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Assess and Address School IAQ: How to Move Beyond 'Acceptable' Air Quality

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Agenda

- What is Indoor Air Quality?
  - How are buildings ventilated?
  - How do we clean the air?
- Measuring Indoor Air Quality
  - Rating IAQ

IAQ and Building Ventilation

Acceptable IAQ

- ***acceptable indoor air quality:*** air in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction.

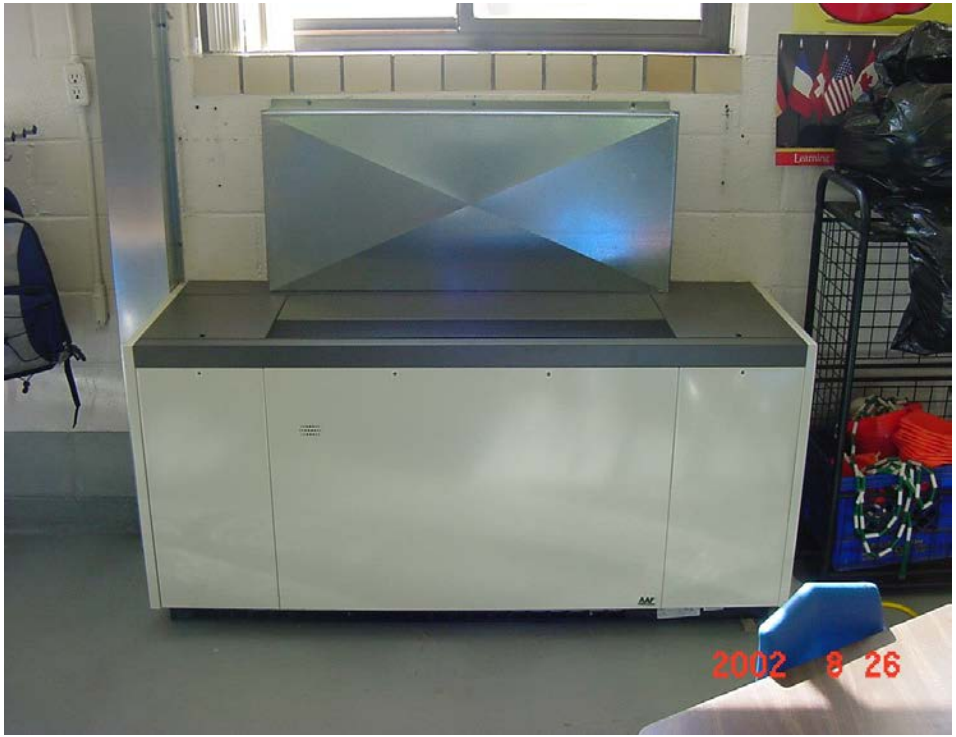
K-12 School Ventilation and Filtration

- Indoor air quality can be improved by:
  - Increasing outdoor air delivery to the building (ventilation)
  - Removing particulates/viral particles from the air (air filtration)
- Ventilation and filtration together can reduce the risk of COVID-19 transmission
  - Walls and barriers interfere with airflow and ventilation

Heating, Ventilating and Air Conditioning (HVAC) Systems

- **Air Handling Unit**
  - Provides filtration, temperature control, and distributes the air
- **Outdoor Air Intake** or **Make-up Air Return**
  - This air replaces indoor air as it is exhausted from the building
- **Duct work**
  - Directs conditioned air in the building

