# ASHRAE Standard 62 – What Now?

## IAQ Design Overview

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# Program / Learning Objectives

- Importance of Building IAQ
- ASHRAE 62.1-2007 Overview
- Ventilation Effectiveness
- Variations in Occupancy or Airflow
- Relationship to USGBC LEED-NC v 2.2

# Why is IAQ Important?

- Not Just Code Compliance
  - Medical Liability Concerns
  - Employee Health Concerns
  - Cost of Poor IAQ

AMA
HELPING DOCTORS HELP PATIENTS

ABA

# Indoor Air Quality

## Medical Liability Concerns:

- ADA requirements of ***bio-chemically handicapped*** – describes people with multiple chemical sensitivity (MCS)
- Poor IAQ (a.k.a Sick Building Syndrome – SBS) is the leading cause of MCS according to the World Health Organization

World Health Organization

# Indoor Air Quality

## Medical Liability Concerns:

- EPA stated that the health risks associated with breathing *indoor* air are 2 to 5 times the risk of breathing *outdoor* air.
- EPA has poor IAQ cited as the 4th highest cancer risk (3500 to 6000 annual deaths)

# Indoor Air Quality

## Medical Liability Concerns:

- World Health Organization estimates that 30% of all buildings suffer from Sick Building Syndrome.
- Improved IAQ in buildings aids in protecting Owners, Developers, and Professional Consultants.

World Health Organization

# Indoor Air Quality

## IAQ and the Building Code:

- IMC/OMC Chapter 4 – Ventilation
  - Based on ASHRAE 62-1999
  - Prescriptive Requirements for Ventilation
  - Permits “Engineered Systems” based on ASHRAE 62.1-2004 or most recent version

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- Ventilation for Acceptable Indoor Air Quality Standard
- Industry Standard of Care for IAQ Systems Design and Evaluation
- Prerequisite for the LEED – NC v2.2 Building Rating System (EQp1: Minimum IAQ Performance)

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- Options for Compliance
- Outdoor Air Quality
  - Standard requires a survey of the project site to determine quality of OA
  - Limit values for various air contaminants
  - Ohio EPA Website

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- Options for Compliance
- Natural Ventilation
  - Based on Space Floor Area – Both Interior and Perimeter Spaces
  - Limitation on Distance of Interior Spaces from Perimeter Openings
- Acceptable for Compliance to USGBC LEED-NC v 2.2 EAp1 – Minimum IAQ Performance

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- Options for Compliance
- Ventilation Rate Procedure
  - Forced Airflow to Building Spaces
  - Must provide the required airflow through-out the occupied range of operation
  - Must be appropriately dehumidified to limit moisture problems

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- Ventilation Rate Procedure
  - Required ventilation is calculated based on occupancy and floor area
- This differs from the previous Standard (OBC) and can result in reduced airflow requirements

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- Ventilation Rate Procedure
  - Re-circulation (Return) Air now classified by space type
  - Class 1 thru Class 4
  - Limits what classification of air that can be returned
- This is more stringent than the previous version of the Standard (OBC)

# Indoor Air Quality

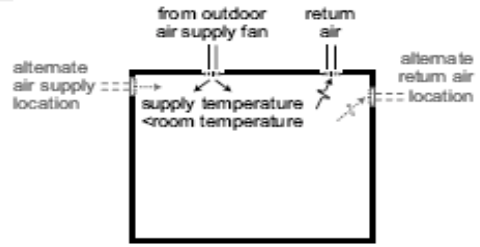
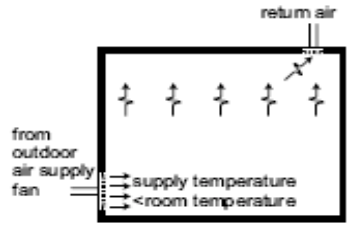
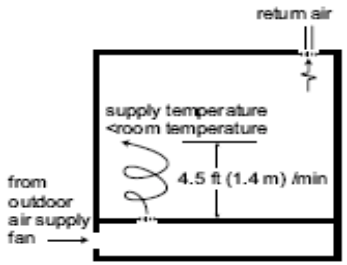
## ASHRAE 62.1-2007 Basics:

- Ventilation Rate Procedure
- Multi-Zone Systems – Typical Application
  - Each Space OA Requirement is calculated as a ratio to the heat-load required airflow
  - The highest ratio governs the entire system
- This is similar to the previous Standard (OBC), but updated to reflect the new Occupancy and Area requirements

