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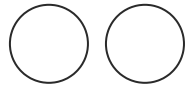
These Portland classrooms don't meet bare minimum targets for indoor airflow

Look up results for your child's school and classroom.

Published on May 15, 2022

Carolyn Hickman with her children Michael Parrish Jr. (left) and Lyric Parrish (center), and nephew Ayden Garland-Mitchell (right). Hickman said all three children are still wearing masks inside Rosa Parks Elementary in North Portland because she doesn't want to risk them catching COVID-19 again. Sean Meagher/The Oregonian

By [Aimee Green | The Oregonian/OregonLive](#)



One in four classrooms in Portland's elementary and middle schools do not meet minimum recommendations for ventilation, increasing the risk of spreading COVID-19 and other airborne diseases, an investigation by The Oregonian/OregonLive has found.

Portland Public Schools last year spent more than \$5 million to improve indoor air quality by placing new filters in buildings and portable air purifiers in all classrooms. Oregon's largest school district paid \$800,000 more to measure airflow in virtually every room of every building.

But then administrators failed to act on that new information.

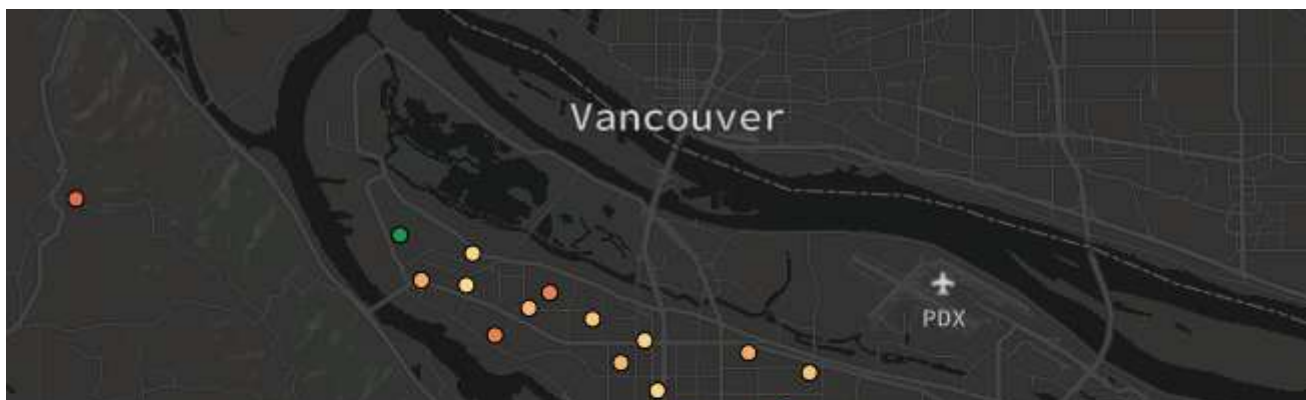
Ventilation in Portland schools

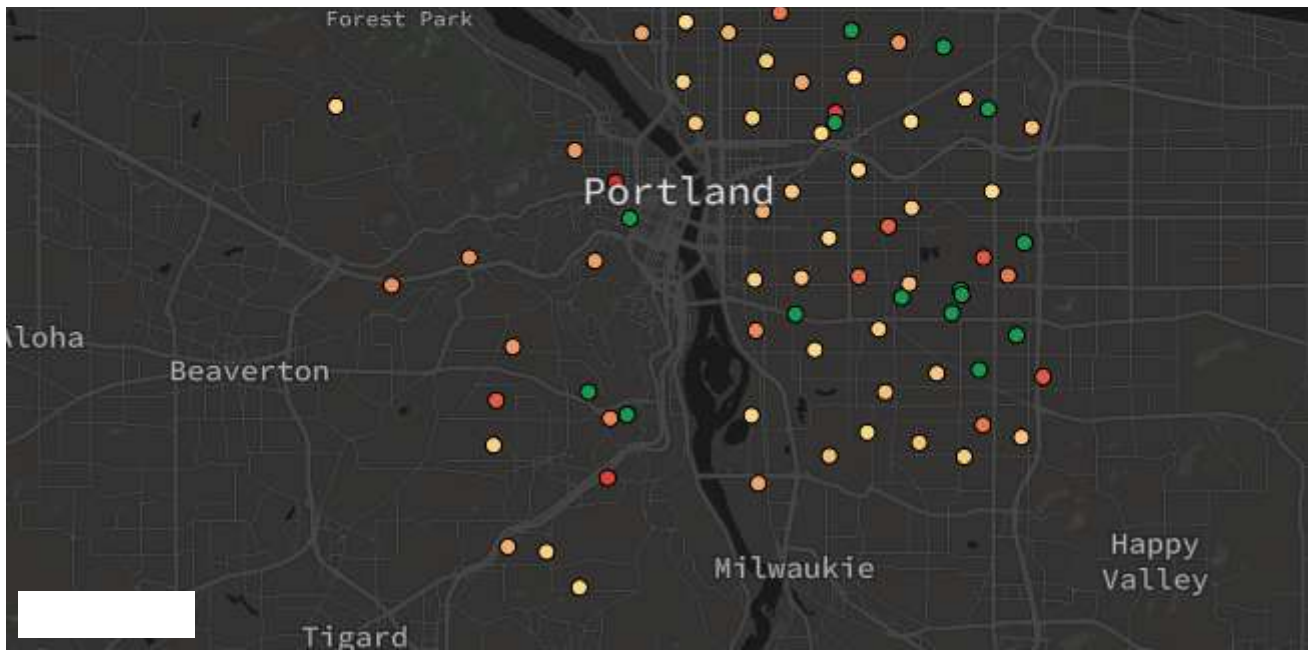
This map shows each school based on the percentage of classrooms that fall below either hour*. Three to four is considered the bare minimum recommended by experts, and at least

Toggle between air change rates at the top of the map. Schools in red have more of their those in orange and yellow have fewer, and those in green have none.

LESS THAN 3 AIR CHANGES/HOUR

LESS THAN





*Reported numbers assume portable air purifiers are running at full speed, but it's common for teachers noise.

Search by school

Click any school to pull up, by room number, hourly air changes (or click the PDF to see Nearly every room in schools is included, from classrooms to offices to cafeterias. But which rooms are classrooms if the rooms had below 5 air changes per hour.

School	Total classrooms	Classrooms w/< 3 air changes/hour	Classrooms w/< 5 air changes/hour
Metropolitan Learning Center PDF			21
Capitol Hill PDF			19
Beverly Cleary at Hollyrood PDF			9
