

FCPS Design and Construction Indoor Air Quality Testing Procedures

The Safety and well-being of the students, faculty, staff and the public are the highest priority of FCPS. The Office of Design and Construction Services (D & C) understands that questions may arise about what precautions are taken to protect building occupants during construction activity. Maintaining good Indoor Air Quality (IAQ) is an integral part of safety during renovations.

Our office would like to offer the following answers to frequently asked questions concerning IAQ:

What efforts are made to monitor and maintain good indoor air quality?

Efforts to monitor IAQ begin with readings taken before the start of construction to establish a record of existing conditions, called a baseline survey. Once construction starts, the D & C safety inspector establishes sample collection locations throughout the areas adjacent to construction. The same locations will be tested during each IAQ event until the areas under renovation are complete. New areas will be added to the sample locations as new areas of construction begin.

The safety inspector records test results which are reported to the construction manager responsible for the project. In the event that unacceptable results are encountered, the safety inspector immediately informs the on-site FCPS representatives and works with them and the general contractor to immediately correct the conditions resulting in the unacceptable readings. The safety inspector then directs measures to be implemented to prevent a recurrence.

What standards are used for determining acceptable indoor air quality?

D & C monitors several parameters during IAQ events in order to maintain the health and comfort of building occupants. Analytes monitored include: total volatile organic compounds (tVOCs), particulates, carbon dioxide (CO₂), carbon monoxide (CO), temperature and humidity.

tVOCs

Currently, there are no federal regulations regarding maximum allowable concentrations of tVOCs. Measurements collected are for relative interpretation and may not be reflective of actual concentrations of specific VOCs (instruments that measure tVOCs are not designed to delineate concentrations of specific chemicals or compounds, but rather a general indicator of total volatile compounds present). According to industry agencies such as the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), American Conference of Governmental Industrial Hygienists (ACGIH), and the World Health Organization (WHO), **typical indoor tVOC concentrations range from 0.125 ppm to 0.5 ppm and levels above 1.0 ppm warrant further investigation.** D & C strives to maintain levels below 0.5 ppm. Anything above 0.5 is investigated.

CO

Carbon monoxide (CO) is a colorless, odorless and tasteless toxic gas that is a by-product of incomplete combustion. Symptoms of low-level exposure to CO may include headache,

nausea, or dizziness. Exposure to high levels (1,600 ppm +) can possibly cause death. Occupational Safety and Health Administration (OSHA) has established an 8-hour CO exposure limit of 50 ppm. The National Institute of Occupational Safety and Health (NIOSH) has established a Recommended Exposure Limit (REL) of 35 ppm over an 8-hr period and a ceiling limit of 200 ppm. The American Conference of Governmental Industrial Hygienists (ACGIH) has a threshold limit value (TLV) for **CO of 25 ppm for an 8-hr period**. CO concentrations in excess of 100 ppm are considered to be immediately dangerous to life and health requiring building evacuation and immediate response by emergency services. D & C strives to maintain CO at below 25 ppm.

CO₂

Carbon dioxide (CO₂) is produced by building occupants during respiration, and concentrations of CO₂ in building spaces are often used as an indicator of the potential for accumulation of indoor air contaminants in those spaces. CO₂ is considered an asphyxiant gas rather than a toxic gas; low levels of exposure (between 1,000 and 2,000 ppm) can cause occupants to begin to feel drowsy and lethargic, while brain damage and death can occur at extremely high levels (~40,000 - 70,000 ppm). OSHA has established an 8-hour time weighted average (TWA) of **5,000 parts per million (ppm) for CO₂**. The current American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 62-00 "Ventilation for Acceptable Indoor Air Quality" recommends indoor CO₂ concentrations be maintained at **less than 700 ppm above the outdoor air concentration**. D & C strives to maintain ASHRAE standards, however; the age and design of some schools did not include HVAC equipment in common areas such as hallways, and these areas are expected to be a bit higher than ASHRAE (but still well within OSHA recommendations).

Temperature

Current ASHRAE guidelines recommend that indoor temperatures in the winter months range between 68-74° F, and between 73-79° F in the summer months (from ASHRAE Standard 55-2010, Thermal Environmental Conditions for Human Occupancy). As stated above, the age and design of some schools did not include cooling equipment in some common areas, but FCPS has a minimum heat setpoint of 65° F in corridors for occupant comfort during winter months. D & C strives to maintain temperatures within these ranges during school hours.

Relative Humidity

ASHRAE recommends that indoor relative humidity range between 30% and 60%. Relative humidity is recommended to be maintained below 60% in order to inhibit the possibility of moisture accumulation and potential resulting mold growth. Extremely low humidity (below 20%) may cause physical discomfort such as dry skin and mucous membranes. D & C strives to maintain humidity within ASHRAE recommendations. However, as with CO₂, some of the older schools were not designed to have conditioned common areas such as hallways; these areas may exhibit slightly higher humidity readings than individual classrooms.

Particulates

Occupational Safety and Health Administration (OSHA) standard for respirable nuisance dust is 5.0 milligram per cubic meter (mg/m³). However, D & C has implemented an action level of

0.150 mg/m³ for common areas adjacent to construction partitions, and 0.050 mg/m³ for areas which are continually occupied, such as classrooms and offices.

The 0.150mg/m³ limit is approximately 33 times more stringent than the OSHA respirable dust exposure limit. This number is based on historic data collected in occupied areas not affected by construction (e.g., during class changes in corridors or in a cafeteria during lunch), and current industry best practices. The 0.050mg/m³ limit is considered to be ambient levels of a "typical office environment", and thus is suitable for comparison to occupied classrooms and school offices.

D & C chooses to implement such stringent standards so that if a reading exceeds the D & C action limits, a wide safety margin is present which allows the contractor to remediate conditions before particulate levels approach the OSHA threshold.

Who monitors the indoor air quality and with what frequency?

The D & C safety inspector is trained in the use of monitoring equipment and applicable standards. The safety inspector conducts regular, random (varied, non-set times, during various construction activities) site visits on each active project, which includes monitoring of IAQ. The frequency of air testing is largely driven by the project schedule and the type and location of construction activities. For instance, at the inception of a project when there is little to no activity inside the building but heavy site work, frequent indoor air quality tests are not typically warranted. However, during periods of demolition, masonry work, or other dust and odor producing activities, more frequent tests are warranted and will be conducted. The safety inspector also makes unscheduled "spot checks" on projects, especially if warranted by observations or reported conditions.

As the safety inspector position is tasked with monitoring the air quality at all FCPS occupied renovation projects, D & C also relies heavily on our Field Construction Representatives to use their knowledge and experience to stop work or require the general contractor to implement additional engineering controls *before* altered air quality becomes a nuisance to occupants. The Field Construction Representatives work closely with and will alert the safety inspector when conditions arise that may warrant additional air testing.

What instruments are used to monitor the indoor air quality?

The safety inspector utilizes a variety of direct-read instruments for IAQ Events, including a Casella CEL-712 Microdust Pro, a MiniRae 3,000 Portable VOC Monitor, and a TSI Q-TRAK 7575.