Clean Indoor Air Toronto

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Board of Trustees
Toronto District School Board
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To the Trustees of the Toronto District School Board;

We are *Clean Indoor Air Toronto*, a group of concerned Toronto residents who are dedicated to improving indoor air quality in our shared public spaces. Many of us are parents of children attending TDSB schools; other members of our group have chronic health conditions that make them vulnerable to infection. We are joined with other concerned Toronto residents and organizations in making the requests outlined below.

We thank the TDSB Staff for the 2024-2025 Climate Action Plan [4865]. Our comments and questions regarding the Climate Action Plan are provided below.

1.0 Background: The need for clean indoor air

If the COVID-19 pandemic has taught us anything, it's that the air in our shared indoor spaces isn't as clean as we think. Besides COVID-19, many serious infectious diseases like measles, tuberculosis, pertussis, and polio are primarily transmitted through the air. The risk is especially high in poorly ventilated spaces.

Since public health protections were lifted in 2022, airborne infectious diseases have continued to circulate at high levels in Toronto and particularly within the school community. We continue to observe the toll that constant illness is having on our students and education staff, as well as the tremendous strain on Toronto's healthcare system.

The Ontario *Building Code* relies on ventilation Standard 62.1, written by the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).[1,2] However, this *Code* is rarely enforced after construction; compliance is assumed but only checked when someone complains. There are no laws or regulations that govern and enforce acceptable indoor air quality, and there is no defined standard for what constitutes clean, safe-to-breathe air. Many Toronto buildings do not comply with ASHRAE Standard 62.1, and that includes schools in the TDSB portfolio.

To add to that, the events of the past 5 years have shown that the current ventilation standard is outdated.[3] It is not designed to handle the multiple challenges we now face:

- Air pollution from climate change-related events, e.g., wildfire smoke, and particulate pollution and pathogens generated by flooding and heavy rains[4–6];
- Serious airborne infectious diseases[7,8];
- Harmful indoor air pollutants that were not contemplated when ASHRAE Standard 62.1 was written, including fine particulates (PM2.5), microplastics, and perfluorylalkyl and polyfluoroalkyl substances (PFAS).[9–12]

Climate change-related events such as wildfires and flooding/heavy rains are bound to become more frequent and severe. The first recommendation during such events is to shelter indoors to protect against the effects of such events. However, it is vital that school buildings are built to protect its occupants against air pollution coming from outside, as well as air pollution coming from within.

Taking action to provide clean, safe-to-breathe indoor air aligns directly with a number of the TDSB's Strategic Directions[13]:

> ***Belong***: Clean indoor air is part of an inclusive environment, where students, especially those from vulnerable sectors (e.g., neurodivergent, immune compromised, LGBTQ2S+), can safely access learning spaces without risking harm to their health.
>
> ***Achieve***: Clean indoor air promotes and supports overall health, and helps students to achieve their fullest potential.
>
> ***Revitalize***: Clean indoor air is part of an inclusive, safe, and modern environment, and serves to revitalize the learning environment for students.
>
> ***Equity***: Providing clean indoor air removes a systemic barrier that is associated with a higher risk of health issues and poor learning outcomes.

Clean indoor air is an accessibility and an equity issue. Poor indoor air quality is associated with higher rates of disease and poor health; buildings with poor air quality are more likely to be found in lower income communities. Although the City of Toronto has an indoor air quality policy for its office-based employees[14], this policy does not extend to all of Toronto's buildings, creating an inequitable access to clean indoor air. Poor indoor air quality forms a systemic barrier: those who are exposed to poor air quality have higher rates of illness and poor health. Students and staff from vulnerable sectors who are aware of the risks of breathing poor quality air will tend to limit their engagement in activities or avoid entering spaces deemed unsafe.

The TDSB has the power to address this inequity and improve access to clean indoor air for the school community.

2.0 Current issues and questions

Adequate clean air delivery, through a combination of ventilation and filtration, is essential for providing safe-to-breathe air indoors for building occupants. When providing clean air, ventilation plays a more significant role as it can be controlled with mechanical ventilation as part of a heating, ventilation, and air conditioning (HVAC) system.

