Promoting Health & Wellbeing through Indoor Air Quality Optimizations

Why?

Americans spend an average of 87% of time indoors.

Provide buildings that don’t adversely impact health

- *Sick Building Syndrome*: a condition in which people in a building suffer from symptoms of illness or become infected with chronic disease from the building in which they work or reside.

Why?

Acceptable Indoor Air Quality (IAQ): air toward which a substantial majority of occupants express no dissatisfaction with respect to odor and sensory irritation and in which there are not likely to be contaminants at concentrations that are known to pose a health risk

What?

Ventilation air: the minimum amount of outdoor air required for the purpose of controlling air contaminant levels in building

Supply = dilution

Exhaust = source control

Clean air

- Filtration: particulate or odor

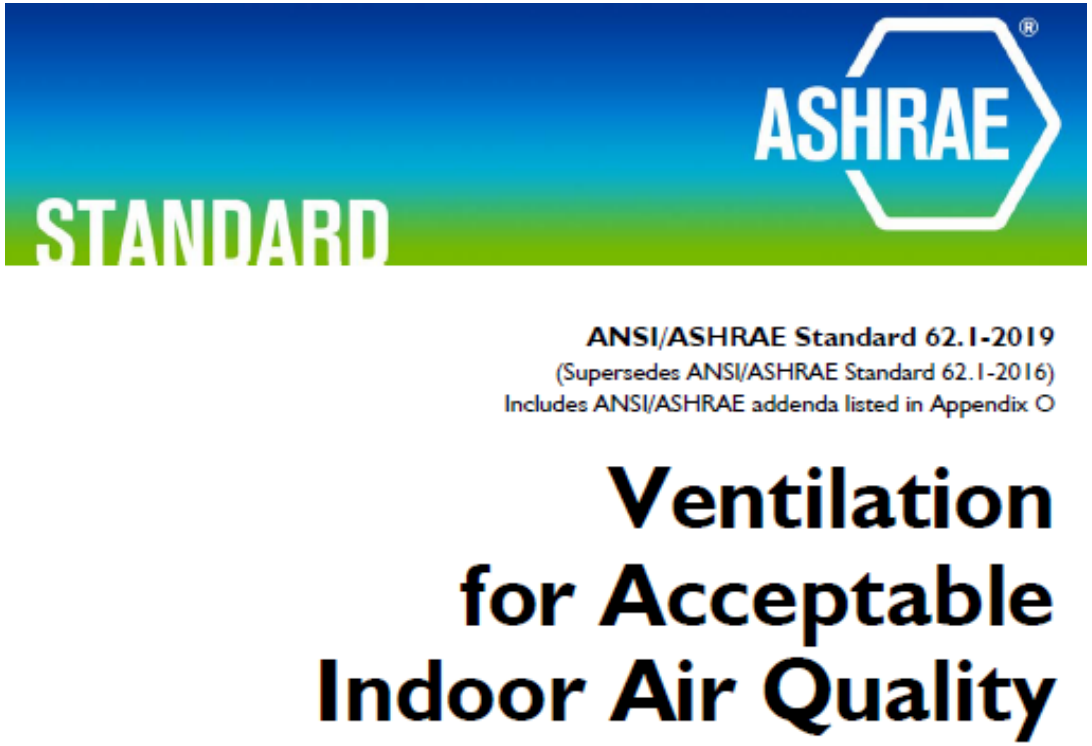
Removing Building Contaminants

Standard of care for indoor air quality

Dilution
- Building Type Significantly impacts
- Minimum OA%
  - 10 – 25% typical of most buildings

Filtration
- MERV 8 in most instances
  - ≈5% of most common droplet size

Combined Effectiveness
- 14-28%

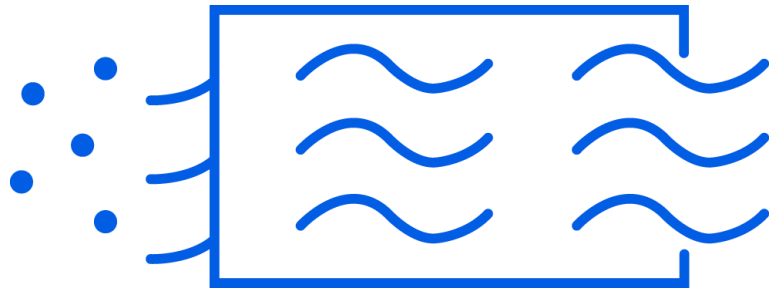


1 Perform system assessment / RETRO-COMMISSIONING

- Systems can **VARY** from original design parameters as much as **10-30 PERCENT**
- Determine a Baseline of Current System Performance and Potential Opportunities for Improvement
  - Filters
  - Outdoor air issues
  - Sequences that affect outdoor air amounts (Fan cycling, DCV & Economizers)
  - Consider Test and Air Balance (TAB) to assess filter change potential

