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Standard Guide for Using Indoor Carbon Dioxide Concentrations to Evaluate Indoor Air Quality and Ventilation¹

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1. Scope

1.1 This guide describes how measured values of indoor carbon dioxide (CO_2) concentrations can be used in evaluations of indoor air quality and building ventilation.

1.2 This guide describes the determination of CO_2 generation rates from people as a function of body size and level of physical activity.

1.3 This guide describes the experimentally-determined relationship between CO_2 concentrations and the acceptability of a space in terms of human body odor.

1.4 This guide describes the following uses of indoor CO_2 concentrations to evaluate building ventilation—mass balance analysis to determine the percent outdoor air intake at an air handler, the tracer gas decay technique to estimate whole building air change rates, and the constant injection tracer gas technique at equilibrium to estimate whole building air change rates.

1.5 This guide discusses the use of continuous monitoring of indoor and outdoor CO_2 concentrations as a means of evaluating building ventilation and indoor air quality.

1.6 This guide discusses some concentration measurement issues, but it does not include or recommend a method for measuring CO_2 concentrations.

1.7 This guide does not address the use of indoor CO_2 to control outdoor air intake rates.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

D 1356 Terminology Relating to Sampling and Analysis of Atmospheres²

D 3249 Practice for General Ambient Air Analyzer Procedures²

E 741 Test Method for Determining Air Change in a Single

Zone by Means of Tracer Gas Dilution³

2.2 Other Documents

ASHRAE Standard 62 Ventilation for Acceptable Indoor Air Quality⁴

3. Terminology

3.1 *Definitions*—For definitions and terms used in this guide, refer to Terminology D 1356.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *air change rate, n* —the total volume of air passing through a zone to and from the outdoors per unit time, divided by the volume of the zone (s^{-1} , h^{-1}).⁵

3.2.2 *bioeffluents, n* —gases emitted by people as a product of their metabolism that can result in unpleasant odors.

3.2.3 *single-zone, n* —an indoor space, or group of spaces, wherein the CO_2 concentration is uniform and that only exchanges air with the outdoors.

4. Summary of Guide

4.1 When investigating indoor air quality and building ventilation, a number of tools are available to understand the building being studied. One such tool is the measurement and interpretation of indoor and outdoor CO_2 concentrations. Using CO_2 concentrations to evaluate building indoor air quality and ventilation requires the proper use of the procedures involved, as well as consideration of several factors related to building and ventilation system configuration, occupancy patterns, non-occupant CO_2 sources, time and location of air sampling, and instrumentation for concentration measurement. This guide discusses ways in which CO_2 concentrations can be used to evaluate building indoor air quality and ventilation.

4.2 Section 6 discusses the rate at which people generate CO_2 and the factors that affect this rate.

4.3 Section 7 discusses the use of indoor concentrations of CO_2 as an indicator of the acceptability of a space in terms of perceptions of human body odor.

4.4 Section 8 describes the use of mass balance analysis to determine the percent outdoor air intake at an air handler based

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² *Annual Book of ASTM Standards*, Vol 11.03.

³ *Annual Book of ASTM Standards*, Vol 04.11.

⁴ Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, NE, Atlanta, GA 30329.

⁵ A common way of expressing air change rate units is ach = air changes per hour.