Unit Ventilators



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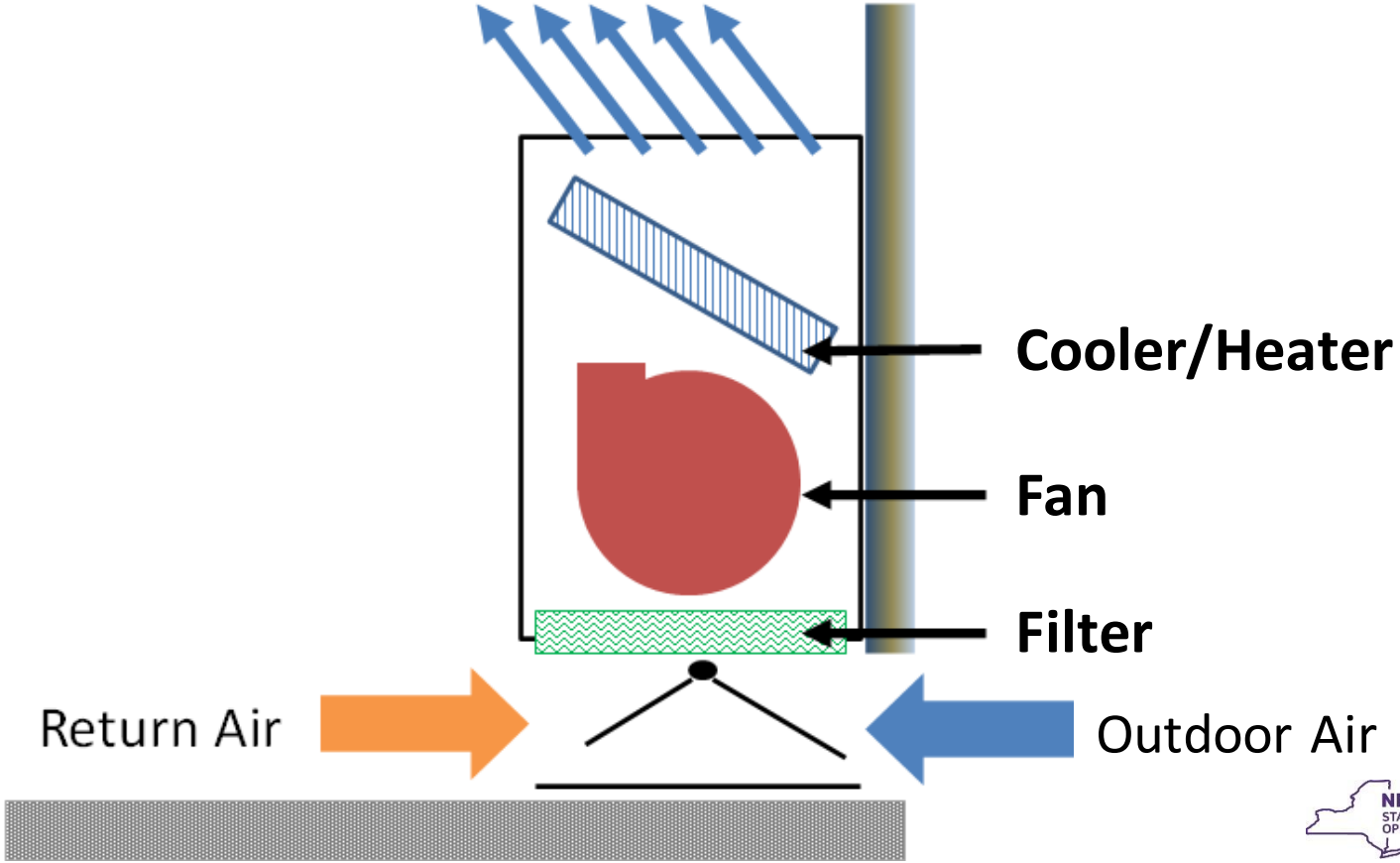
Cooler/Heater
Fan
Filter
Return Air
Outdoor Air

Improve Ventilation

Minimum standards must be met

- Openable windows should be 4% of classroom floor area
  - 30 ft. x 30 ft. x 4% = 36 sq. ft. of openable windows
- Mechanical ventilation should supply 300 to 450 cfm of outdoor air for a typical classroom
  - Assembly spaces, shops and labs normally require more outdoor air

Consult your school's Engineer/Architect or NYSED Facilities Planning about improving ventilation

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Filtration of Centralized HVAC Systems

- Check and replace existing unit air filters as per manufacturers' instructions
- Upgrade to a filter with a Minimal Efficiency Rating Value (MERV) of MERV 13, or the highest rating compatible with existing equipment