2 Improve filtration

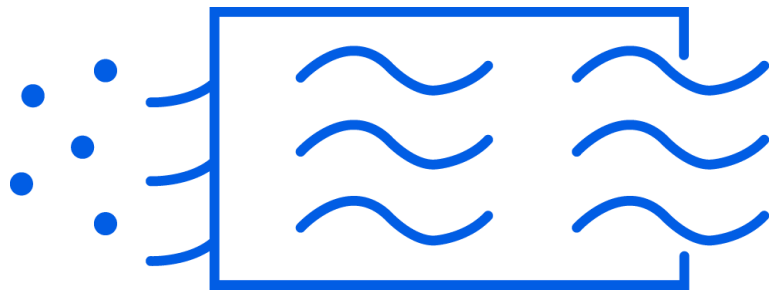
- **MODIFY FILTER RACKS** to accept higher capacity / effective filters (MERV-13, etc.)



- **IMPROVE EDGE SEALS** on filter racks to reduce bypass air
  - Pros – Life cycle effectiveness, additional air cleanliness
  - Cons – increased fan energy, first cost impacts, increased filter cost, feasibility determined on individual equipment basis

2 Improve filtration

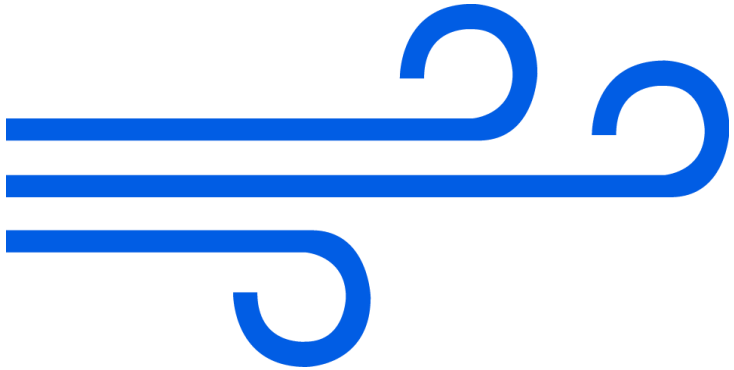
- **Room recirculation units with HEPA or MERV 16 filter.**



