

School HVAC Systems and COVID-19 Risk Reduction

Public School Capital Outlay Oversight Task Force

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Presenter:

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New Mexico Public School Facilities Authority

Partnering with New Mexico's communities to provide quality, sustainable school facilities for our students and educators.

Agenda

- **PED Reentry Requirements for Schools in NM**
- **ASHRAE Guidelines**
- **HVAC Projects in Schools**
- **Ventilation vs Filtration**
- **Air Cleaners, Purifiers, and Disinfecting Technologies**
- **Recommendations**
- **Questions**

PED Operational Requirements for Reentry

1. Reentry Guidance Document

- Ensure ventilation systems operate properly and increase circulation of outdoor air as much as possible, as long as this does not pose a safety or health risk to students or staff.
- https://webnew.ped.state.nm.us/wp-content/uploads/2020/07/20NMPED_ReentryGuide.pdf

2. COVID-19 Response Toolkit Document

- Ventilation system upgrades and improvements will increase the delivery of clean air and dilute potential contaminants within each classroom and school facility. The NMPED will be deploying the ASHRAE recommendation which states the target level for filtration in schools is minimum efficiency reporting value (MERV) 13 or higher. On average, this will remove 75 percent of particle size of 0.3 to 1.0 μm .
- https://webnew.ped.state.nm.us/wp-content/uploads/2020/09/NMPED_COVID19ResponseToolkit_ELEMpublic.pdf

PED COVID-19 Response Toolkit (cont.)

- In instances where MERV 13 filters are not available or not compatible with existing HVAC systems, the NMPED will work with those districts and schools to identify the highest quality compatible filters.
- Additionally, districts and schools unable to immediately install MERV 13 or its equivalent must work with their operations staff to take the following actions in accordance with the guidelines from the CDC:
 1. Run the central air fan continuously;
 2. Open dampers to increase air flow;
 3. Open windows and doors (be mindful of possible safety considerations);
and;
 4. Deploy box fans or other portable fans and air purifiers with high air circulation capacity in addition to prioritizing the use of these items in classrooms with higher ventilation needs.

PED COVID-19 Response Toolkit (cont.)

PED School Safety Plan Checklist includes the following certification:

- You have an established and written **protocol on inspecting, repairing, and providing maintenance on ventilation systems** within your buildings.

Filtration levels (MERV ratings) shall be maximized for equipment capabilities. MERV 13 filters shall be used in HVAC systems that are compatible with that type of filter. Systems that are not compatible with a MERV 13 filter shall use the filter with the highest MERV rating compatible with the system.

What is ASHRAE?

American Society of Heating, Refrigerating, and Air Conditioning Engineers

- Founded in 1894, ASHRAE is a global professional society of over 55,000 members committed to serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields.
- Develops and implements standards for building systems performance.
- ASHRAE guidelines and standards are integrated into the International Building Code (IBC), Mechanical, Plumbing, Electrical, Fire, and Energy.

ASHRAE's Position on COVID-19

- Transmission of SARS-CoV-2 through the air is sufficiently likely that airborne exposure to the virus should be controlled. Changes to building operations, including the operation of heating, ventilating, and air-conditioning [HVAC] systems, can reduce airborne exposures.
- There is broad variation of complexity, flexibility, and age in HVAC equipment, systems, controls and Building Automation Systems (BAS) in educational facilities.
- Working with an engineer or qualified HVAC technician, ASHRAE guidance should be applied to each unique climate zone, unique school building, and individual HVAC system.
- **Fundamental goal: increase outside air to the spaces and treat return air.**

ASHRAE Recommendations for HVAC Systems

1. **Assess** the existing HVAC system design and condition of components.
2. **Increase ventilation:** deliver more outdoor air into the building.
 - Diluting indoor contaminants with outdoor air is a first line of defense against aerosol transmission of COVID-19.
 - Pre- and post-occupancy fresh air purges are recommended.
3. **Improve filtration:** install MERV-13 filters, if this will not adversely impact the performance of the existing system.
4. **Clean the air:** install air purifiers, air cleaners, and disinfection devices to supplement efforts to increase ventilation and improve filtration.
5. **Energy use considerations:** develop local solutions that are functional with the existing HVAC systems and economically viable.