Improve Air Filtration

CDC and ASHRAE:

"Aim to achieve filtration… similar to a MERV 13 filter…"

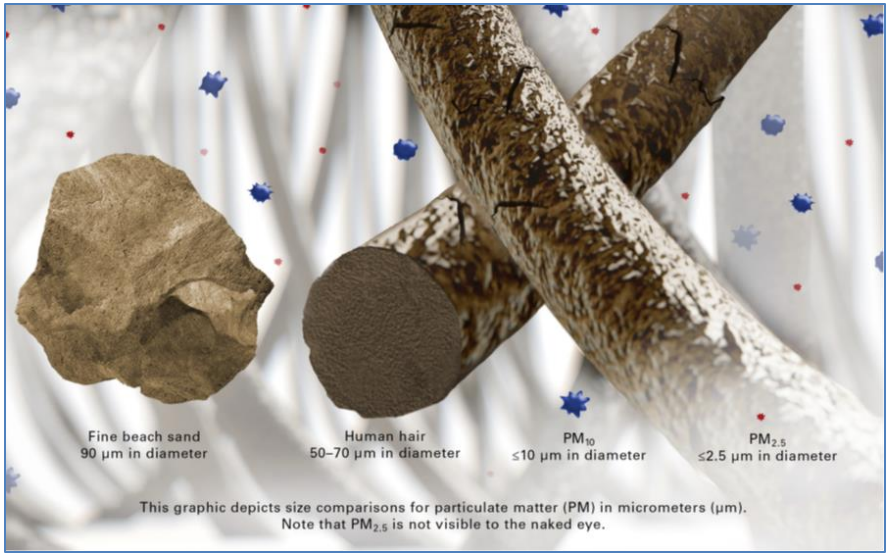
MERV 13 filter removes:

>90% of particles 3.0-10.0 µm

>85% of particles 1.0-3.0 µm

>50% of particles 0.3-1.0 µm

- https://www.ashrae.org/technical-resources/filtration-disinfection#mechanical



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Ventilation Summary

- Where possible, promote cross ventilation by opening windows and doors to increase air flow
- Consider using portable air cleaners in rooms that have minimum fresh air supply and in other rooms where ventilation is limited due to cold weather
- Consider using fans to cross ventilate rooms
- Prepare for colder months, when windows are closed

Use of Portable Air Cleaners in Schools

Why focus on air cleaners?