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

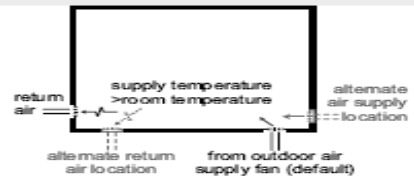
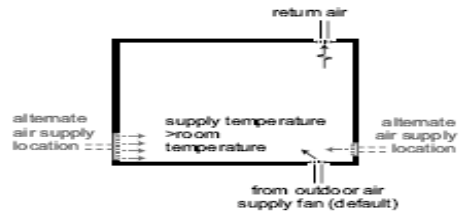
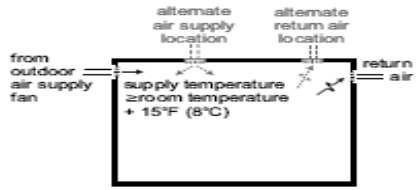
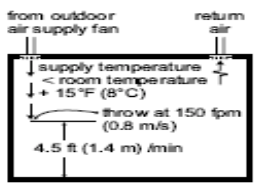
- **Ventilation Rate Procedure**

| Mode | Description | Supply Air Conditions | $E_z$ | Schematic |
|---|---|---|---|---|
| COOLING | Ceiling supply of cool air and ceiling return | Supply air temperature is cooler than room air. | 1.0 |   |
| | Thermal displacement | Supply air temperature is cooler than room air and delivered at a low velocity to achieve unidirectional flow and thermal stratification. | 1.2 |   |
| | Underfloor air distribution | Supply air temperature is cooler than room air and delivered at 150 fpm so that the supply air jet reaches at least 4.5 ft above the floor. | 1.0 |   |

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- **Ventilation Rate Procedure**

| Mode | Description | Supply Air Conditions | $E_z$ | Schematic |
|---|---|---|---|---|
| HEATING | Floor supply and return | Supply air temperature is warmer than room air. | 1.0 |   |
| | Floor supply of warm air and ceiling return | Supply air temperature is warmer than room air. | 0.7 |   |
| | Ceiling supply of warm air and ceiling return | Supply air temperature is more than 15 °F Warmer than room air. | 0.8 |   |
| | Ceiling supply of warm air and ceiling return | Supply air temperature is less than 15 °F Warmer than room air, provided 150 fpm supply air jet reaches to Within 4.5 ft of the floor. | 1.0 |   |

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- Ventilation Rate Procedure
- Diversity and Variable Occupancy
  - Diversity in Overall Building Occupancy is applied at the System Level
  - Short Term Occupancy of each Space may be evaluated during the Occupied time period
  - Classroom, Theaters, Lobbies
- Limited in the previous version

# Indoor Air Quality

## Variable Occupancy Example

**Q**

What is the design occupancy ($P_z$) of a 5000 $ft^2$ pre-function space to convention meeting rooms with a 15 foot ceiling?

**A**

Using the default value in Table 6-1 for occupancy density, the peak number of occupants is estimated to be 30/1000 * 5000 = 150 people. The averaging time period is then:

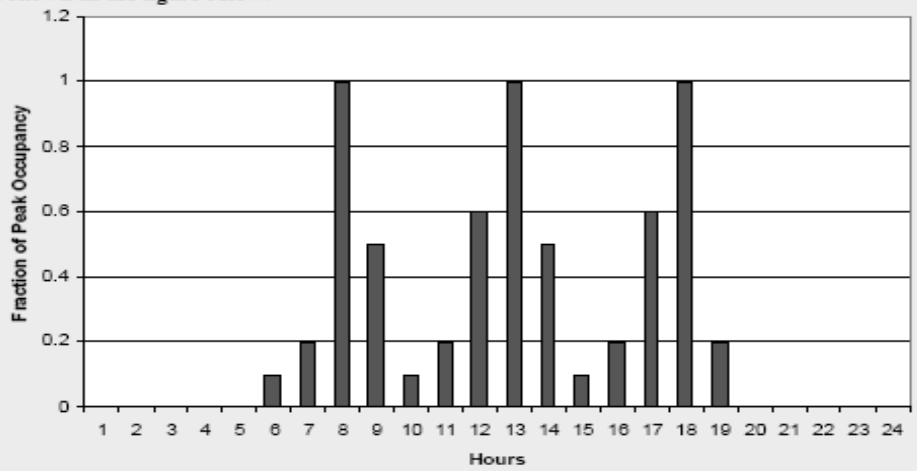
$$T = \frac{3v}{V_{bz}}$$

$$= \frac{3 * 5000 * 15}{150 * 7.5 + 5000 * 0.06}$$

$$= 160 \text{ minutes}$$

$$= 2.6 \text{ hours}$$

Assume that the design day is a series of meetings or seminars in the morning and afternoon. The occupancy profile is estimated as shown in the figure below:




The time-weighted average population fraction is the largest consecutive total fraction over the averaging time (T). In this case, with the window rounded up to 3 hours, this occurs from noon to 2 PM (hours 12–14 in the chart above). During this period the average is (0.6+1+0.5)/3 ~0.7. So the design occupancy is 0.7 * 150 = 105 occupants.

# Indoor Air Quality

## Interrupted Airflow Example

**Example 6-X—Time-Averaging Intermittent Supply Fan Operation**

### Q

A simple single zone AC unit supplies cooling to a building located in a humid climate. Humidity is better controlled if the unit is allowed to cycle on calls for cooling (rather than running continuously) to avoid the intake of humid, unconditioned outdoor air. Is this allowed by *Standard 62.1*?

### A

Yes, but probably not in a manner that will address the humidity problem. To meet *Standard 62.1* with cycling, the design of the system and controls must ensure that the average outdoor airflow rate over the averaging time (T) meets or exceeds the system minimum outdoor air intake flow rate ($V_{ot}$) if it were provided continuously. This leads to three problems.

- First, the outdoor air rate to the AC unit must be higher than $V_{ot}$ to overventilate the space when the fan is on, making up for the time it is off.
- Second, control logic may be needed to force the unit to run even when cooling is not required to ensure that $V_{ot}$ is maintained over the averaging window. For example, let's say the averaging time is two hours and that the outdoor air rate was designed to be 50% greater than the continuous (without averaging) rate. The control system could then be designed so that if the unit had cycled off for x minutes, it would be forced to run at least three times as long (3x minutes) before it is allowed to cycle off again; and if x=30 minutes, the system would be forced on even if no cooling is required to ensure the average of two hours is met. When forced on in this way, the system will be supplying humid, unconditioned outdoor air at a rate that is even higher than the required continuous outdoor air rate.
- Third, since the outdoor air rate is higher, the cooling capacity of the unit must be higher due to the higher outdoor air load. For simple single zone AC units (particularly direct expansion systems), increased cooling capacity often means increased fan size and increased supply airflow, which means increased supply air temperature at any given load and higher space humidity.

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- IAQ Procedure for Ventilation
- Performance Based Calculation and Modeling
  - Contaminant Sources
  - Contaminant Concentrations
  - Target Contaminant Levels
  - Perceived IAQ
  - Air cleaning systems

# Indoor Air Quality

## IAQ Procedure System Options:

- Mechanical Air Cleaning
  - Treat Airborne Contaminants
  - Particulate and Vapor (Fume)
- Permits re-circulation of air and reduction of outdoor air requirements
- Effective when ambient outdoor air quality is sub-standard – Urban Environments

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- IAQ Procedure for Ventilation
- Acceptable for Alternative Compliance to IMC/OMC – Chapter 4
- NOT Acceptable for Compliance to USGBC LEED-NC v2.2 EQp1 – Minimum IAQ Performance

# Indoor Air Quality

## ASHRAE 62.1-2007 Basics:

- Construction & Start-up Requirements
  - Requires protection of occupied spaces adjacent to construction zones
  - Required Air Balance of Systems
  - Testing of Condensate Drain Pans
- Similarly – ASHRAE 90.1 requires commissioning of M/E Systems in buildings exceeding 50,000 SF

# Indoor Air Quality

## Summary:

- ASHRAE 62.1-2007 is significantly more complex than current IMC/OMC requirements for ventilation
- Generally, ASHRAE 62 will result in reduced outdoor airflow requirements and, therefore, reduced energy consumption
- USGBC LEED-NC v 2.2 has differing requirements than IMC/OMC for minimum ventilation requirements

# ASHRAE Standard 62 – What Now?

## IAQ Design Overview

# Questions?

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## IAQ Design Overview

# Thank you!

Resources:

www.ashrae.org
www.usgbc.org
www.heapy.com



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