(a) Use of indoor CO_2 concentration to assess ventilation

Carbon dioxide (CO_2) concentration is generally measured in "ppm" (parts per million), and the average level of CO_2 outdoors ("ambient level") is about 420 ppm.[15] With regards to ventilation, heating, and air conditioning of indoor spaces, current Ontario building code adheres to ASHRAE Standard 62.1.[1,2] ASHRAE Standard 62.1 provides the rationale for using indoor CO_2 concentration as a means for measuring outdoor air supply rate.[2]

The Ontario Society of Professional Engineers (OSPE) has calculated that if an indoor space with mechanical ventilation is in compliance with ASHRAE Standard 62.1, the recommended upper limit of CO_2 concentration in an elementary school classroom is 900 ppm.[16] Health Canada's recommended maximum CO_2 level for indoor spaces is approximately 1000 ppm.[17] This is the same threshold set by the City of Toronto for its office-based employees.[14] In 2023, ASHRAE published an addendum to Standard 62.1-2022 which cites an

outdoor air supply rate for classrooms as being 10 cubic feet per minute per person, and a maximum CO_2 level of 600 ppm above ambient level in classrooms, around 1050 ppm.[18]

An indoor concentration of CO_2 above ~1000 ppm is indicative of inadequate ventilation and poor air quality. For those indoor spaces with mechanical ventilation, CO_2 levels that routinely peak over 1000 ppm indicate possible non-compliance with ASHRAE Standard 62.1. Poor ventilation allows for the accumulation of indoor air pollutants and infectious aerosols, both of which can have harmful health outcomes.[8,19] In addition, chronic exposure to levels of CO_2 above this threshold is associated with headaches, fatigue, poor concentration, and poor performance.[20]

(b) Current status of ventilation and filtration in TDSB buildings

On January 22, 2024, TDSB Staff presented a report summarizing ventilation-related investments and actions taken thus far.[21] In their report, staff stated the following (in italics); our comments and questions regarding current status are provided after each statement.

- *Ensuring where possible, indoor spaces receive three to six equivalent air changes per hour*

Parents in our network have used the Aranet4 CO_2 monitor and routinely recorded CO_2 levels surpassing ~1000 ppm, in some cases reaching over 3000 ppm, which is clearly indicative of poor ventilation. The TDSB has not disclosed the results of any air balancing studies done to assess ventilation rate and equivalent air changes per hour. None of the parents/caregivers in our group have been able to obtain this information.

- *Specifying MERV 13 filters for any new mechanical equipment.*
  Existing Mechanical equipment has the highest MERV rated filter that its design will allow

As of the current date, it has not been publicly disclosed which schools have MERV-13 filters installed in their air handling unit(s). TDSB schools still have MERV 10 filters, unless it is a new installation (Aleksandra Proevski, TDSB Occupational Health and Safety, email message, December 28, 2023).

MERV-13 filters are recommended by ASHRAE, OSPE, and the Lancet COVID-19 Commission as a necessary component for filtering the building's air supply to remove air pollution and airborne pathogens, including infectious aerosols.[16,22,23] Thus, MERV-13 filters help to make buildings more resilient to climate-related pollution, protecting building occupants from air pollution coming from outside as well as from within. <u>All TDSB school buildings should have MERV-13 filters installed in their air handling units.</u>

An independent HVAC engineer in our group has stated that most, if not all, air handling equipment in TDSB school buildings should be able to take a MERV-13 filter. It is notable that other Ontario school boards including Peel Region, Waterloo Region, and Durham Region have taken a proactive approach by installing MERV-13 filters in all school buildings and taken action if the filter causes issues (which has been infrequent).

