Clean & Safe?

Schools continue to be challenged with disinfecting buses and facilities as they learn from the use of chemicals and discover new ventilation technologies

Written by **Jim Romeo**

Amid a global pandemic, and sometimes contentious public debate, some schools are re-opening, while others default to remote learning and hybrid learning models.

Reopening schools in some school districts means school buses are running again. As they do, clean and safe environments are always a prerequisite, now and into the future. Transportation staff continues to clean and disinfect bus surfaces, with some challenges arising, while fleet directors are considering air purification technologies as funds become available.

Clean Air on the Bus

Disinfectants are one part of the equation, when it comes to hygienic solutions to fight COVID-19 inside school buses. Perhaps the more important component to combatting the new novel coronavirus is to control the onboard air quality that students are exposed to. The Centers for Disease Control and Prevention (CDC) updated its guidance on the spread of COVID-19 to indicate it is primarily spread through respiratory droplets or small particles in the air. And President Joe Biden specifically targets the implementation of ventilation systems and improved air quality in school buildings, as part of his plan to safely reopen K-8 public schools by next month. This includes school buses.

Ventilation systems are an acceptable use of funds under both the Coronavirus Aid, Relief, and Economic Security (CARES) Act passed last spring and section 1313 of the Consolidated Appropriations Act of 2021 passed into law late last year, as a means to improve air quality in school facilities and to minimize the risk of the coronavirus disease transmission.

The CDC provides specific guidelines for ventilation in schools. However, the information is focused on buildings. In short, it indicates that increasing the air exchange as well as filtering the air are best practices. It recommends opening windows, inspecting and maintaining local exhaust ventilation, and repositioning outdoor air dampers and temporarily disabling any controls that would automatically limit the supply air. It also advises using fans to increase the effectiveness of open windows when weather permits or repositioning supply and exhaust diffusers to create directional airflow. And though it may require more investment, the CDC recommends adding portable HEPA fan and filter systems and installing ultraviolet germicidal irradiation (UVGI).

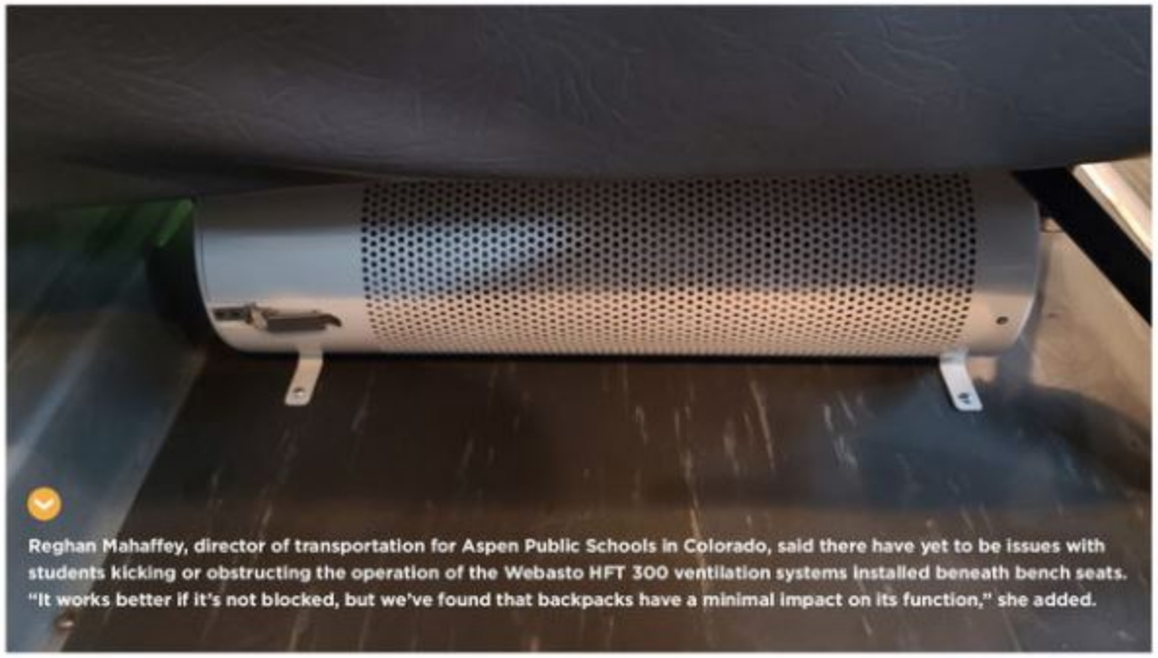
Many state and local district plans recommend opening windows where appropriate. But winter weather adds complications, especially on buses. Technology to the rescue once more.

