# 9 INDOOR AIR QUALITY

## 9.1 Introduction

The University acknowledges that indoor air quality can be affected by any of a myriad of airborne gaseous and solid contaminants. Whenever possible, contaminants will be identified and controlled to minimize exposure. If necessary, measurements of air quality can be made under the direction of the Safety Officer. As much as possible, the University will attempt to meet the guidelines provided by the voluntary standard, ASHRAE 62. However, the University also recognizes that it may be difficult to meet the guidelines in older buildings that were designed prior to the standards being written. Requests for an indoor air quality assessment should be forwarded to the supervisor, who will then direct it to the attention of the Safety Officer.

## 9.2 Carbon Dioxide

Carbon dioxide is the product of human respiration. It is a normal constituent of fresh outdoor air. The concentration of carbon dioxide in indoor air is a good indicator of the adequacy of ventilation and the dilution of contaminants and odours. As the volume of fresh, outdoor air supplied into the building decreases, the concentration of carbon dioxide increases. This is especially true of schools, with a large occupancy load. For the purposes of providing fresh air to occupants in "office buildings", 20-30 cfm/person should be supplied. This may be a difficult standard to meet in a classroom setting.

As the concentration of carbon dioxide reaches above 700 ppm + outdoor concentration, there are increasing complaints of "stuffy air", lack of ventilation, lack of oxygen, headaches, and fatigue. As the levels go above 1200 ppm, these complaints are more common and may be more severe in some people.

## 9.3 Temperature

Thermal discomfort may be related to the ambient air temperature, air stratification and air velocities (as well as relative humidity). Individuals vary with respect to what temperature is most comfortable for them. If someone is dissatisfied with the temperature, the result may be a reduction in performance and an increase in fatigue. Wide swings in temperature also affect the body's ability to regulate its temperature and can lead to increasing discomfort. Thermostats should be set at one temperature, with slight adjustments for changing levels of activity in the room.

Large changes in temperature can also lead to changes in humidity levels that can further impair comfort.

## 9.4 Humidity

Humans are designed to function best at relatively high levels of humidity (>40%). Low humidity can lead to feelings of being too hot or too cold; nose, throat, and eye irritation; dry skin; headaches; nose bleeds, exacerbation of cold and flu symptoms; and static electricity. Wide swings in humidity can also lead to discomfort in people, and may accompany wide swings in temperature.

High humidity may result in a decrease in the cooling system of the body, leading to fatigue, stiffness and headaches. It may also lead to condensation, which can pave the way for microbial growth.

## 9.5 Carbon Monoxide

Carbon monoxide is a colourless, odourless, toxic gas that is a product of incomplete combustion. Contamination occurs when combustion gases are not properly exhausted, are being re-entrained into the building, or are coming inside from an external source. Few effects are seen at low concentrations. At higher concentrations, health effects include headaches, decreased alertness, flu-like symptoms, nausea, fatigue, rapid breathing, chest pain, confusion, and impaired judgement.

**Summary**

| Contaminant | Health Effects |
|---|---|
| Carbon dioxide | Feeling of lack of ventilation, complaint of lack of oxygen, stuffiness, headaches, fatigue. |
| Temperature | Reduced performance, fatigue. |
| Low Humidity | Discomfort, feeling too hot or cold, nose irritation, throat irritation, eye irritation, dry skin, headaches, nose bleeds, exacerbation of cold/flu symptoms, static electricity. |
| Carbon Monoxide | Headaches, decreased alertness, flu-like symptoms, nausea, fatigue, rapid breathing, chest pain, confusion, impaired judgement. |

## Standards used for interpretation of indoor air quality

| Standard | Parameter |
|---|---|
| <700 ppm + outdoor concentration a | carbon dioxide |
| 5 ppm b | carbon monoxide |
| 20-23.5 C (winter) c<br>23-26 C (summer) c | temperature |
| 25-68% d<br>30-40% (winter) c<br>40-60% (summer) c | humidity |
| 20-30 cfm fresh air/person d | air supply |

a this recommended level varies with the organic compound of interest.
b Indoor Air Quality in Office Buildings (Canadian target guideline value)
c ASHRAE 62, Ventilation for Acceptable Indoor Air Quality
d ASHRAE 55, Thermal environmental conditions for human occupancy.

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| Implemented | 2005 |
| Revised | October 2008 |
| Revised | May 2014 |
| Reviewed | June 2017 |
| Next review | 2020 |