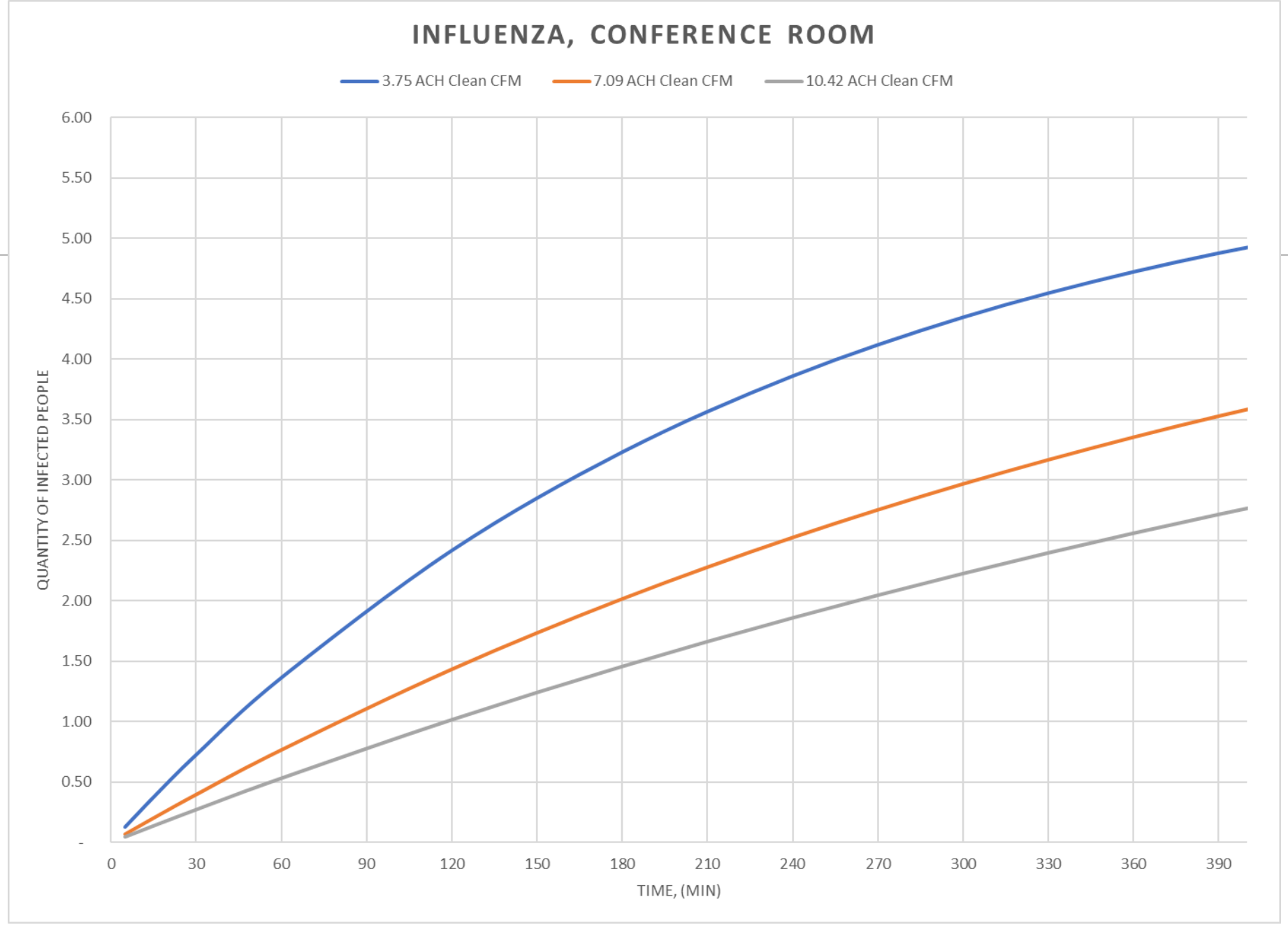
- **High Occupant density Spaces or spaces with low MERV filtration**
  - Pros – Life cycle effectiveness, IAQ benefits, increases ACH
  - Cons – increased fan energy, first cost of units, noise, maintenance cost

3 Increase ventilation / dilution

- **INCREASE** the quantity of **AIR** introduced to a **SPACE VIA** the **HVAC** Systems

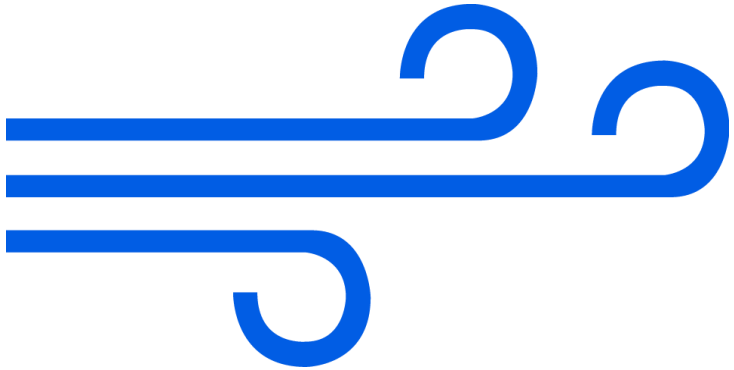


- Extend operating hours
  - Efficacy tied to filter rating and OA percentage
  - Pros – Low first cost
  - Cons – Additional fan power usage, potential additional cooling and heating of outdoor air


INFLUENZA, CONFERENCE ROOM
3.75 ACH Clean CFM
7.09 ACH Clean CFM
10.42 ACH Clean CFM
QUANTITY OF INFECTED PEOPLE
6.00
5.50
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
-
0
30
60
90
120
150
180
210
240
270
300
330
360
390
TIME, (MIN)

