesticide spray residues, carpeting, copy machines and air-conditioning coolants. As a result, indoor air may contain a concentration of some components which are greater than the outdoor ambient air. The composite effect of multiple pollutants results in a situation described as the 'Sick Building Syndrome' (SBS), a term which was used to describe the presence of acute non specific symptoms in the majority of people caused by working in buildings with an adverse indoor environment. SBS can seriously impact human respiratory systems leading to various short term and long term illness and is suspected when a substantial portion of the people spending extended time in a building report or experience acute on site discomfort.

TYPES OF AIRBORNE CONTAMINANTS

Airborne contaminants are unwanted materials in the air, which are harmful for human health. They enter the building through the HVAC systems or are carried by building occupants or are generated within the building surfaces. The pollutants of our concern can be divided into three groups:

1. Particulates
2. Gaseous contaminants
3. Microorganisms

Particles - Particles are very small solid or liquid substances that are light enough to remain suspended in air (e.g., mists, dust, or pollen). Of primary concern from a health standpoint are: 1) small, invisible respirable-size particles, with a higher probability of penetrating deep into the lungs, where they may stay a long time and may cause acute or chronic effects, and 2) larger particles, such as some molds, pollen, animal dander, and house dust allergens, which do not penetrate as deeply, but may cause an allergic response.

Gaseous pollutants - The gaseous contaminants are actually collections of molecules – unlike particulates – and are best distinguished from particulates by size. Very small particulate matter may be about 0.12 microns in diameter, while gas-phase contaminants are typically only a fraction of nanometer i.e., about 30,000 – 40,000 times smaller. Gaseous contaminants have harmful or annoying effects on the ventilated space or its occupants. These effects are noticeable at different concentration levels. In most cases, contaminants become annoying by their odors before they reach levels that are toxic or even deadly.

Gaseous pollutants include gases, such as carbon monoxide, sulfur dioxide, nitrogen oxide, nitrogen dioxide, formaldehyde and many other volatile organic compounds (VOC) released from the use of products such as paints, adhesives, veneer, polish, dyes, solvents, caulks, cleaners, deodorizers, personal hygiene products, waxes, hobby and craft materials, and pesticides. These contaminants generate within the building and travel from sources outside the building via infiltration or via the HVAC system air intakes located too close to roads, loading docks, trash dumpsters or exhaust vents.

Microorganisms - The most common microorganisms found in a building include fungi, bacteria and viruses. Except for viruses and certain bacteria, most contaminants are larger than 1 micron in diameter. Microorganisms have long been ignored by HVAC system designers and managers, but increasing concerns about indoor air quality (IAQ) have focused attention on the need to limit the concentration of microorganisms.

STRATEGIES FOR INDOOR ENVIRONMENTAL CONTROL

Methods for controlling contaminants fall into three categories:

- 1) Source Control - Suppressing the generation rate;
- 2) Removal control - Arrestance by extraction devices;
- 3) Dilution control - High rates of air changes per hour.

Control of pollutants at the source is the most effective strategy for maintaining clean indoor air. Control or mitigation of all sources, however, is not always possible or practical. Ventilation, either natural or mechanical, is the second most effective approach to providing acceptable indoor air.

Source Control

Usually the most effective way to improve indoor air quality is to eliminate individual sources of pollution or to reduce their emissions. Some sources, like those that contain asbestos, can be sealed or enclosed; others, like gas stoves, can be adjusted to decrease the amount of emissions. Source control of volatile organic compounds (VOCs) like formaldehyde can be accomplished by selecting and using low-emitting products (Furniture, building materials, paint, cleaning chemicals, textiles and office equipment like printers) in the indoor environment. Select products that have been tested and verified by reputable third-party certification programs like Green Seal and Green Guard. This will ensure that products have been tested and found to conform to the most stringent standards for low impact on the indoor environment. Source of allergens is generally from pets, dust, mold and insects.

Some of the simple source control methods would be:

- Banning smoking or providing a separated ventilated space for smokers.

- Using and storing paints, solvents, pesticides, adhesives in closed containers in well ventilated areas.
- Using these pollutant sources in periods of low or no occupancy.
- Allowing time for new building materials to gas off before occupancy.
- Fixing any water leaks.
- Replacing

To view the remainder of the course material and to take the quiz for PDH credit, you must purchase the course.

Close this window and click "Add to cart" on the product page.

Unfo
reduc

Remc

Air cle

various

mecha

genera

availabl

conditio

ation are

ollutants

o the

nated or

cles of

market:

d ion

also

air-

1. Mechanical filtration involves passing the airstream through the filter media, where the filter trap the airborne contaminants. The success of filtration systems depends on their ability to capture the right contaminants in the right quantity; factors that depend to a great extent on the type of filtration system installed. These are available in a number of different configurations, including flat panels, pleated panels, blankets and bags. Most panel type filters have a rated