Bridger PDF			21
Lent PDF			27
Hayhurst PDF			22
Glencoe PDF			27
Richmond PDF			28
Skyline PDF			14
Woodmere PDF			23
Vernon PDF			29

Harrison Park PDF	38	
Rosa Parks PDF	26	
Rieke PDF	19	
Astor PDF	21	
Winterhaven PDF	14	

Source: Portland Public Schools

Map: Mark Friesen/staff

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Testing identified nearly 500 out of 2,000 classrooms — or 25% — in elementary and middle schools with exceptionally low ventilation and filtration rates, even with the purifiers running full blast, according to the newsroom's analysis of district records. In all, about 1,250 classrooms in those buildings – or more than 60% – do not meet higher levels frequently recommended by air quality experts.

The newsroom found no striking disparities between schools serving wealthy or working-class communities, with a portion of classrooms across the city recording low rates in a checkerboard fashion.

Portland's airflow in K-8 schools lags behind rates reported by most local districts. Out of the dozen largest surveyed by the newsroom, **eight — including Beaverton, Hillsboro and Lake Oswego — say they've met or surpassed minimum recommendations** for ventilation in all classrooms, although few actually went room to room measuring it.

No local, state or federal agency sets requirements for the number of times the total volume of air in a classroom must be replaced each hour.

But experts at **Harvard University** and elsewhere recommend three to four hourly air changes as the bare minimum. At least five or six per hour is recommended by 10 experts and **organizations** contacted by The Oregonian/OregonLive.





Portland Public Schools bought 5,200 Intellipure portable air purifiers primarily for its elementary and middle schools. The district paid between \$575 and \$629 for each purifier, plus shipping.

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Yet an estimated 7,500 students across the district are taught primarily in classrooms that fail to reach even the minimum of three hourly air changes. And that assumes air purifiers are running at top speed — something some teachers say doesn't happen because the machines are too noisy.

“It's too low and it needs to change,” professor Jose-Luis Jimenez said of Portland's subpar ventilation rates.