Several vendors are recommending filtration and air treatment that show much promise. Relatively few school districts are using newly installed ventilation filtration equipment, but that may be changing as funding becomes available.

Perhaps the school district with the most experience in school bus ventilation systems is Fort Payne City Schools in DeKalb County, Alabama, located in the northeast part of the state. Laran Adkins, the district's director of child nutrition and transporta-

Laran Adkins, the director of child nutrition and transportation for Fort Payne City Schools in northeast Alabama, and her head mechanic Tony Meyers oversaw the installation of 24 ProAir HEPA-6 ventilation systems in August to combat SARS-CoV-2 virus transmission.

Read the CDC guidelines for proper ventilation of schools.



Reghan Mahaffey, director of transportation for Aspen Public Schools in Colorado, said there have yet to be issues with students kicking or obstructing the operation of the Webasto HFT 300 ventilation systems installed beneath bench seats. "It works better if it's not blocked, but we've found that backpacks have a minimal impact on its function," she added.

Meanwhile, Aspen Public Schools in Colorado has been using HEPA-14 filters in its 32 buses since Thanksgiving. Director of Transportation Reghan Mahaffey said the district used about $34,000 in CARES Act funds to purchase and install the Webasto HFT 300 systems that meet CDC ventilation guidelines.

Aspen students returned to in-person classes from hybrid learning on Oct. 26. Since the HEPA-14 systems have been installed, Mahaffey said she has seen a dramatic improvement in not only fewer students testing positive for COVID-19 but also the onboard air quality. Webasto claims that 99.95 percent of airborne infections and contaminants are removed, resulting in up to 300 cubic meters of fresh air per hour. The system targets particles of 0.3 microns or larger.

"I've personally noticed that the cabin air noticeable smells cleaner," said Mahaffey, who has been driving routes due to driver outages resulting from quarantines.

The HFT 300 system is noisy at 70 db, which required Aspen to move the 8-inch by 24-inch units from directly behind driver compartments to about eight rows back, bolted underneath one of the bench seats. The district also takes advantage of a noise cancelation feature that allows each driver to switch off the device at railroad crossings. Paul Baczewski, Webasto's national account manager, explained that the HFT 300 can also be automatically disabled when the stop-arm and eight-way loading and unloading light are activated.

Mahaffey said she doesn't anticipate needing to replace the filters until September. Baczewski explained that filter manufacturer Virgis mandates that the filter life is not to exceed 12 months, and Baczewski estimates filter life expectancy in a normal school bus environment to be eight to 10 months.

There are also important lessons learned from what public transit authorities are doing with air filtration. The United Safety brand Active Air Purification Technologies with RGF UV-PHI has a long history of purifying air in many different applications, including for transit authorities and fire departments. These successes suggest that school buses may very well benefit from the same technology, according to the company.

"We use a technology called ultraviolet PHI. UV-PHI is the acronym, and PHI stands for photohydroionization," explained Ken Hedgecock, United Safety's national sales manager. "Basically, what we are doing is taking a UV bulb, and with a catalyst around that UV bulb, we're creating a very safe level of

The Centers for Disease Control and Prevention offers recommendations on how to clean and disinfect facilities.

use of disinfectants, about 10 percent indicated they had problems with the chemical reaction on the bus vinyl and seat material. "It has not been from improper cleaning by the drivers," shared Patty Jackson, transportation director for Unified School District 341 in Oskaloosa, Kansas. "The disinfectant leaves a white film over the seats that then has to be wiped off."

Aspen's Mahaffey noted a similar residue, which drivers must also remove from windows.

Jennifer Haag, director of transportation of Peotone Community Unit School District 207-U in Peotone, Illinois, echoed that sentiment, adding that she and her staff are finding a film on the seats and other areas that are sprayed.

Other directors are finding similar results to the frequent cleaning. Sharron Harwin, transportation director at Lucia Mar Unified School District in Arroyo Grande, California emphasized the importance of wiping down surfaces after spraying them. "Leaving the chemical on seats is breaking down vinyl," she observed.

Meanwhile, Mike McClure, director of transportation services at Fayetteville Public Schools in Arkansas, said he has seen a "slight discoloration of seats" and has received "complaints from students about discoloration of clothing."

Katie Delano, the director of transportation services at Coalinga Huron Unified School District in Coalinga, California, said the frequency of cleanings is also posing problems at her district. "It has not been improper, it has been so often," she explained. "Prior to COVID-19, we cleaned buses daily. Now we do it between each run. We are doing close to 60 runs a day with nine drivers. This means a lot of use and a lot of cleaning."

The result, she added, is that the seat covers are more brittle. The average age of her fleet is 18 years old, and she said the material used on the older buses may not be as resilient as on a newer bus.

