Ventilation Technical Advisory Panel Agenda

Meeting #02
1/14/2022
9:00am –10:00am
Location: Zoom Video Conference Call

Members:	Francois Bertrand, Damien Crowell, Ravnit Aujla, Patti Dundas, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls, Grant Sheppard, Shawn Chisholm
Guests:	N/A
Regrets:	N/A

TIME	TOPIC		LEAD
9:00am– 9:10am	**1.0 Meeting Agenda**	Information	Francois Bertrand
9:10am – 9:25am	**2.0 Funds for Ventilation**	Information	Francois Bertrand
9:25am – 9:40am	**3.0 HEPA Filter & Increased Outdoor Air Supply Experience**	Information	Bob Beukers and Josh Currie
9:40am – 9:55am	**4.0 Roundtable**	Information	All
9:55am –10:00am	**5.0 Wrap up/Items for Future Meetings**	Information	Francois Bertrand

Next Meeting: TBD

Ventilation Technical Advisory Panel Agenda

Meeting #01
12/17/2021
10:00am –11:00am
Location: Zoom Video Conference Call

Members:	Francois Bertrand, Damien Crowell, Ravnit Aujla, Patti Dundas, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls
Guests:	N/A
Regrets:	N/A

TIME	TOPIC		LEAD
10:00am– 10:15am	**1.0 Introductions**	Information	Francois Bertrand
10:15am – 10:25am	**2.0 Terms of Reference**	Information	Damien Crowell
10:25am – 10:35am	**3.0 Baseline Knowledge to Date on Ventilation**	Information	Damien Crowell
10:35am – 10:45am	**4.0 Questions**	Information	Francois Bertrand
10:45am –11:00am	**5.0 Wrap up/Items for Future Meetings**	Information	Damien Crowell

Next Meeting: TBD

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Ventilation Technical Advisory Panel
Minutes – Meeting #01

Date: Friday – December 17, 2021
Time: 10:00am to 11:00am
Location: Video Conference Call
Members: Francois Bertrand, Damien Crowell, Ravnit Aujla, Patti Dundas, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls

Guests: N/A

Regrets N/A

Agenda Item	Discussion/Action items
1. Introductions	• Stephen McNicholls has joined the panel and he brings over 30 yrs experience working as a mechanical engineer on HVAC projects at schools in BC. • A representative from Health is anticipated to join the panel for future meetings.
2. Terms of Reference	• The Terms of Reference (ToR) was circulated to the group and comments were incorporated. • Panel members were asked to review the ToR and provide any comments/suggestion by January 1, 2021.
3. Baseline Knowledge to Date on Ventilation	• School districts have put a lot of effort into adjusting to a COVID-19 environment. Increased air exchanges with HVAC systems, obtaining advise from consultants and performing additional maintenance of HVAC systems. • MERV 13 have been a challenge for school districts given that they can't be easily integrated into existing HVAC systems. • There are a # of classrooms in the province without ventilation systems. • HVAC specialist highlighted that ventilation (air exchange) is key in creating good indoor air quality. **Action Item:**

	• Ministry to conduct some research to gain a better understanding of existing data on HVAC systems at schools in BC.
4. Questions	• Investigated a number of questions including gain better understanding of existing ventilation systems in schools; see if portable HEPA filters are appropriate; identify a standard assessment for HVAC systems (CO2 monitoring); and how to provide accurate information on CO2 levels. Note that CO2 monitoring systems have a certain lifespan and mobile devices aren't always accurate.
5. Wrap-up/Items for Future Meetings	• Meeting #02, TBD • Items for future meetings: Update from public health representative ○ Time: TBD • Location: Video Conference Call
6. Adjournment	• Meeting adjourned at 11:00am

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Ventilation Technical Advisory Panel
Minutes – Meeting #02

Date: Friday – January 14, 2022
Time: 9:00am to 10:00am
Location: Video Conference Call
Members: Francois Bertrand, Damien Crowell, Ravnit Aujla, Patti Dundas, Chuck Morris, Collette O'Reilly, Bob Beukers, Josh Currie, Stephen McNicholls, Grant Sheppard

Guests: N/A

Regrets Steve Hopkins

Agenda Item	Discussion/Action items
1. Meeting Agenda	• Agenda was circulated in advance of the meeting and no concerns were raised. • Grant Sheppard, Director, Independent Schools from the Ministry will attend Ventilation Technical Advisory Panel meetings.
2. Funds for Ventilation	• Federal funding announced in December and dedicated to ventilation is expected to be distributed to public school districts and independent schools shortly. • The Ministry has identified deployment of portable HEPA filters in occupied classrooms and portables that currently have no access to mechanical ventilation as the top priority for this funding. • Some concerns were raised about the effectiveness of portable HEPA filters. • The Ministry doesn't view HEPA filters as a permanent solution but a temporary measure that can assist with air purification and provide comfort to stakeholders.
3. HEPA Filter & Increased Outdoor Air Supply Experience	• A number of school districts including Abbotsford and Kelowna have purchased portable HEPA filter units. • Jade HEPA filters units that Abbotsford and Kelowna have been installed and operated for a number of months and no significant issues raised by stakeholders at this point.