“This is what the pandemic has uncovered,” added Jimenez, a preeminent authority on indoor COVID-19 transmission who conducts research at the University of Colorado Boulder. “There has been a neglect of ventilation.”

Coronavirus infections are once again climbing after a lull from the **record-breaking winter**. They are being fueled by an omicron subvariant nearly as contagious as the measles, and federal officials are preparing for the **potential of 100 million infections** beginning this fall.

The Biden Administration recently **stressed** the importance of **ventilation** in all buildings – from grocery stores to offices to schools – calling it one of the steps that “will be critical to getting America back to our normal routines while protecting people from COVID-19.” Multnomah County officials last week recommended indoor masking in businesses and schools **for the first time** since a statewide mandate ended in March, citing rising cases and hospitalizations.

Aside from preventing the spread of COVID-19, good ventilation and filtration can reduce exposure to viruses that cause common colds or the flu, and lessen the frequency of health problems caused by mold, pollen, wildfire smoke and other forms of **air pollution** – including asthma, allergies and, in the long-term, heart disease and stroke.

Proper ventilation also can prevent the build-up of carbon dioxide, which some studies show can hinder how students **stay alert and learn**.

Since Oregon's mask mandate ended, the average number of weekly coronavirus cases reported among Portland Public Schools students has jumped 15-fold, significantly faster than the five-fold increase across Multnomah County during the same time frame. However, it's also true that coronavirus infections are inconsistently reported, it's unknown how many students were actually infected at school or were wearing masks, and some schools with higher ventilation rates have just as many reported COVID-19 cases as those with lower ones.

Portland officials, provided with the newsroom's analysis, say families of the district's 45,000 students have no reason for alarm.

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"We take the health and safety of our students very seriously ... " said Dan Jung, the district's chief operating officer. "Our classrooms are safe. We're maximizing what we're able to do. And we feel good about where we are."

Coronavirus hit Carolyn Hickman's family in January — her young son, daughter and nephew, who lives with her, tested positive first, followed by her husband and herself.

She believes the children caught the virus at Rosa Parks Elementary in North Portland, where more than half of classrooms fail to meet minimum ventilation recommendations despite the building being only 16 years old.

Hickman said the entire family diligently wore masks before they got sick, and the kids went nowhere but home and school.

Hickman's second-grade son and fourth-grade nephew are in classrooms with about two air changes per hour, and the cafeteria has one.

Although Hickman is grateful no one in her family fell seriously ill, she ended up taking the entire month off from work as her family quarantined and isolated. It was a huge financial hit.

"It's kind of shocking because it's a new school," Hickman said. "You'd think the air would be better."

Portland high schools have much better ventilation rates than many elementary and middle schools, in part because they use higher-powered air purifiers and in some cases renovations have provided more frequent air changes. Less than 1% of high school classrooms fall below minimum recommendations if their purifiers are running at max speed.

Nationwide, experts say it's common for schools and other buildings to have low ventilation rates. But at least some districts have refused to settle.

Public schools in Washington, D.C., stand out. Officials there raised air quality in the worst performing classrooms from two air changes per hour to at least four to six, said Raj Setty, a mechanical engineer whose firm has worked with a few dozen school districts across the country to improve indoor air.

District of Columbia Public Schools, whose enrollment is close in size to Portland's, spent **about \$24 million**.

"It's extremely expensive to renovate schools," Setty said. "But with COVID, there is lots of money available for infrastructure upgrades. It's still there."



Superintendent Guadalupe Guerrero said the district has done an “admirable job” to improve air quality in schools by, among other things, spending more than \$5 million to upgrade buildings' filters and put portable air purifiers in every classroom. Courtesy Portland Public Schools

Superintendent Guadalupe Guerrero’s **proposed budget** for the 2022-23 school year includes at least \$65 million in federal COVID-19 response money to pay for, among other programs, staff training and to help kids who fell behind academically during the pandemic.

The district could not point to any of that money earmarked specifically to increase air changes per hour.

“For public schools,” Guerrero said, “we have done, I think, an **admirable job** in ensuring that the air quality in our schools are as optimal as they can be, within our means.”

‘There isn’t a standard’

Without clear, government-established standards, Portland and other school districts are left to make their own decisions about improving ventilation in classrooms to slow the spread of disease.