3 Increase ventilation / dilution

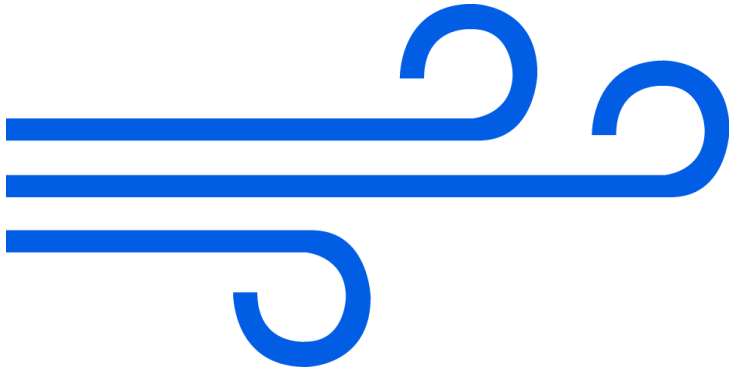
- **INCREASE** the quantity of **AIR** introduced to a **SPACE VIA** the **HVAC** Systems



- Turn off fan cycling (increase ACH)
  - Efficacy tied to filter rating and OA percentage
  - Pros – Low first cost, IAQ improvements
  - Cons – Additional fan power usage, potential additional cooling and heating of outdoor air

3 Increase ventilation / dilution

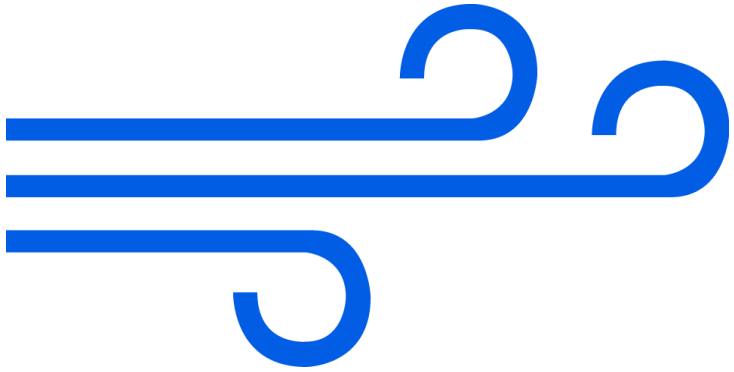
- **INCREASE** the quantity of **AIR** introduced to a **SPACE VIA** the **HVAC** Systems



- Raise VAV box minimums (increase ACH)
  - Efficacy tied to filter rating and OA percentage
  - Pros – Low first cost, maintenance
  - Cons – Additional fan power usage, additional cooling and heating energy usage, may need BAS contractor, exist equipment limitations

3 Increase ventilation / dilution

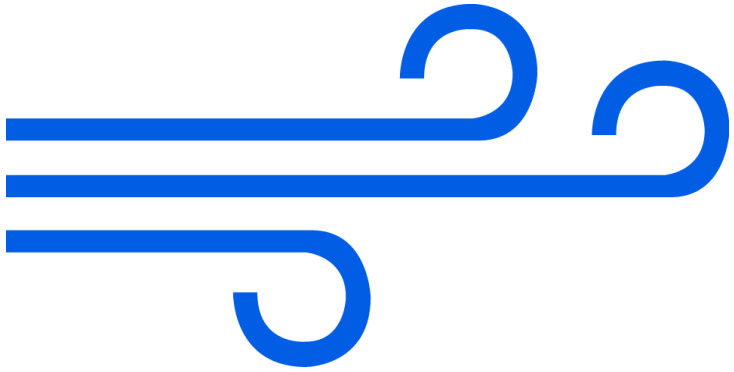
- **INCREASE** the quantity of **OUTDOOR AIR** introduced to a **BUILDING VIA** the **HVAC** Systems



- Reset Outdoor air setpoint
  - Pros – Low first cost (no new equipment)
  - Cons – higher heating and cooling energy usage, need to engage professionals to determine limits of equipment and set