	• Utility costs as a result of increased outdoor air supply have increased significantly and it is a challenge for school districts. • The HVAC consultant highlighted that HVAC systems need to be viewed holistically and that outdoor air supply and proper functioning controls are key aspects of these systems. • There are some concerns that MERV-13 filters and portable HEPA filters may be seen by some stakeholders and public as the main solution to reducing potential virus transmission and that is not the case.
4. Roundtable	• Ministry is currently trying to find a representative from Health to join the Ventilation Technical Advisory Panel.
5. Wrap-up/Items for Future Meetings	• Meeting #03, TBD • Items for future meetings: Update from Health representative ○ Time: TBD • Location: Video Conference Call
6. Adjournment	• Meeting adjourned at 9:45am

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Ventilation Technical Advisory Panel
Minutes – Meeting #03

Date: Friday – February 11, 2022
Time: 11:00am to 12:00pm
Location: Video Conference Call
Members: Francois Bertrand, Damien Crowell, Ravnit Aujla, Megan Graham, Aimee King, Patti Dundas, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls, Grant Sheppard, Shawn Chisholm

Guests: Dr. Ariella Zbar, Dr. Michael Schwandt, Tym Berger, Richard Taki, Emily Peterson

Regrets N/A

Agenda Item	Discussion/Action items
1. Meeting Agenda	• Agenda was circulated in advance of the meeting and no concerns were raised. • Introductions
2. Updated Terms of Reference Review	• Only update was the addition of panel and ad hoc members. It will be finalized for the next meeting.

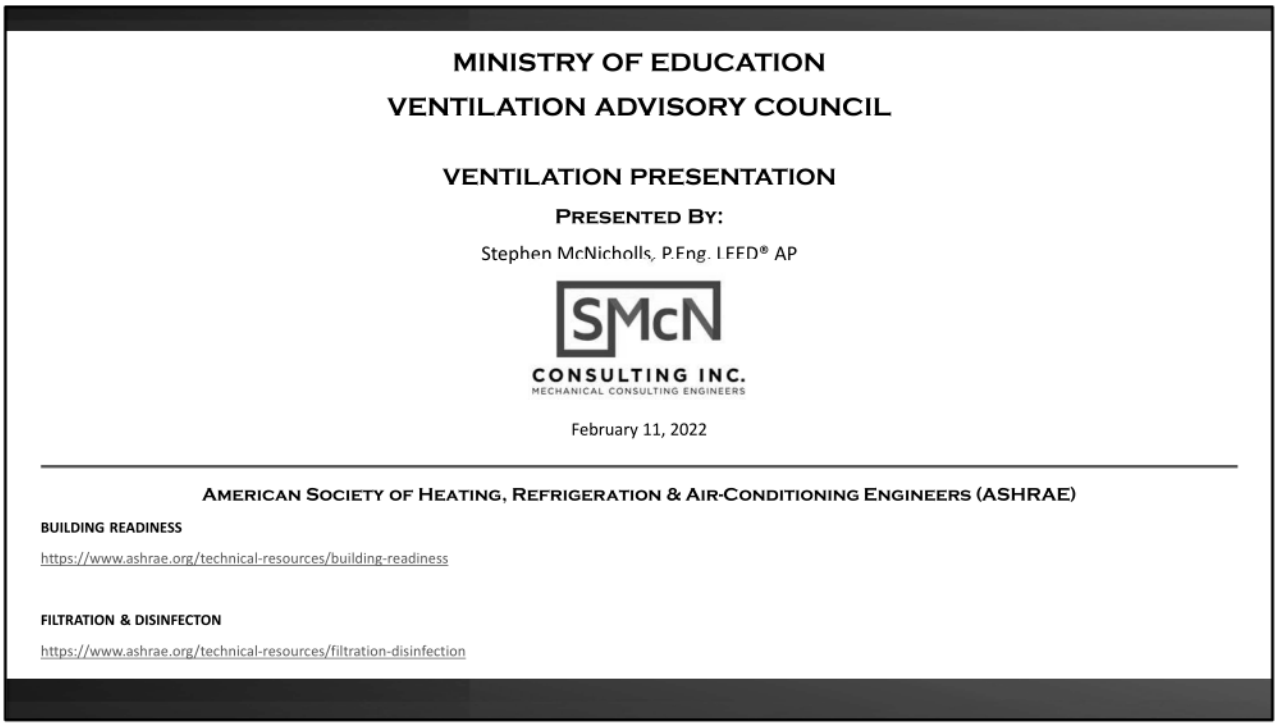
3. Health's Perspective	• Seven questions from panel members were presented to Dr. Ariella Zbar, Dr. Michael Schwandt, and Stephen McNicholls.
	• Data suggests relatively low transmission and risk in schools.
	  ○ While Omicron variant is more transmissible than previous variants, transmission remains low in school settings.
	• Impact of ventilation on COVID-19 viral transmission is not to be overstated. Some schools may benefit, but biggest impact will be addressing issues in small, unventilated rooms in older buildings. This may have a small 'incremental' improvement in decreasing transmission of COVID-19.
	  ○ Recommended approach by medical experts is a targeted strategy: identifying problematic rooms/spaces.

