BREATHE EASY WITH PROPER VENTILATION AND INDOOR AIR QUALITY (IAQ)

Tired of stuffy buildings and stale air? Unlock the secrets of healthy indoor environments.

In this course, we will delve into the critical role of ventilation in maintaining good indoor air quality (IAQ). You'll learn ventilation strategies to prevent the spread of airborne diseases and create healthy buildings. Industrial ventilation emphasizes the control of heat and contaminants by dilution ventilation and local exhaust ventilation.

Embedded within the course are essential metrics, practical tips, and handy rules of thumb to help you make well-informed decisions.

Let's get started with essential metrics and rules of thumb.

INDOOR AIR QUALITY

	Description	***Rules of Thumb***
	Indoor Air Quality (IAQ)	*Air quality refers to the overall condition of the air, considering factors like pollutants, temperature, humidity, and ventilation.* *IAQ refers to the quality of the air within buildings, specifically as it relates to the health and comfort of the people who occupy them.*
	Issues with poor IAQ	*Health risks. Two common issues are:* *a. Sick Building Syndrome (SBS): General indoor discomfort.* *b. Building-Related Illness (BRI): Specific illness from a building, e.g., Legionella bacteria in cooling water.* *Good IAQ helps to create a comfortable breathing environment for occupants.*
	Causes of Poor IAQ	*a. Inadequate ventilation or fresh air.* *b. Poor air distribution - inappropriate intake/exhaust air locations* *c. Filter problems - inadequate maintenance, and more.*
	IAQ Improvement Strategies	*a. Source Control: Remove pollution source.* *b. Air filtration: MERV 8 to 13* *c. Adequate ventilation: Fresh air matters! Aim for 15 – 20 CFM per person.*

	Description	*Rules of Thumb*
		d. Air changes per hour: 2 - 4 air changes per hour. *e. Temperature: Typically, around 73-76°F for comfort.* *f. Moisture: Control humidity between 30% - 60%.*

VENTILATION CODES AND STANDARDS

	Description	*Rules of Thumb*
	Codes and Standards	ASHRAE Standard 62. a. ASHRAE 62.1: For public and commercial buildings. b. ASHRAE 62.2: For residential buildings. c. ASHRAE 170: Ventilation Requirements for Health Care Facilities.

VENTILATION STRATEGIES

	Strategy	*Rules of Thumb*
	Natural ventilation	*Wind driven and stack effect (temperature/air density difference).*
	Mechanical ventilation	*a. Utilize fans.* *b. May be designed as supply air, exhaust air and balanced ventilation.* *c. Dilution ventilation for comfort and local exhaust ventilation (LEV) for contaminant control.*
	**Hybrid ventilation**	*Combining natural and mechanical methods.*

NATURAL VENTILATION

	Natural Ventilation Parameters	*Rules of Thumb*
	*Space Coverage*	*a. Effective up to 25 ft depth from exterior openings.* *b. Keep openings @ 5% of floor area.*

	Natural Ventilation Parameters	***Rules of Thumb***
	Cross-ventilation	*a. Effective up to 5x room height.* *b. Windward inlets and leeward outlets optimize airflow.* *c. Aim for 1:1 inlet-outlet area ratio.*
	Single-sided Ventilation	*a. Effective up to 2.5x room height, max 33 ft.* *b. Provide multiple spaced openings.* *c. Design windows at 2-3 ft height for unobstructed airflow.*
	Stack Effect	*a. High elevation aids air movement.* *b. Position inlets at lower levels and exhaust at higher elevation for heat dissipation.*

MECHANICAL VENTILATION

	Type of Ventilation	***Rules of Thumb***
	Supply Air	*Blows fresh air in (common for most comfort areas).*
	Exhaust Air	*Sucks stale air out (ideal for removing heat, pollutants, fumes/contaminants, and odor, found in kitchens, restrooms, and labs.*
	Balanced or hybrid	*Maintains balanced pressure, uses both supply and exhaust (flexible for specific needs).*

MIXING VENTILATION Vs DISPLACEMENT VENTILATION

	Ventilation Type	***Rules of Thumb***
	Mixing Ventilation	*Fresh air mixes with existing air throughout the room (common, but less efficient).* *a. Air velocity > 400 ft/min.* *b. Maintains uniform temperatures.* *c. Needs higher air volumes.* *d. Works for both cooling and heating environments.*
	Displacement Ventilation	*Fresh air displaces stale air at floor level, creating a clean breathing zone. (More efficient, ideal for high ceilings).*