3 Increase ventilation / dilution

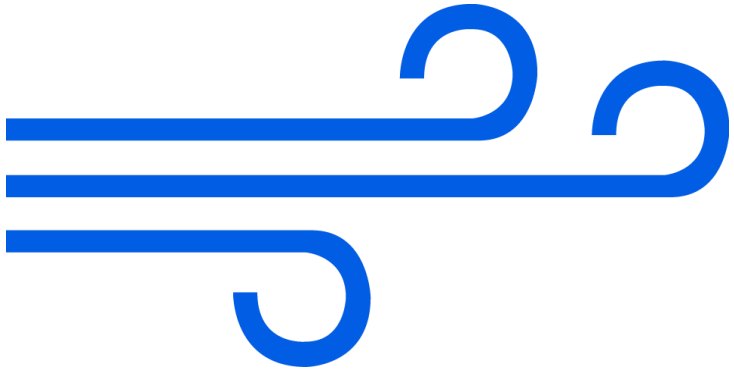
- **INCREASE** the quantity of **OUTDOOR AIR** introduced to a **BUILDING VIA** the **HVAC** Systems



- Reset Demand Control Ventilation Setpoints (typical of high occupancy spaces)
  - Pros – Low first cost
  - Cons – higher heating and cooling energy usage

3 Increase ventilation / dilution

- **INCREASE** the quantity of **OUTDOOR AIR** introduced to a building **VIA** the **HVAC** Systems



- Controls sequence to maximize outdoor air
  - Pros – Low first cost, IAQ benefits, low maintenance, enable disable
  - Cons – Limited by equipment, strong potential high operating cost, requires BAS contractor engagement

4 EMPLOY VIRUS INACTIVIATION TECHNOLOGIES

- UVGI (ultraviolet germicidal irradiation)

- Upper Room UVGI Targeting high occupant density areas (waiting rooms, breakroom)
  - Can be equated to increased ACH
- Install in Ductwork and in equipment
  - Great for mold and bacteria, less effective at viruses due to dwell time

4 EMPLOY VIRUS INACTIVIATION TECHNOLOGIES

- BPI (Bi-Polar Ionization)

- Beware of Ozone development;
  - Pros – Maintenance, improved IAQ benefits, terminal unit application
  - Cons – Difficult to quantify benefits

The Kroger Co. IAQ Actions

- Monitor IAQ
- Open Fresh Air Dampers to Maximum System Can Handle
- Increase Filtration
- Photohydroionization (PHI)
- Verification