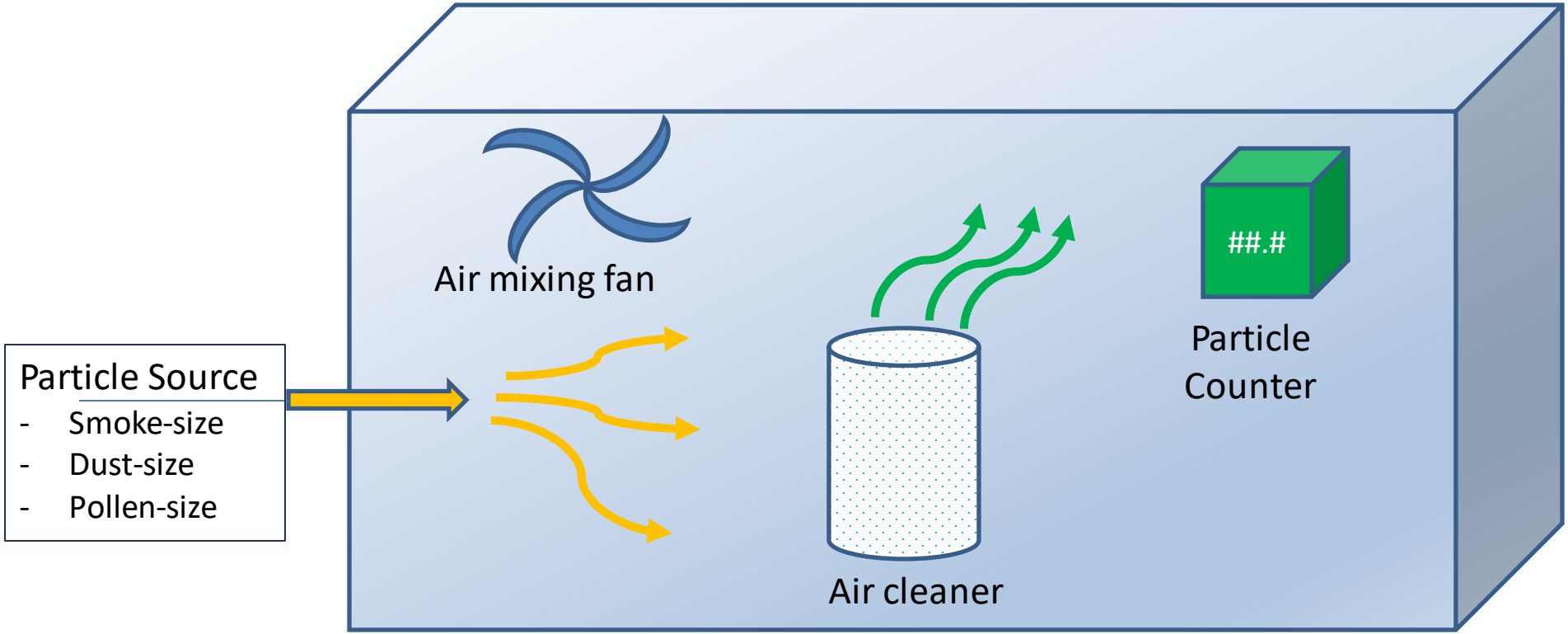
- Health benefits beyond COVID
  - Flu, colds, asthma
  - Particle removal – dust, mold
  - Chemical removal – VOCs and some odors
- Can be installed and operated where needed
- Can be placed and relocated easily
- Cost-effective and available for Fall 2022

How to select them for your school?

Portable Air Cleaners

- Use these devices in single rooms with closed door and windows
- Be sure the device is sized appropriately with the correct Clean Air Delivery Rate (CADR)
- Use the CADR rating of the device for tobacco smoke when comparing air cleaners, as this rating corresponds most closely with airborne viral particle sizes of concern
- Air cleaners should contain a high-efficiency particulate air filter or MERV 13 or greater filter efficiencies
- Units that feature ionizers, precipitators, or ozone generators do not provide additional benefit and can generate harmful byproducts

Clean Air Delivery Rate (CADR)



Reading the CADR label

Suggested Room Area

Clean Air Delivery Rate in CFM for Smoke, Dust, Pollen

- Select air cleaners so that you have higher CADR than your room air supply rate (>300-450 cfm)
- If you use multiple air cleaners, the total CADR is the sum of the air cleaners
- CADR is typically measured at the air cleaner's highest speed, which may be too noisy for classrooms

https://www.epa.gov/indoor-air-quality-iaq/guide-air-deaners-home
This is an example of a label from a portable air cleaner

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Blue Light Special?

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Biological Inactivation or Sterilization

- Ultraviolet Germicidal Irradiation (UVGI)
  - Used in clinical settings to prevent TB spread
  - UV has been shown to affect viruses, bacteria and humans
- What are the health risks and safety standards?
- What amount of UV is needed? – "Fluence" – UV dose
- What kind of UV light – UVA, UVB, UVC, far-UV?
  - No official labeling system for identifying lights
- How long does it take to sterilize different bioaerosols?
    - FDA – '4 log reduction' for air purifiers
- How much of the treated air is exhausted versus recirculated?

Not recommended by DOH/SED for schools

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Destruction and Decomposition

- Ionizers, ozone generators, photocatalytic oxidation, dry hydrogen peroxide, hydroxyl generators, etc.
- Chemical and Physical processes to form products in air
  - What is produced and how do the products affect humans, mold, bacteria, viruses?
  - What are the other chemical reactions that it causes in indoor air?
  - How long does it take versus how fast is the room air change rate?
  - How much of the treated air is filtered, exhausted and recirculated?
- No industry standards or oversight

Not recommended by DOH/SED for schools

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Other Technologies

Foggers, disinfectants, air fresheners, nano-treated surfaces, etc.

