MAZZETTI

ASHRAE RP-1864

Investigating the applicability of Standard 62.1's Ventilation Rate Procedure for Healthcare Rooms

February 1, 2026

ASHRAE Winter Conference 2026

Evaluating VRP for Healthcare Ventilation

Purpose

Determine if the Ventilation Rate Procedure of 62.1 be used for healthcare spaces, potentially reducing energy consumption and greenhouse gas emissions.

Objectives

1. Identify and characterize contaminants unique to healthcare spaces.
2. Assess whether VRP can control these contaminants; develop new values of Ra and Rp if needed.

Approach & Data Sources

Workshops

Interviews & multi-disciplinary workshops with Hospital Partners:

- Stanford Health Care
- Kaiser Permanente
- Nemours Children's Health

Clinical literature review

Extensive literature review conducted by SHC

5,000 articles screened → 300 analyzed for ventilation–contaminant relationships

Stanford HEALTH CARE

Contaminants

Identified contaminants across 158 healthcare spaces (ASHRAE 170 Table 7-1, 8-1, 9-1)

→ Infectious aerosols

→ Gas-phase contaminants

→ Inhalation Anesthetics

→ VOCs

→ particulates

→ cleaning chemicals

Room geometry

Space type data from over 100 projects analyzed to derive mean area, ceiling height, and occupancy for each Standard 170 space type.

Which Contaminants Actually Drive Ventilation?

Infectious aerosols

- Primary contaminant of concern
- Critical metric is clean air delivery per person

Enzyme-based detergents

- Used on scopes in endoscopy rooms
- Aerosolized proteases require dilution of ~245 CFM; ≈ 1.14 cfm/ft² for a 280 ft² room.
- Dilution need is clean air—not necessarily outdoor air

Formalin

- Very low evaporation during specimen collection: 5 open vials ~0.07 ppm (<< OSHA limits).
- Standard precautions: minimize open-container time & use local exhaust in histology/grossing

Methyl Methacrylate (MMA)

- High short-term generation during bone cement mixing.
- Even conservative modeling → 0.01 cfm/ft² keeps exposures <11% of OSHA limit.

Cleaning chemicals (HP/PAA/AA)

- Measured concentrations well below limits even at <1 ACH
- Chemical decay dominates over ventilation.

Nitric Oxide

- NICU fugitive emissions extremely low
- Modeled levels <1% of OSHA limit. Ventilation does not drive control needs.

Nitrous Oxide

- Only contaminant where VRP may not apply—requires dedicated research.

Minimum Ventilation Rates by Contaminant

Key	Contaminant	Min Room Vent Rate*	Unit	OA Required?
1	Formalin	0.12	cfm/ft^2	Yes
2	Enzyme-based detergents	245	cfm	No
3	Lint	0	cfm	No
4	Methyl Methacrylate	0.01	cfm/ft^2	Yes
5	Cleaning Products Containing Hydrogen Peroxide, Peracetic Acid, & Acetic Acid	0.15	cfm/ft^2	No
6	Ethanol	0.06	cfm/ft^2	Yes
7	Bleach (Sodium Hypochlorite)	0.06	cfm/ft^2	Yes
8	Nitric Oxide	0.06	cfm/ft^2	Yes
9	Nitrous Oxide	N/A		Yes

* Room dilution requires clean air. Room exhaust or OA at system provide system-level control, where OA is required.

Infectious Aerosols

- Space-by-space comparison reveals ***no discernible correlation*** between S170 ACH and S241 Equivalent Clean Airflow (ECA)
- Aerosol generation correlates to occupancy, not room volume.
- Effective mitigation depends on clean air delivery, air distribution and other factors, of which ***outdoor air ventilation is only one component***.

Proposed Values of Ra & Rp

Area: Ra (cfm/ft^2)

Group	Ra	Description
0	0	Space is normally unoccupied and is exhausted so do not need to dilute return air; no outdoor air required
1	0.06	No significant space-related contaminants other than routine cleaning that occurs typically once per day.
2	0.12	No significant space-related contaminants other than cleaning and disinfection that occurs multiple times per day.
3	0.18	There may be significant space-related contaminants and/or frequent cleaning/disinfection.
4	0	Higher contaminant generaton rates may exist in space, but minimum total room airflow will provide dilution within the space. The space is exhausted, so system-level dilution is not required.

People: Rp (cfm/person)

Activity Level	Ventilation Rate, Rp
Mostly Sedentary	5 cfm/person
Light activity such as standing or walking, or mostly sedentary but more vocal	7.5 cfm/person
Moderate aerobic activity – more than just standing or light walking, or with vocalization	10 cfm/person
Moderate to high activity, maybe combined with moderate to high vocalization	20 cfm/person

Conclusions

- ACH is not evidence-based
- Contaminant generation is related to activity and occupancy, not room volume
- Standard 170 ACH over-ventilates ~85% of spaces, resulting in excess energy consumption & GHG emissions
- VRP works for most contaminants
- Clean air delivery rate, ventilation effectiveness are key metrics

Recommendations

Next Steps

- Adopt VRP for all healthcare spaces except those using inhalation anesthetics
- Adopt the proposed Ra and Rp values – do not retrofit them to mimic current ACH tables
- Adopt Standard 62.1 Air Classification method for recirculation rules – customized for healthcare contaminants

Future Focus

- Develop a clean airflow standard for minimum airflow to each space
- Research ventilation needs for inhalation anesthetics

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