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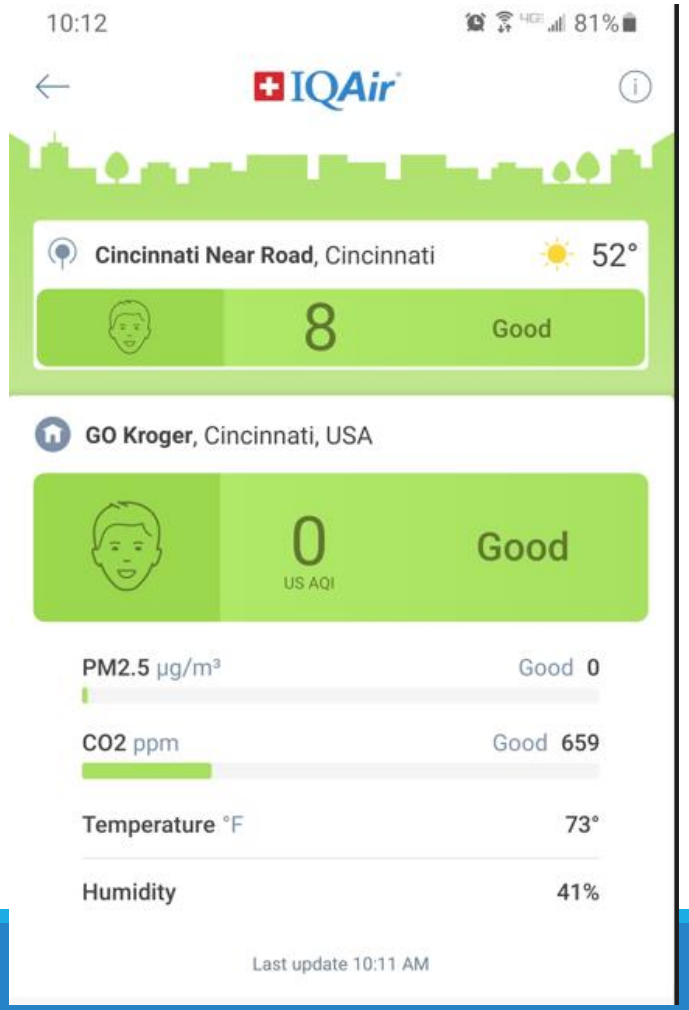
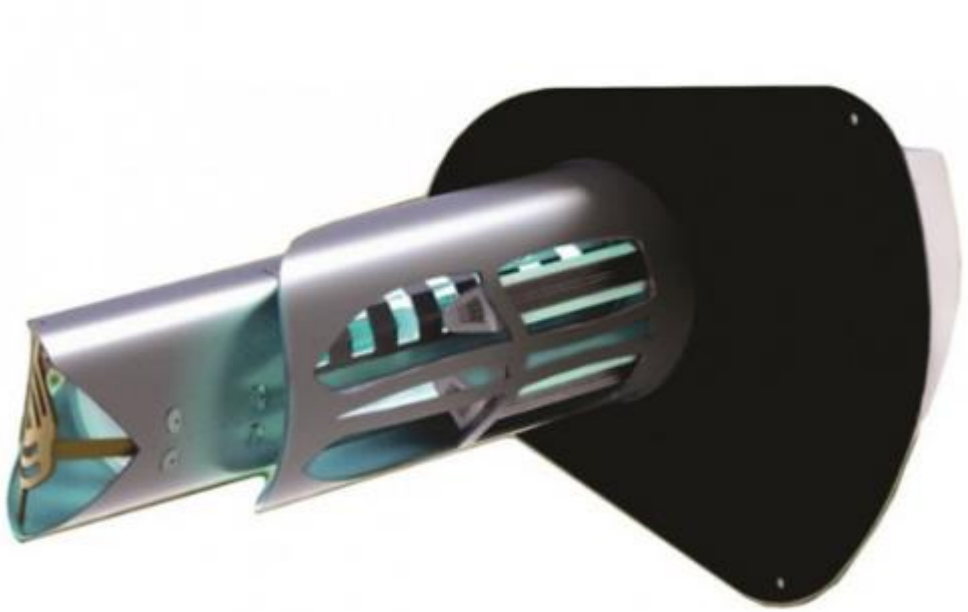
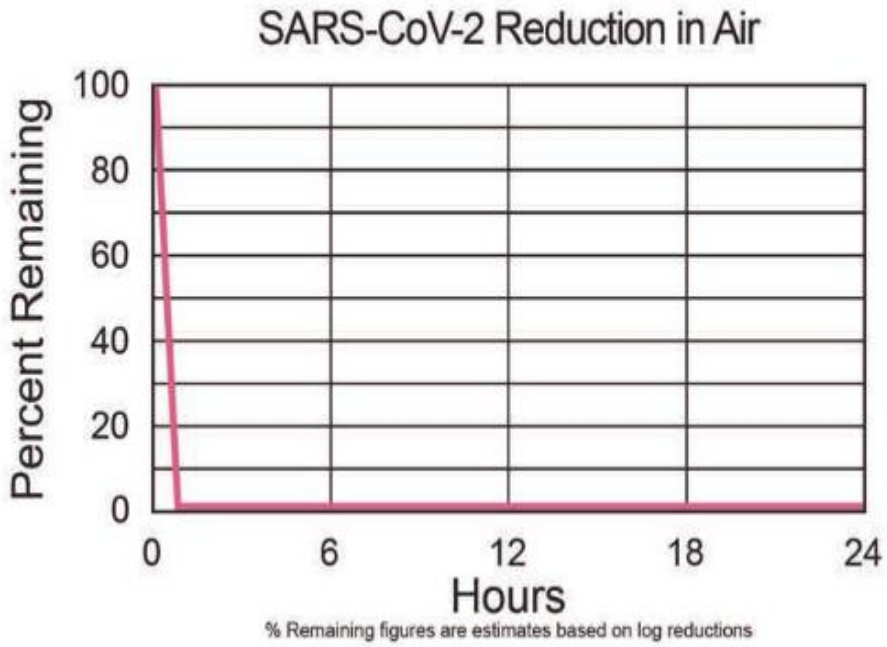
The Kroger Co. IAQ Actions



The Kroger Co. IAQ Actions

Testing summary: >99.8% inactivation of the airborne SARS-CoV-2 virus within the occupied space based on the direct air sampling method