- "FDA does not intend to object to the distribution and use"
- "FTC is tracking complaint data related to coronavirus and taking actions against scammers…"
- EPA testing is limited and resource intensive

NYSDOH will review the scientific evidence on a case-by-case basis

NYSDOH will not comment on specific appliances or manufacturers

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Case Studies of Portable Air Cleaners in Schools

NYC Air Cleaners in Schools

- First priority was to ensure adequate ventilation per CDC guidelines. Air purifiers were provided as a supplement to normal ventilation
- Initial plan was to use air purifiers in 'at-risk' spaces (nurses' stations) but rapidly changed to all occupied rooms
- NYC spent $85,000,000 to install air purifiers in 62,000 rooms
  - Two air cleaners in each classroom provides ~2.4 ACH
- They surveyed over 30 different types of units before selecting hybrid technology (air filters and electrostatic precipitators) with minimal ozone (UL and CARB compliant)
- NYCDoHMH study of COVID-19 in NYC schools found relatively low infection rates as students returned full-time to in-person class in Fall 2020
  - Pediatrics (2021) 147 (5): e2021050605. https://doi.org/10.1542/peds.2021-050605

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Erie County Air Cleaners for Schools

- 10,600 air filtration units ordered for every K-12 classroom in Erie County
  - https://www2.erie.gov/health/index.php?q=press/erie-county-department-health-funds-air-filtration-equipment-k-12-schools-erie-county
- Erie County Department of Health has invested just under $5.3 million using CDC ELC COVID-19 Funding
  - https://www.cdc.gov/ncezid/dpei/elc/covid-response/index.html

Albany County Air Cleaners

- **County Executive McCoy Announces Purchase of 5,000 Air Purifiers for K-12 Schools**
- The County Executive's Office worked closely with the Albany County Department of Health and local districts to provide air purifiers for every school that requested the technology for an additional layer of COVID-19 protection

https://www.albanycounty.com/Home/Components/News/News/2021/59

Outline of a Classroom IAQ Rating System

What is the IAQ in a Classroom?

Use a composite index of ventilation rate, particle filtration, and temperature control

- **A – exceeds standards**
- **B – meets standards**
- **C – needs improvement**

Dashboard reporting and transparency

Seasonal performance; Intra- and Inter-school comparisons; other environmental impacts

Tailor Existing Standards and Methods for IAQ Assessment

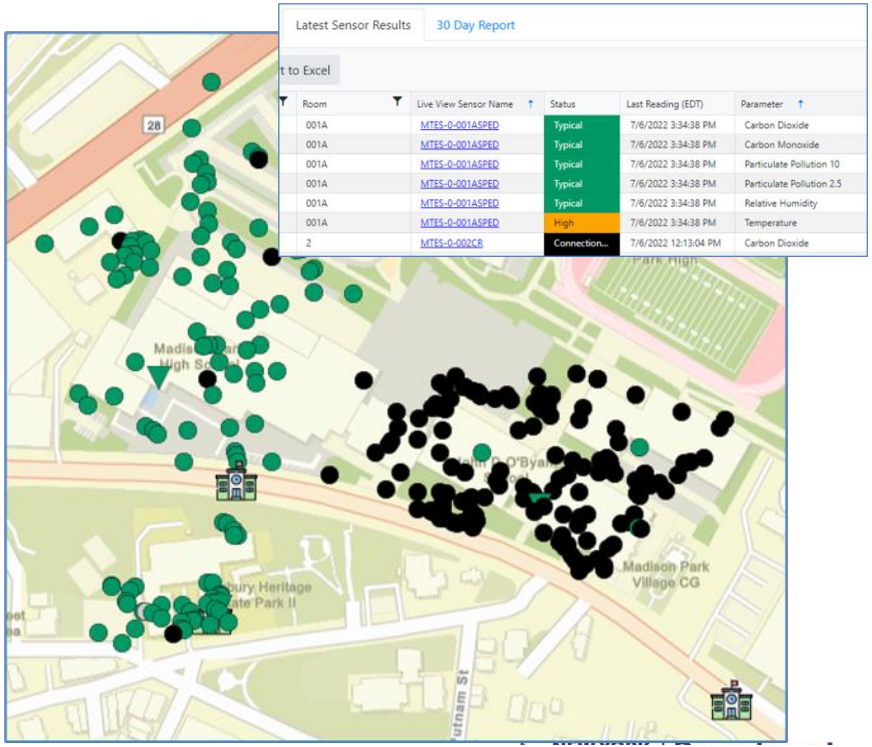
- **Checklists.** EPA Tools for Schools, NEMI Ventilation Verification and Energy Optimization Assessment
- **Standards.** ASHRAE Standards for Ventilation, Thermal Comfort; Uniform Code
- **Methods.** EPA, OSHA, ASTM, AIHA, Harvard School of Public Health