School HVAC Replacement Projects

1. HVAC replacement projects in schools are disruptive, costly, slow, and tend to include scope creep and unforeseen conditions.
2. To replace heating and cooling systems with new, sophisticated systems capable of functioning with increased (variable) outdoor ventilation rates and improved filtration up to MERV13, the following assumptions can be made:
 - \$1 M to \$5 M per school site to replace/upgrade HVAC systems.
 - 12 to 24 months to complete a typical HVAC replacement project (procurement, design, and construction).
 - Many districts will struggle to maintain sophisticated HVAC systems throughout the life of the equipment.

Ventilation vs Filtration

- Ventilation and filtration goals compete and must be balanced.
- ASHRAE recommends increased outdoor air ventilation rates as the first step to dilute COVID-19 droplets and aerosol particles in classrooms.
 - Dilution of contaminants can occur within the classroom before these contaminants can be filtered.
- Installation of MERV13 filters will reduce outdoor air ventilation rates in existing systems.
 - Higher MERV ratings = more restrictive filter.
 - Smaller particles are captured, including some aerosol virus particles.
 - Less air can pass through more restrictive filters.

Ventilation Considerations

1. Outdoor air ventilation rates can be increased by opening windows and doors or by running mechanical systems:
 - Electrical fans draw outdoor air through exterior louvers and push the air through indoor spaces and out of the building.
2. Increased outdoor air ventilation rates will stress existing HVAC systems and will increase heating and cooling costs.
3. Increased ventilation will have functional and economic limits:
 - Functional: Heating and cooling systems will need to effectively “treat” the outdoor air, raising or lowering the ventilation air temperature to acceptable indoor temperature ranges.
 - Economic: Districts will need to be able to afford higher gas and electric bills, especially during winter.

Additional Ventilation Considerations

1. 60-70% of schools in NM are cooled by evaporative cooling systems.
 - Some evaporative cooling systems cannot accommodate any kind of MERV filter, but can deliver as much as 20 air changes per hour (ACH).
 - Based on the high rate of dilution, cooling systems provide better indoor air quality than heating systems in NM.
2. Opening outdoor air louvers to increase mechanical ventilation rates may increase the risk of damage to other building systems.
 - Outdoor air louvers and fans often share mechanical rooms with potable water lines, fire suppression systems and other elements that may freeze if more untampered outdoor air is introduced.
 - Increased outdoor air may also increase the quantity of dust and moisture levels within buildings, shortening the life of air filters and increasing the risk of water related damage.

Filtration Considerations

1. Not all existing HVAC systems will accommodate any type of filtration.
 - Some schools are heated with simple radiant heating systems that do not include mechanical air ventilation (baseboard radiators).
 - Some evaporative cooling systems will not accommodate MERV filters.
2. Installing MERV13 filters in existing HVAC systems can stress system components and may void manufacturer warranties.
 - Electrical fans may experience increased load and strain to push air through more restrictive filters.
 - Heat exchanging elements may overheat and crack if less air is passing over the surfaces than was designed.

Additional Filtration Considerations

For existing systems that can accommodate MERV 13 filters, the following will impact implementation:

- MERV 13 filters cost 3 to 5 times as much as MERV 8 filters.
 - \$7.5 M for APS to upgrade to MERV 13.
 - Filters only available for bulk orders, not practical for small districts.
- MERV 13 filters are not available for immediate delivery, with up to 3 month lead times common, occasionally longer.
- Filters must be replaced on a quarterly basis.
 - Belen has 700-800 filters to replace quarterly, dozens of system types and specific filter sizes.
- Existing systems may use more electricity to circulate air through more restrictive filters.

Air Purifiers, Cleaners, and Disinfecting

- New products and technologies are being marketed to schools to provide portable, plug-in solutions to increase ventilation rates, improve filtration, and disinfect spaces.
- Considerations for districts:
 - Is the product proven effective at eliminating viruses?
 - Can district staff effectively operate and maintain the equipment?
 - Is the product available for purchase and timely delivery?
 - Is the product suitable for a classroom/school environment?
 - Is the operating decibel level less than 55 dB?
 - Will the school's electrical service support the installed devices?
 - Is the product proven safe for children, non-toxic, etc?
 - Is the product proven durable within a classroom environment?

Recommendations for Districts

1. Hire a qualified, experienced HVAC technician or professional engineer to assess the existing HVAC system design and condition of system components at each individual school site before increasing mechanical ventilation rates or installing MERV13 filters.
2. Identify functional and economically viable approaches to increase outdoor air ventilation rates and improve air filtration, based on the specific HVAC systems and components installed per school site.
3. Consider purchasing and implementing proven, safe, and effective air purifiers, air cleaners, and air disinfecting technologies that can be operated by district personnel and sustained within district budgets.

Questions

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Thank You!