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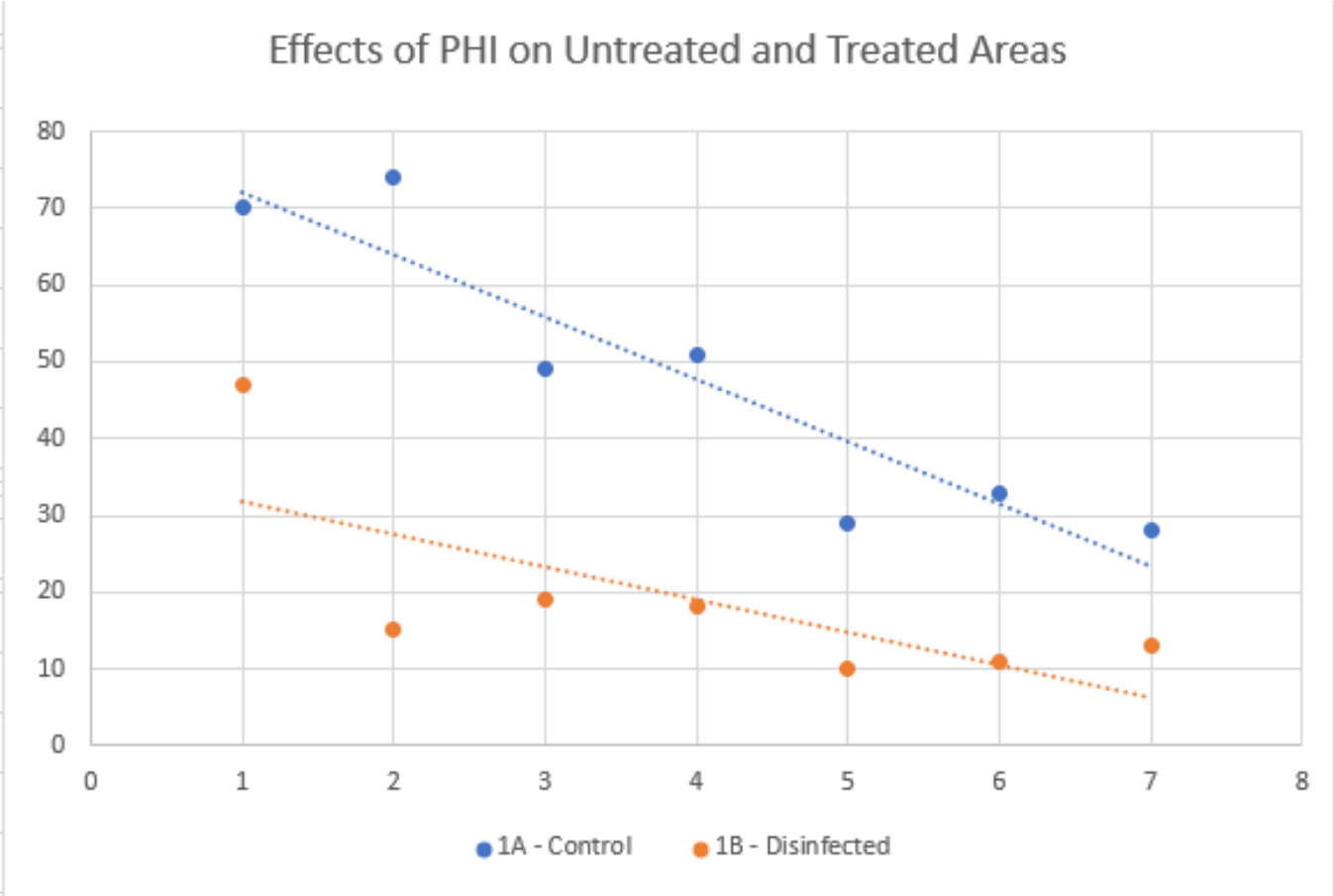
The Kroger Co. IAQ Actions



The ATP test is a process of rapidly measuring actively growing microorganisms through detection of adenosine triphosphate, or ATP.