- *[...] the TDSB is installing CO2 sensors and occupancy sensors on new ventilation equipment, to monitor fresh air delivered to the school in relation to occupancy levels. This program is closely coordinated with BAS [Building Automation Systems] upgrades and new installations, and the recommissioning of ventilation system controls.*

Although the TDSB has installed CO_2 sensors, they have been placed "on new ventilation equipment", as a single sensor within the central air handling unit, rather than inside a classroom. This results in measuring a building-wide average, and provides no information about the ventilation rate in each room or ventilation zone in a building. ASHRAE guidance clearly states that "a single CO_2 concentration does not apply to all space types and occupancies for the purposes of assessing ventilation."[24]

Ventilation and air supply varies from one room or ventilation zone in a building to another. Indoor CO_2 concentration in each room will vary according to the characteristics of the room, the occupants, and the

type of ventilation provided to the room. Consequently, ASHRAE has stated that when demand control ventilation is being utilized, such as with the Building Automation System, there must be at least one CO_2 sensor per ventilation zone or room.[18]

- *Air filtration is another key recommendation – there are approximately 16,000 institutional-grade HEPA filter units provided to schools for use in occupied classrooms, portables, and resource rooms, as well as libraries, cafeterias, and gymnasiums that do not have mechanical ventilation in place.*

As noted on the TDSB website, all classrooms have been equipped with a HEPA filtration unit (portable air purifier). The model found in classrooms is the Austin Healthmate HM400. However, because the TDSB does not have a policy governing the use of the portable air purifiers, they are often not used or they are not being used effectively. Parents/caregivers in our group have observed the air purifiers turned off, or pushed into a corner such that air intake is blocked.

A common complaint is that the Austin units are very noisy, resulting in the lack of use. At the highest setting, the Austin Healthmate has a noise level of 67 dB (Sean Domon, Austin Air Systems, email, November 25, 2024), higher than the range of 48 to 55 dB that is considered tolerable background noise in a classroom.[25,26]

Another issue is that independent tests have found that the Austin Healthmate has a relatively low clean air delivery rate (CADR, 36 cubic feet per minute or cfm) at the lowest setting, which is quiet enough at 40 dB to be acceptable for classroom use, which means more than one unit would likely be required in a classroom to provide adequate air filtration.[27] For an average sized classroom of 750 ft^2, at the lowest setting with CADR of 36 cfm, it would take 3 hours 28 minutes to complete 1 air change. There are other air purifiers available which are quieter, provide a higher CADR, the replacement filters are relatively inexpensive, and are more energy efficient than the Austin unit (which consumes 56 W at low, 82 W at medium, 132 W at high).[27]

(c) Questions regarding the 2024-2025 Climate Action Plan

Our review of the 2024-2025 Climate Action Plan ("the Plan") has raised some issues which we urge the Board of Trustees to consider.

- The Plan mentions that the Board has established a net-zero greenhouse gas (GHG) emissions by 2050 as an aspirational goal. However, the City of Toronto's TransformTO Net Zero Strategy has a timeline for net zero GHG emissions by 2040.[28] The TDSB should accelerate its timeline to match the City of Toronto.
- The Climate Action Plan does not mention the installation of MERV-13 filters in ventilation equipment. As noted earlier, MERV-13 filters are recommended for effective cleaning of air supply within a building, and should be considered essential for climate resiliency in terms of protection against climate-related air pollution, indoor air pollutants, and airborne pathogens. Will all new and replaced ventilation equipment be required to have MERV-13 filters installed?
- Many TDSB schools do not have air conditioning and cooling is needed to increase climate resiliency. With regards to cooling equipment, there is no mention of installation of a heat pump, only mention of installation of air conditioning. A heat pump supplies both cooling and heating, as well as reducing GHG emissions and energy consumption. We note that the Plan mentions replacement of rooftop air-handling units at the end of their life with high performance hybrid pumps. We urge the Board to consider replacement of all fossil fuel-burning appliances (furnaces, water heaters) in TDSB schools with heat pumps to reduce GHG emissions, improve energy efficiency, as well as supplying cooling to those buildings that do not yet have air conditioning.