	Ventilation Type	*Rules of Thumb*
		a. Air velocity < 100 ft/min. *b. Best for high ceilings.* *c. Creates vertical temperature gradients.* *d. Generally quieter due to lower air speed.* *e. More suitable for cooling than heating.*

FRESH AIR VENTILATION RATES

	Minimum outdoor air	*Rules of Thumb*
	General spaces	Average range 15–20 CFM per person.
	Smoking lounges	50 - 60 CFM per person
	Restaurants	*10 - 15 CFM per person*
	Retail spaces	*5 - 10 CFM per person*
	Classrooms	*7.5 - 10 CFM per person*
	Auditoriums	*5 - 10 CFM per person*

Refer to Table 6.1, ASHRAE 62.1 for more accurate values. Refer Table below:

Recommended Fresh Air Ventilation Rates based on ASHRAE Std. 62.1

The current ASHRAE Standard 62.1, 2021 (Table 6.1) sets out minimum ventilation rates based on room size and occupancy. In practical terms:

a. If the number of occupants in a room doubles, the ventilation rate should also double.
b. Larger spaces necessitate a greater volume of outside air.

The rightmost column in the table provides the total outside air (OA) rate based on both occupancy and room area.

	People (CFM/person)	Area (CFM/sq. ft)	Occupant density (per 1000 sq. ft)	Combined OA Rate, CFM/person
Classrooms (ages 5-8)	10	0.12	25	15

	People (CFM/person)	Area (CFM/sq. ft)	Occupant density (per 1000 sq. ft)	Combined OA Rate, CFM/person
Restaurants	7.5	0.18	70	10
Hotel Bedroom	5	0.06	10	11
Office space	5	0.06	5	17
Conference/meeting	5	0.06	50	6
Computer rooms	5	0.06	4	20
Warehouses	-	0.06	-	
Auditoriums	5.0	0.06	150	5
Religious places	5.0	0.06	120	6
Libraries	5.0	0.12	10	17
Lobbies	5.0	0.06	150	5
Museums/galleries	7.5	0.06	40	9
Retail mall	7.5	0.06	40	9
Beauty and nail salons	20	0.12	25	25
Pet shops	7.5	0.18	10	26
Supermarket	7.5	0.06	8	15
Disco/dance floors	20	0.06	100	21
Health clubs	20	0.06	40	22
Bowling alley	10	0.12	40	13
Gambling casinos	7.5	0.18	120	9

Refer ASHRAE Std. 62.1, 2019 (Table 6-1) for detailed list.

EXHAUST AIR VENTILATION

ASHRAE Standard 62.1, 2019 (Table 6.2) specifies the extract of exhaust air ventilation rates for various facilities. For complete list refer to the Standard.

	Occupancy Category	Exhaust Rate, CFM/unit	Exhaust Rate, CFM/ft^2	Air Class
	Art classrooms	—	0.70	2
	Auto repair rooms	—	1.50	2

	Occupancy Category	Exhaust Rate, CFM/unit	Exhaust Rate, CFM/ft^2	Air Class
	Barber shops	—	0.50	2
	Copy, printing rooms	—	0.50	2
	Educational science laboratories	—	1.00	2
	Janitor closets, trash rooms, recycling	—	1.00	3
	Kitchenettes	—	0.30	2
	Kitchens—commercial**	—	0.70	2
	Locker rooms for athletic, industrial, and healthcare facilities	—	0.50	2
	Shower rooms	20/50 per fixture	—	2
	Paint spray booths	—	—	4
	Parking garages	—	0.75	2
	Residential kitchens	50/100	—	2
	Storage rooms, chemical	—	1.50	4
	Toilets—public*	50/70 per WC, urinal	—	2

*Recommended: 2 CFM per sq. ft. or 10 air changes per hour, whichever is higher.

**Recommended: Kitchens require higher exhaust rates due to cooking-related pollutants. Aim for a minimum of 100 CFM plus 1 CFM per square foot of kitchen area.

AIR CHANGES PER HOUR (ACH)

	Parameters	*Rules of Thumb*
	Air changes per hour (ACH)	*Number of times the room air is replaced with fresh air in an hour. Higher ACH means more frequent air*