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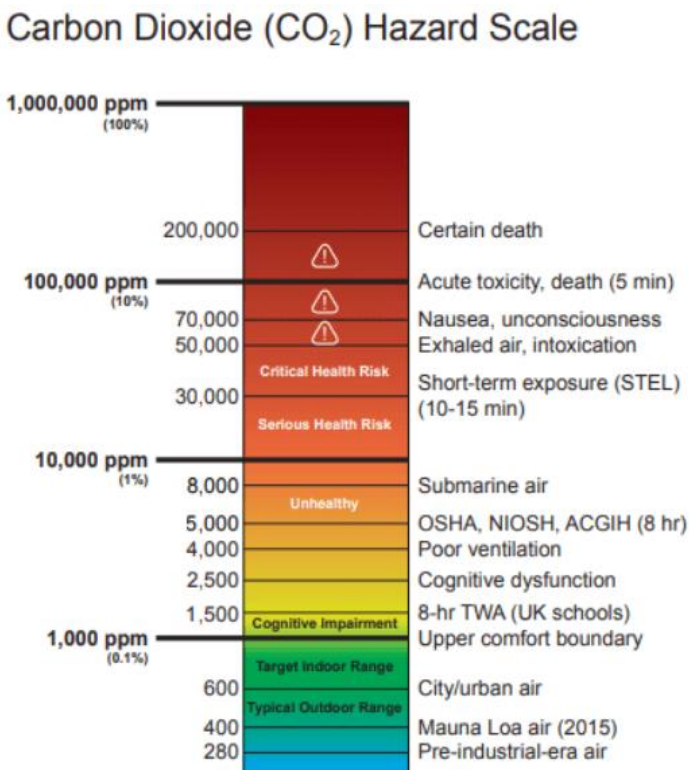
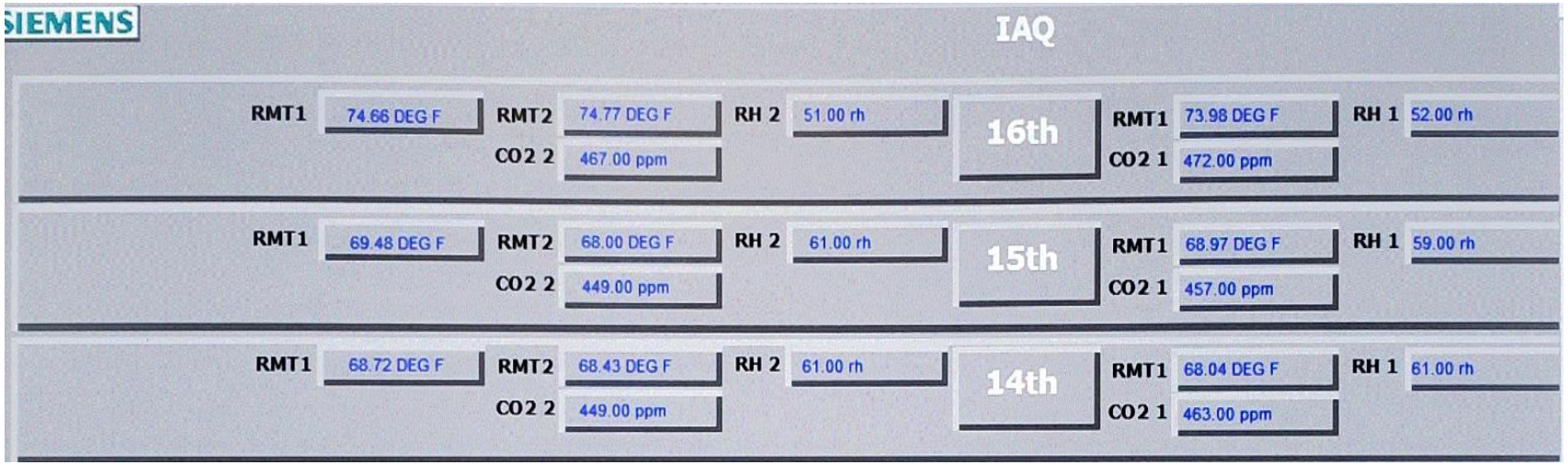
Procter & Gamble – Health & Wellness Management Ventilation Systems

- Employee Health & Wellness Training
- Design HVAC Systems to ASHRAE Standards (55 and 62)
- Computerized Maintenance Management System
- Advanced Building Diagnostic Systems
- Monitoring of Temperature/Humidity/CO2

Procter & Gamble – Health & Wellness Management Ventilation Systems





Procter & Gamble – Health & Wellness Management Ventilation Systems