Coronavirus spreads through the air, where it can remain suspended for hours. Frequently replacing a room's entire volume of air – either with fresh outside air or by cleaning it through filters – can dramatically reduce risk.

The White House recently cited **a study** that found people were about three times more likely to be infected in a room with a single hourly air change compared to a room with five air changes. Another **analysis** found even more striking results.

Richard Corsi, who studies indoor air transmission as dean of the University of California Davis' School of Engineering, said universal mask wearing provided significant defense from COVID-19. By removing commonly worn masks, a room with two hourly air changes would need eight total air changes to offer the same protection, he said.

As fewer people wear masks, Corsi said it's crucial to improve both ventilation by bringing in more outside air and filtration by running high-powered air purifiers.

“That boggles my mind that some school districts are resisting,” he said.

School districts should change the air at least three to six times every hour, and should strive for six to eight, according to **new recommendations** by a committee of ASHRAE, a group of engineers that sets ventilation standards for buildings.

Schools that settle for the “minimum” are aiming too low, said Bill Bahnfleth, chair of the group's Epidemic Task Force, which is separate from the committee that made recommendations. He said the problem is the “worst acceptable” becomes “good enough.”

Six air changes, Bahnfleth said, “is an attainable target for most places.”

Portland schools officials say they set no goal, despite what they told state workplace safety regulators.

In September, Oregon Occupational Safety and Health (OSHA) received a complaint alleging inadequate ventilation was exposing employees at one Portland school to COVID-19.

The district's senior manager for health and safety, Brett Borgeson, responded in January. He wrote that the room in question had more than three air changes per hour, which he described as "adequate."

"The goal is to get at least 3 air exchanges in a room per hour," Borgeson wrote. "If at least 3 were observed then this is considered optimal. If under 3 were observed then repairs to the unit ventilator were made."

Jung, the district's chief operating officer, told The Oregonian/OregonLive he didn't know enough details to explain the apparent discrepancy between his assurance that no goal exists and what Borgeson wrote.

"I'm being clear that there isn't a standard," Jung told the newsroom. "I understand there was a sentence (in the OSHA response) and maybe there's some confusion there."

If Portland had set a goal of three, as Borgeson's letter stated, nearly 500 K-8 classrooms would fall short of that standard.

Jung, Borgeson and the district's media relations department didn't respond to several written follow-up questions about the letter to state regulators.

The district said it never set an hourly air change goal because public health agencies didn't say it needed one.

"If the experts tell us it's time to move to three, four or five, then PPS will comply with whatever the experts within the government agencies tell us," said Freddie Mack, the district's senior director of communications.

Multnomah County Public Health does not issue recommendations for hourly air changes, although the county says it tells school districts to consult industry experts and provide as much ventilation as possible based on information provided by the state. The Oregon

Health Authority says it does not have recommendations for hourly air changes but, on [a page](#) titled “Public Health Recommendations,” shares advice citing experts who recommend three to six.

Eight local school districts — including two in Multnomah County — chose to set ventilation goals. Many said they followed that same or similar advice.



Amy Hoffmann (right) and her daughter, Maisy Borden, 8, outside of Lent School in Southeast Portland. Maisy's classroom has 1.5 air changes per hour, well below minimum ventilation recommendations. Hoffmann wonders if opening windows would help or hurt because of vehicle exhaust from neighboring Interstate 205. Dave Killen/staff

‘It has to lead to something’

The airflow measurements collected by Portland Public Schools prompted little action and limited transparency, frustrating the few families and teachers who have learned of the results.

District officials say they didn't directly notify parents, staff or the teachers' union about airflow results or present findings to the school board. Instead, they began **posting results** last August to the risk management page of the district website.

Jung said the district obtained air measurements during the past year to gain a better understanding of its ventilation systems, and to possibly help determine how it'll spend bond money approved by voters for construction and renovations.

"We rarely send out information about the health and safety efforts that we do," Jung said of the results. "Those don't normally get communicated widely."

The Oregonian/OregonLive completed its district analysis by reviewing more than 1,000 pages of ventilation reports posted to the district's website, identifying the total number of classrooms in each school and counting how many had below three or five hourly air changes. The review calculated percentages only among rooms that were officially designated as classrooms.

The newsroom's analysis found vast disparities among schools. Some classrooms have no ventilation but, with air purifiers running full strength, reach only between one to two hourly air changes. Others have excellent airflow hitting 15 hourly changes, equal to levels in **hospital operating rooms**.

