



What contaminants can cause problems in indoor air quality?

This article will discuss the common contaminants that may cause indoor air quality (IAQ) problems in non-industrial workplaces (e.g. offices). It should be noted that the IAQ problems in such workplaces may be quite different from those in industrial settings (e.g. workshops).

Poor indoor air quality may cause the occupants to have some symptoms (e.g. headaches, dizziness and cough) and even building-related diseases (e.g., allergies and infections).

In North America, the airborne contaminants, which are mostly from indoor sources may come from outdoor sources as well are the second most common cause for IAQ problems, while inadequate ventilation is the most common cause for such problems.

The common airborne contaminants in indoor environments are summarized as follows:

I. Chemical Agents

1. Carbon Dioxide (CO₂)

Carbon dioxide, a colourless gas, is produced by human respiration and by the combustion of most fuels (e.g. coal, natural gases and gasoline). Thus, humans are often the major indoor sources of this gas unless there are unvented or poorly vented combustion appliances indoors.

Carbon dioxide does not cause any health problems at the levels typically encountered indoors. However, in IAQ investigations, carbon dioxide is routinely measured as an indicator of inadequate ventilation air. In other words, if the carbon dioxide level is significantly higher than normal levels in an occupied indoor area, it would suggest that the ventilation for that area may be insufficient.

2. Carbon Monoxide (CO)

Carbon monoxide is a colourless and tasteless gas generated by the incomplete combustion of fuel that contains carbon atoms. Carbon monoxide is a very dangerous gas because it can cause asphyxia. Exposure to this gas may lead to fatigue, headache, shortness of breath, nausea; and in severe cases, it may cause death.

3. Nitrogen and Sulfur Oxides

The gases of nitrogen dioxide (NO₂) and sulfur dioxide (SO₂) are produced by the combustion of fossil fuels.

Nitrogen dioxide may affect the respiratory system. Sulfur dioxide can cause irritation to the eyes, nose, throat and respiratory tract, and it can cause bronchoconstriction in asthmatics. Exposure to nitrogen dioxide or sulfur dioxide at very high concentrations, which are usually encountered only in industrial settings, may be life threatening.

4. Particulates

Usually, particulates can cause direct health problems only when they are in the air. Airborne particulates include a variety of very small substances that can stay in the air for a relatively long period.

Exposure to airborne particulates may result in irritation to the eyes, skin and respiratory system. Very small particulates ("respirable particulates") are particularly irritating for asthmatics.

5. Fibers

Many kinds of airborne fibers (natural or synthetic) may be encountered indoors. Their sources include carpet, building materials and furnishings, and occupants' clothing and activities.

Airborne fibers may be irritating as airborne particulates. Among all types of fibers, asbestos and glass fibers have caused the most serious concerns in terms of IAQ. Asbestos is the most dangerous type of fiber. As the inhalation of asbestos may cause cancer, exposure to asbestos must be strictly controlled.

6. Ozone

Ozone (O₃) is a colourless gas with a sharp, irritating odour. In ambient air, ozone is generated by the photochemical oxidation of some products of combustion. It may be produced by the operation of photocopy machines in office buildings.

Exposure to ozone can cause severe irritation to eyes, nose, throat and upper respiratory tract.

7. Formaldehyde

Formaldehyde (HCHO) is a very volatile compound. It often exists indoors as it is used widely in some building materials, furniture and other products.

Exposure to formaldehyde in the air can cause irritation of the eyes, nose, throat, and skin. Asthmatics may be more vulnerable to formaldehyde. Formaldehyde is a suspected carcinogen.

8. Other Volatile Organic Compounds (VOCs)

VOCs may be from a variety of products used indoors, such as personal care products, paints, cleaning agents, and pesticides.

Some VOCs, e.g. acrolein, are irritants. The health effects of VOCs largely depend on the types of the VOCs.

9. Radon

Radon is a naturally occurring noble gas that emits ionizing radiation, i.e. alpha-ray. Radon is a decay product of uranium. As uranium exists naturally in small quantities in most soil and rocks, many building materials may contain this element. Therefore, exposure to radon may occur in some buildings, especially in the basements.

Exposure to radon decay products may cause lung cancer.

10. Environmental Tobacco Smoke

Exposure to tobacco smoke may cause many health problems. It may increase the risk of developing lung cancer and respiratory diseases.

II. Biological Agents

1. Infectious Agents

Infectious agents encountered indoors include bacteria, viruses and fungi. Depending on the types of the agents, they may cause various types of infectious diseases, e.g. influenza, measles, tuberculosis, Pontiac fever, Legionnaire's disease, and aspergillosis.

2. Allergens

The main sources of biological allergens in indoor air are animals (dogs, cats, birds, rodents), arthropods (dust mites, cockroaches), fungi, and actinomycetes.

These allergens may induce different types of allergic diseases such as asthma, allergic rhinitis, and hypersensitivity pneumonitis.

3. Biological Toxins

Biological toxins include endotoxins produced by some bacteria and mycotoxins produced by fungi. Some of the toxins are very harmful. For example, aflatoxins, i.e. mycotoxins produced by certain types of fungi, may cause cancer.

4. Microbial VOCs

Microbial VOCs are produced by microorganisms (bacteria and viruses). These compounds produce discomforting odours that are usually related to mould contamination and decay.

When complaints about indoor air quality arise, the indoor air quality should be investigated by quality professionals.

If your workplace requires indoor quality air testing, please do not hesitate to contact OHCOW at 523-2330 or 1-800-461-7120.

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