"The typical pre-COVID day was 32 routes plus activities and sports with 15 drivers," added Delano, "I believe because of the frequency we clean, seat repairs are through the roof due to how often we clean, not improper cleaning." ●

Ryan Gray contributed to this report.

tion, shared that ProAir HEPA ventilation systems were installed last August in all school buildings and throughout the fleet of 24 Blue Bird All American buses. The ProAir HEPA-6 systems were installed in coordination with the local bus dealer, Busworx.

"Our superintendent had looked into it for classrooms," explained Adkins. "Then when we got to buses and started talking about it. He said we need to do that. We need to do everything possible to try to eliminate the transmission of COVID-19 or any other viruses that could be transmitted."

She relayed during the STN EXPO Virtual conference in late January that each unit exchanges air at a rate of 460 cubic feet per minute, which equates to exchanging air volume on the bus 12 times an hour. In addition, the HEPA filters claim to remove 99.9 percent of all particulates, including viruses, from the air. The units are optimized with an air conditioning system but can run without one. Adkins relayed that ProAir recommended to Busworx that two HEPA filter systems be installed if a bus doesn't have air conditioning.

Adkins added that the district did utilize CARES Act funding to cover the majority of installation costs. ProAir came on site and installed the systems on all 24 buses in a week and a half. Meanwhile, Busworx representatives trained district mechanics on how to change the filters and when to clean them.

Dave Oberdorff, the vice president of sales and business development for ProAir, said the company began receiving phone calls, emails and inquiries last March from student transporters nationwide asking if ProAir had any products that could help reduce the presence of the SARS-CoV-2 virus on their buses.

With some experience providing filtration for hospitals and the medical vehicle market using HEPA Filters and UV-C Germicidal lamps, ProAir's engineering team went to work researching how to effectively apply this technology to a full size 40-foot school bus.

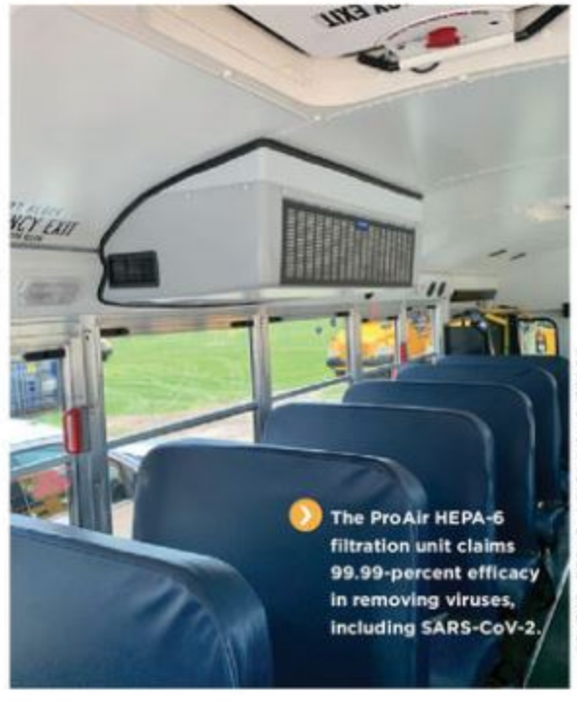
"With about 70 percent of the COVID-19 virus being spread thru the air attached to water particles, we knew proper air filtration had to be part of the COVID-19 containment solution," he added

In early research, ProAir looked to the CDC guidelines on how many air turns per hour were recommend for a hospital room to minimize the viral load. "And that information and subsequent testing helped determine the size of the blowers to apply to the new school bus air filtration units," Oberdorff added.

The filtration units include HEPA-3, HEPA-4 and HEPA-6 filters as well as a high-capacity TRUE HEPA Filter that ProAir said is 99.99 percent effective on particles as small as 0.3 microns, such as airborne mold spores, pollen, dust, bacteria and viruses, including the SARS-CoV-2 virus that causes COVID-19. The system is tested to FDA requirements for pharmaceutical manufacturing.

"Each ProAir filtration unit is supplied with a pre-filter to remove larger particulates from the air, helping to extend the life of the high-capacity TRUE HEPA filter and allowing it to focus on removing the small airborne pathogens down to 0.3 microns in size," shared Oberdorff.

In addition to the high-capacity TRUE HEPA Filtration, ProAir offers an optional germicidal virus killing UV-C lamp for additional air purification. These units were designed, tested and built to ensure that the UV-C lamp is contained within the unit and focused on the airstream at the back of the HEPA Filter to further clean the air of mold spores, pollen, dust, bacteria and viruses.