District officials would not disclose air changes per hour in the superintendent's office, nor would they allow The Oregonian/OregonLive into schools to take photos of ventilation systems even when students were not present.

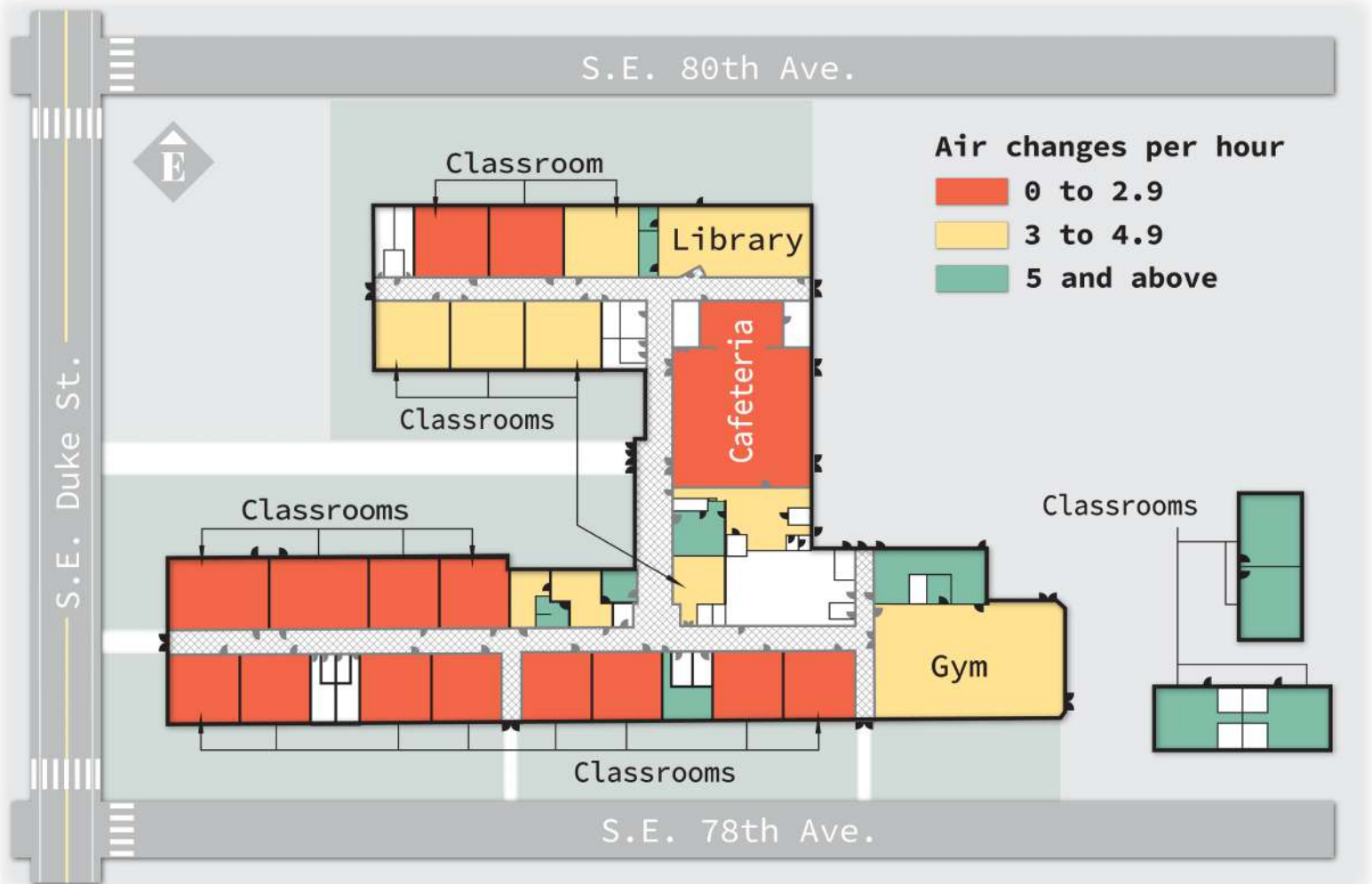
Maya Pueo von Geldern's two sons attend Vernon School in Northeast Portland, where 59% of classrooms — including her children's — fall below three air changes per hour. The school's cafeteria, gym and main library do, too. Districtwide, more than half of officially designated cafeterias, gyms and libraries also fail to reach that level.