3.0 Building for climate resiliency

Expert organizations including ASHRAE, the Lancet COVID-19 Commission, and the Ontario Society of Professional Engineers have published recommendations on indoor air quality with regards to reducing infectious aerosols and fine particulate (PM2.5) pollution.[16,23,29,30] In response, the California Department of Public Health updated their air quality guideline for classrooms, recommending a minimum ventilation rate of 30 cubic feet per minute per person (cfm/person), equivalent to around 14 litres per second per person (lps/person); this rate is approximately double the ventilation rate of 7 lps/person currently specified in ASHRAE Standard 62.1.[31]

Both the Lancet COVID-19 Commission and ASHRAE recognize that the higher the ventilation rate, the greater the reduction of airborne disease transmission: ASHRAE Standard 241 cites a total equivalent CADR of 20 lps/person as the target ventilation rate for controlling infectious aerosols in a classroom setting (wherein equivalent CADR is combined clean air supply from ventilation and from filtration).[29]

In view of the above, and the issues noted in Section 2.0, we ask that the Planning & Priorities committee amend the TDSB's 2024-2025 Climate Action Plan to include the following items:

1. **Conversion to heat pumps**
   Replace all fossil fuel-burning furnaces and water heaters with heat pumps and/or hybrid heat pumps. The upfront cost of investing in heat pumps will be made up rapidly in terms of the reduction in emissions, as well as energy consumption, as heat pumps are more energy efficient. Fossil fuel-burning appliances contribute to indoor air pollution by generating fine particulate pollution, and products of incomplete combustion including nitrogen oxides and polyaromatic compounds; replacement of these appliances with heat pumps removes this source of indoor air pollution. In addition, heat pumps also provide both air conditioning and heating. Accelerating the replacement of furnaces with heat pumps will mean more schools will get air conditioning sooner, which will increase resilience to extreme heat related to climate change.

2. **Ventilation upgrades/retrofits**:
   HVAC upgrades/retrofits to install heat pumps or hybrid heat pumps must meet the latest recommendations for ventilation by expert organizations for effective reduction of infectious diseases and fine particulate (PM2.5) air pollution. As per The Lancet COVID-19 Commission and ASHRAE Standard 241 (2023), for effective reduction of airborne disease transmission, the minimum classroom ventilation rate must be at least 10 lps/person, preferably 14 lps/person, and up to 20 lps/person.[23,29,32] Classrooms which do not have mechanical ventilation or air conditioning should be prioritized, followed by those classrooms that do not have adequate ventilation (ie. ventilation rate is less than 7 lps/person, generally indicated by CO_2 routinely exceeding ~1000 ppm, and does not meet ASHRAE Standard 62.1).

3. **IAQ monitoring system:**
   Install an IAQ monitoring system for indoor levels of carbon dioxide (CO_2) and PM2.5, with a CO_2 sensor and PM2.5 sensor in each classroom or ventilation zone.[18,30] The IAQ monitoring system should include real-time reporting of collected data in a website that is accessible to the public. The monitoring system would allow building operators to adjust ventilation rates as necessary.

4. **In-room air filtration and air cleaning:**
   Provide adequate in-room air filtration with portable air purifiers to increase total equivalent clean air delivery rate (CADR) within each classroom, with the goal of meeting ASHRAE Standard 241's target of 20 lps/person. This may mean increasing the number of portable air purifiers per classroom. We urge the Trustees and the TDSB to consider investment in portable air purifiers that provide a higher CADR at lower noise levels, and are energy efficient. A policy to require the use of these devices should be implemented and training should be provided to all staff on the proper usage, placement and benefit of air purifiers.

Ensuring that the learning spaces that students and staff use are supplied with clean air will pay back itself approximately 9 times the cost in savings from absences, better health, and improved focus and behaviour.[33]

We urge the Trustees to invest in the well-being of TDSB students and staff by directing TDSB to take actions that promote access to clean indoor air and make school buildings more resilient to the effects of climate change. By doing so, the TDSB can protect our students and TDSB staff from the effects of climate change, as well as the health impacts of indoor air pollution and airborne diseases. It will allow our students to achieve their fullest potential, and fulfill their aspirations without the risk or burden of poor health.

Please feel free to contact us if you have any questions or if you wish to further discuss this issue.

Yours Sincerely,

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