Outline of Steps

- Visual assessment – site walkthrough and evaluation of operations
- Ventilation measurement – rate of fresh air supply in ‘Air Changes per Hour’ (ACH)
- Filtration measurement – testing performed in rooms
- Temperature comfort – maybe seasonal approach?
- Data – acquisition, cleanup (formatting), reduction and calculations
- Reach out to SEHP if you’d like to get involved

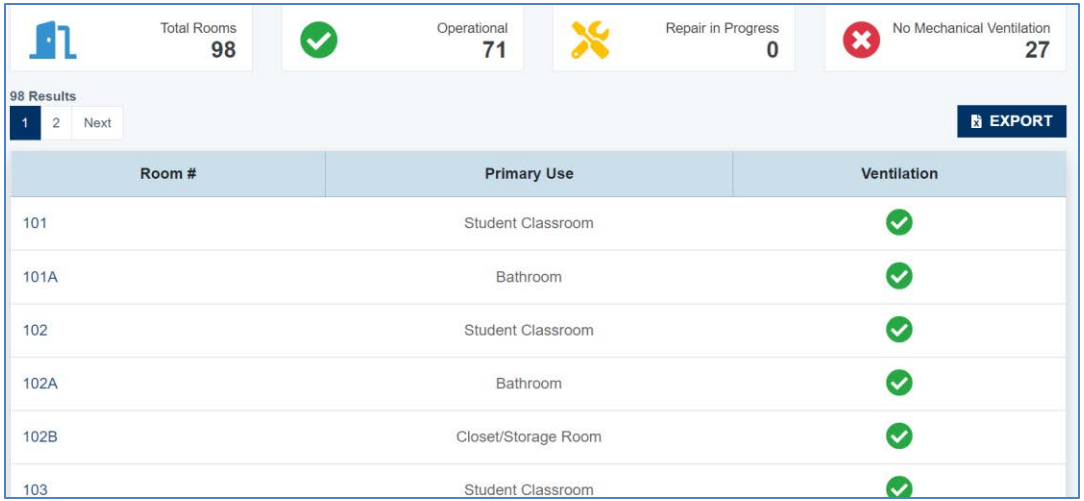
Some Existing Models

- **NYCDOE** – School Building Ventilation Status
- **Boston Public Schools** – Air Quality and Air Exchange Testing Results
- **Los Angeles Unified School District** – Know Your Air Network
- **Vermont** – Explorations in School Indoor Air Quality