Von Geldern was baffled that she learned of the results not from district officials, but from The Oregonian/OregonLive. She thinks the district should have a community-wide discussion about whether and how to improve indoor air.

“What’s the plan for doing something about it?” von Geldern said. “How much money is going into projects and studies that don’t result in any change? I’m all for studying air quality in schools, but it has to lead to something that benefits our students.”

Indoor air quality at one Portland school

Woodmere Elementary is one of 16 schools where at least half of classrooms fall below minimum recommendations for airflow, even with air purifiers running on high. At least three hourly air changes is recommended by experts, with many calling for at least five or six. As shown below, classrooms with low airflow are often grouped together.



Source: Portland Public Schools

MARK GRAVES/THE OREGONIAN

Ventilation is even worse at Lent School in Southeast Portland, where 74% of classrooms fall below minimum recommendations.

Amy Hoffmann’s third grader spends most of the day in a classroom with 1.5 air changes per hour.

Before the COVID-19 pandemic struck and she had to stop volunteering, Hoffmann remembers encountering a wall of warm, stuffy air and sniffing children when entering her younger and older daughters' classrooms. Now she wonders if the school's low ventilation rates are to blame.

Hoffmann said the airflow rates are especially disappointing given the school's composition: 77% of students are Latino, Black, Asian, Pacific Islander or multi-racial, and nearly all students qualify for free or reduced-price lunch. Statistics show Black and Latino families and households with socioeconomic challenges are more likely to be harder hit by COVID-19 because of increased exposure to the virus and lack of healthcare.

"Don't even complain to me one single second about these kids' test scores," Hoffmann said. "They are breathing old, stale air. How can their brains even turn on?"

Districtwide, The Oregonian/OregonLive's analysis of school reports found no consistent differences in ventilation rates between buildings serving high-income or low-income communities.

At West Sylvan Middle School, with boundaries encompassing some of the city's wealthiest neighborhoods, 45% of the classrooms fell below minimum recommendations — including one classroom with the worst ventilation and filtration in the district, at just 0.2 hourly air changes even if its air purifier is running full blast.

But at the newly rebuilt Kellogg Middle School in Southeast Portland, which has received extra funding because it serves a high percentage of families with lower incomes, all classrooms have at least five air changes per hour.

The result is that students appear to attend schools with good or bad ventilation based on the luck of the draw. That's fundamentally unfair, said Elizabeth Thiel, president of the Portland Association of Teachers union.

"If we have classrooms where some students are more likely to get sick, that means they are more likely to miss school, to get behind, to miss out on opportunities," she said. "It means parents are more likely to miss work."



Rachel Hanes, a second-grade teacher at Glencoe Elementary in Southeast Portland, plans to buy a carbon dioxide monitor with her own money to measure air quality in her classroom. “It’s really inexcusable how unhealthy our school buildings are and a failure on every level from the state down to the district,” she said. Mark Graves/staff

While high schools typically have better ventilation, that’s especially true at Franklin and Grant, which have been heavily renovated in recent years. But even new construction doesn’t guarantee good, built-in ventilation. The new McDaniel High School in Northeast Portland **reopened last fall** after more than \$200 million in updates. Even so, more than half its officially designated classrooms have fewer than three air changes per hour without purifiers operating, district records show.

The newsroom’s analysis also found district high schools generally have higher ventilation rates because they benefit from more powerful – albeit noisier – air purifiers than in the elementary and middle schools.

At full speed, Portland’s purifiers in lower grades **generate 59 decibels**, which is the equivalent of a normal conversation and well above the sound range recommended by the engineering group ASHRAE. In high schools the purifiers reach **70 decibels**, equal to the **sound generated** by a washing machine.

Most teachers contacted for this story said they run their air purifiers at half speed.

“If you turn it up full blast, you have to yell,” said Rachel Hanes, a second-grade teacher at Glencoe Elementary in Southeast Portland.

Hanes said the district didn’t provide guidance about the need to run the purifier on high. Ventilation in her room measures just under three air changes with the purifier running at full speed and one without it.