	• General agreement that improving ventilation in schools is a long-term priority for issues beyond COVID-19: climate change; pollution; wildfire smoke. • Currently, there is not widespread support for emerging technologies (e.g., UV-C light, negative ionizers, etc.) given limited testing and potential adverse impacts. • Concerns raised about noise of filters, which may negatively impact the learning environment. • Research literature provided by health experts for panel members to review. (See list of items below).
4. HVAC Consultant Overview of Ventilation System	• Focus on 'building readiness', with recommendation to evaluate existing ventilation systems to determine if are properly functioning • Ventilation systems should be looked at holistically including both outdoor air exchange and filtration.
5. Roundtable and/or Questions	• The nuance and complexity of the impact of ventilation systems in relation to COVID-19 transmission was emphasized. • While improved ventilation may have marginal benefit for reducing COVID-19 transmission, it is also important to focus on broader long-term benefits. • Finer filters would have the most benefit to the indoor air quality when outside air is poor (wildfires, heavy pollution, etc.)
6. Wrap-up/Items for Future Meetings	• Meeting #04, TBD • Items for future meetings: ○ Time: TBD • Location: Video Conference Call
7. Adjournment	• Meeting adjourned at 12:07 PM

Links to Literature Provided by Health Experts:

EPA - Creating Healthy Indoor Air Quality in Schools

BCCDC - COVID-19 and indoor air: Risk mitigating measures and future-proofing



- ….as part of our business development and marketing plan….
- we brainstormed ways of entering what we've labelled the "recreational/municipal" sector
- what we are considering to be under this umbrella are publicly funded projects like libraries, fire halls, rec centres, ice rinks, town offices
- so in general a fairly broad topic
- we also brainstormed ways of improving our presence with the K-12 sector

Building Readiness

Specific recommendations from the Building Guidelines:

- System Analysis
- Ventilation
- Increased filtration
- Flushing calculations

Building Readiness Team

The Building Readiness Team could include licensed and certified professionals and companies that can perform the analysis, testing, design, construction, control programming, balancing, commissioning, maintenance and operation services required to make the adjustments and achieve the performance included in these recommendations. The following are the typical service providers that may be required:

- Commissioning Provider (CxP)
- Test and Balance Company (TAB)
- Building Automation Systems (BAS)
- Engineer
- Owner's Facility

Building Readiness Plan

HVAC strategies could include, but not limited to, the following items:

- Increased Ventilation
- Improved Filtration
- Air cleaning devices (such as UVGI and other newer technologies)

Systems Evaluation

The Owner should consider evaluating their building systems to check that it is operating in proper order (per design conditions or current operational strategies), is capable of being modified to align with **HVAC mitigation strategies**, and to identify deficiencies that should be repaired.

This could be viewed as tactical commissioning of the systems to determine risk areas for the building operating in epidemic conditions.

Evaluate your BAS (Controls System)

It is crucial for the owner to understand the type of BAS they have in their building. HVAC controls range from simple single zone thermostats controlling a single HVAC unit to complex BAS that integrate the controls for large buildings and even multiple buildings, such as for school districts, university campuses and large government installations, and everything thing in between.

Optimally a digital (computerized) control system has been provided, which allows complex operational sequences to be programmed, which can optimize space conditions and energy use. These are typically also accessible via web-based platforms, allowing remote access to information and site conditions.

There are also legacy systems, which use electric and pneumatic controls and time clocks that do not have modern, digital communications interfaces and, therefore, do not allow building operators any insight into how their buildings are performing without being physically in the building or at the piece of HVAC equipment.

Ventilation per Code

ASHRAE is indicating that the building systems need to be evaluated to confirm that the building's HVAC systems are capable and operating to provide the code required or design levels of outdoor air when the building is occupied.

The intent is to operate the systems in this manner when the building is occupied.