Example – Boston dashboard

NYCDOE Ventilation Tracker



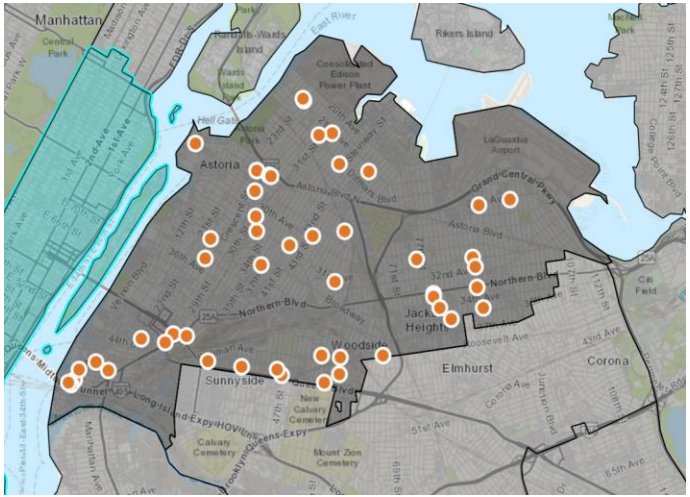
Total Rooms	Operational	Repair in Progress	No Mechanical Ventilation
98	71	0	27

98 Results

1 2 Next

EXPORT

Room #	Primary Use	Ventilation
101	Student Classroom	✓
101A	Bathroom	✓
102	Student Classroom	✓
102A	Bathroom	✓
102B	Closet/Storage Room	✓
103	Student Classroom	✓



- The NYCDOE Ventilation Tracker shows which classrooms have correctly operating ventilation systems
- Website is updated when reports are received from each school
  - https://schoolsearch.schools.nyc/

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The following slides are for reference and illustration as needed

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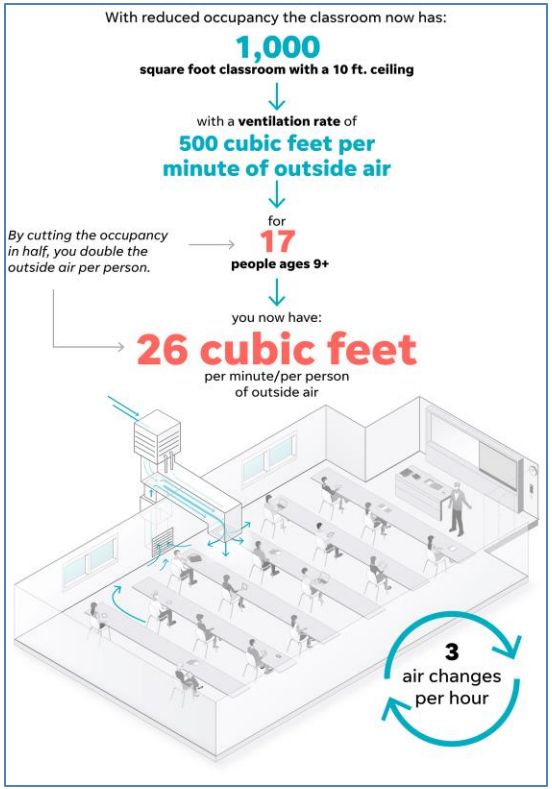
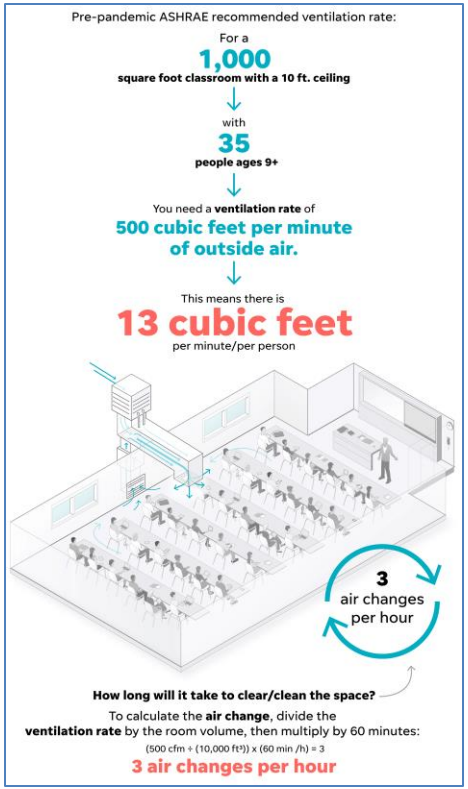
Observations

Room Ventilation





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