Hanes is concerned about the spread of disease, so she keeps classroom windows open year-round. Students bundle up. Hanes and close to half of her students are still wearing masks.

“The very fact that they have those numbers and they did nothing to address it, let alone tell us about it, just speaks volumes to what’s acceptable in our schools,” she said.

Parent Joe Kraus tried to convince the district to increase the fresh outside air flowing into his daughter’s first-grade classroom at Alameda Elementary in Northeast Portland.

She was diagnosed with cancer as a newborn and underwent chemotherapy. While she’s healthy now, he worries it weakened her immune system and wants to limit her COVID-19 exposure in the classroom, which only meets bare minimum ventilation recommendations.



Joe Kraus, father of 7-year-old Luella Kraus, a first-grader at Alameda Elementary in Northeast Portland, said he told district officials about experts' recommendations that schools achieve at least 5 or 6 air changes per an hour, but got nowhere. "They weren't really acknowledging those better metrics are out there." Beth Nakamura/staff

Kraus told the district about experts who called for at least five or six air changes an hour. But the district wouldn't act, Kraus said, and a different parent later bought a second air purifier for the classroom.

"I didn't get why they seemed to put a line in the sand and didn't seem to do any improvements, in a city that has taken COVID pretty seriously," Kraus said. "I didn't see why they didn't go the extra mile."

'Once-in-a-generation opportunity'

Better ventilation provides more protection and prepares schools for the next pandemic, whenever it might arrive, experts say.

Some hope it's part of a growing movement.

“Similar to how we looked at food in the cafeterias, we looked at **lead in the water**, now we're addressing the air,” said Setty, the consultant who advises school districts on achieving cleaner air.

Portland Public Schools already has taken some important steps by measuring airflow in every one of its classrooms and by investing more than \$5 million in portable air purifiers, filters for those machines and high-quality filters for building ventilation systems.

But Portland's work should not stop there, experts say.

“I don't think they're done at all,” said Jimenez, the University of Colorado Boulder professor.

Setting goals for hourly air changes and testing is key.

Seattle Public Schools officials **set a goal** of at least five changes per hour and, after testing every classroom, say they've met it. Officials say the district met an even higher standard of 10 hourly air changes for band and choir rooms – making Seattle a standout among districts.

Air purifiers are a significant next step to improve air quality but they must be regularly cleaned and internal filters replaced. Portland after a year has yet to replace filters in its elementary and middle schools although the manufacturer's recommendation calls for it as often as every six months. Officials say they plan to replace filters soon and are not behind schedule.

Districts also should pay attention to the real-world implications of the noise their purifiers generate. One possible solution, experts say, is placing multiple purifiers in classrooms with inadequate ventilation and running them at lower speeds, which could produce the same or more air cleaning capacity but less racket.

They also recommend districts **install real-time monitors** to measure carbon dioxide and particulate matter, two chief indicators of indoor air quality. When levels **rise above a set threshold**, districts can flush in more outside air, turn up purifiers or open windows.

“Trust but verify is my motto,” said Mark Hernandez, a University of Colorado Boulder professor who studies microbiological air pollution. “We can trust our building engineers and reports, but we actually have to verify, and that’s where the monitoring comes in.”

Boston Public Schools has done just that, placing real-time monitors in every classroom **with data** publicly available online. **Washington, D.C.**, also installed 10 to 15 real-time monitors in every school.

A final, expensive strategy is ensuring districts set and meet ventilation goals when renovating existing buildings and constructing new ones.

Jung, Portland’s chief operating officer, said the district already has **slated \$75 million** toward improving heating, cooling and ventilation systems from the \$1.2 billion construction bond **voters approved** in November 2020. About 15 schools will see ventilation improvements, although the full list hasn’t been finalized.

But without a goal — and evidenced by shortcomings at McDaniel High — there’s no assurance that the renovations will offer good ventilation and avoid the need for purifiers.

Although Portland schools leaders have said they’re pleased with the district’s progress, many experts say ventilation remains too low in too many classrooms. They hope Portland’s opportunity to improve is not squandered.

“If there is a silver lining from the pandemic, it’s that we have a once-in-a-generation opportunity to address air quality issues that have long plagued schools ... ” said Elliott Gall, an associate professor at Portland State University who specializes in indoor air quality. “We just have to do it right.”

Mark Friesen and Dave Cansler contributed to this report.

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