The ProAir HEPA-6 filtration unit claims 99.99-percent efficacy in removing viruses, including SARS-CoV-2.

SOURCE - PROAIR - HELPA-6 ON CURRIS DE

hydrogen peroxide in the passenger compartment that will in turn eliminate viruses and bacteria. So, it will go after and seek out any type of microbe, whether it be viral or bacterial, and eliminate it."

Hedgecock said a third-party lab tested the technology for the elimination of the SARS-CoV-2 virus that causes COVID-19 and claims greater than 99-percent efficacy. "What is unique about this test is that it was performed with the actual SARS-CoV-2 virus in an 8-foot-wide by 8-foot-tall by 20-foot-long chamber," he added.

Though the active purification system has yet to be used on school buses, Hedgecock said that Green Bay Metro in Wisconsin was the first to adopt it. Link Transit and Kitsap Transit in Washington state plan to retrofit their entire fleets with the technology, as do CapMetro in Austin, Texas, and Sunshine Line in Tampa, Florida.

Another company that specializes in air quality for buses is Lumin-Air, which offers a retrofit solution that uses germicidal UV at 254 nanometers. The company said all of the UV is contained in an enclosure as part of the bus ventilation system to disinfect recirculated air before reentering the bus. Student passengers and transportation staff are not exposed to any UV, and no ozone, hydrogen peroxide, ions or other disinfectants are distributed onto the occupants or into the air they breathe,

99% of school districts/bus companies have increased disinfecting of school buses due to COVID-19
(Out of 185 responses)

76% of school districts/bus companies require school bus drivers to wipe down the seats/high-touch areas after every run
(Out of 184 responses)

82% of respondents said they know the composition of the chemicals their staff is using to clean
(Out of 184 responses)

the company added.

Lumin-Air offers a MERV-13 equivalent filtration option with the pressure drop equivalence of a standard MERV-4 filter, but the dust holding capacity is several times that of a 4-inch-deep filter.

Safe Disinfecting and Lessons Learned

While air treatment is an effective yet relatively untapped way to improve the air quality and treat the air that pupils breathe, school districts have been and continue to be militant in how they clean and disinfect their buses.

"Keeping the environment students are in clean is vital to maintaining well-being. Ventilation and surface disinfectants are not substitutes for one another," explained Kelly Ward-Smith, a spokesperson for GOJO Industries, a manufacturer of hand hygiene and skin care products such as PURELL Surface Disinfectant. "Ventilation will help keep the air fresh, but surface disinfection plays a significant role in slowing the spread of germs since germs often live on surfaces that we touch, and we can pick up those germs that may make us sick."

She continued, "Instead of leaving this important step out, choose a safe and effective surface disinfectant because harsh chemicals like bleach or quats can cause adverse reactions. Harsh chemicals can release pollutants in the air that will affect students with allergies or asthma. Because many disinfectants may leave behind residue if not properly rinsed, disinfected surfaces touched by students, even those without allergies or asthma, could lead to skin irritation."

As such, it's important to take great precautions in disinfecting buses by following regulatory guidelines. The CDC has very specific guidelines on safe and best practices for applying disinfectants for school buses. At the forefront of its recommendation is to use disinfectant on the EPA's List N: Disinfectants for Coronavirus (COVID-19). Logically, EPA advises to follow the instructions on the label to ensure safe and effective use of the product. Recommended actions for applying disinfectant include wearing gloves, goggles or protective eyewear, and providing adequate ventilation while applying disinfectant. EPA also recommends to label diluted solutions to avoid any confusion, and don't mix chemicals or disinfectants. EPA emphasizes, numerous times, to follow the label directions.

The topic continues to cause anxiety among school bus component suppliers, who worry about a hodgepodge of chemicals degrading their products. IMMI, the manufacturer of the Safe-Guard brand of school bus seats, seatbelts and integrated child seats, has been developing its own acceptable disinfectant solution. Julie Cooley, IMMI's vice president of corporate and marketing communications, confirmed to *School Transportation News* last month that field tests are ongoing.

When STN surveyed transportation directors about the

Cleaning Agents/ Devices Used Since the Onset of COVID-19

82% Industrial cleaners/ disinfectants

65% Electrostatic sprayer

11% Household cleaners/ disinfectants

8% Bleach

7% Other (hand sanitizer, disinfectant wipes, opening windows for ventilation, ultraviolet cleaning devices)

5% Air filtration systems
(Out of 186 responses, more than one answer possible)

97% said the cleaning/ disinfecting agents being used are certified by the EPA as safe and appropriate to use on viruses
(Out of 186 responses)

10% of respondents say they have encountered damaged seats, restraints or other equipment as a result of using cleaning/disinfecting agents
(Out of 185 responses)