Increased Ventilation above Code

Increasing outdoor air above code is considered a mitigation strategy to be evaluated. There is potential that building operators could increase their systems **outdoor air ventilation** to reduce the recirculation air back to the space. The guidance indicates that this should be done, if it is the selected mitigation strategy for this system, as much as the system and or space conditions will allow. It is very important that these overall building systems are evaluated by a qualified TAB firm, Cx provider or design professional to confirm that the modifications for pandemic safety do not create additional issues.

A concern is the ability to maintain space conditions. Hot and humid climates could struggle to keep the space below acceptable temperature and relative humidity for comfort. Cold climates could struggle to keep the space above acceptable space temperature and relative humidity for comfort.

Pre- or Post-Occupancy Flushing Strategy:

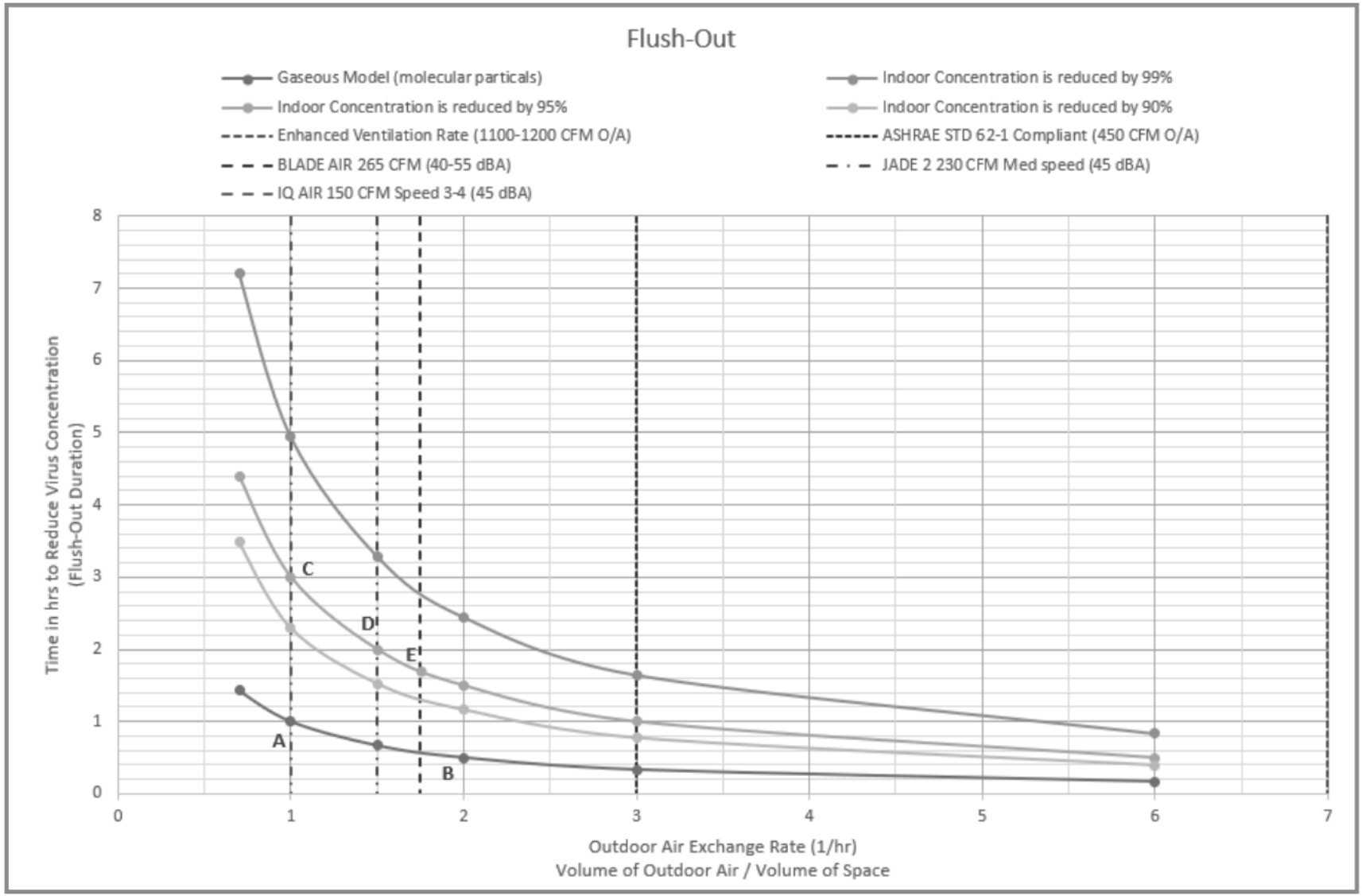
The intent is to confirm that while the building is occupied, the ventilation schedule should assist in removing bio-burden during, pre-occupancy, and post- occupancy of the spaces. Flush the spaces for a duration sufficient to reduce concentration of airborne infectious particles by 95%.

For a well-mixed space, this requires **3 changes of space volume using outdoor air (or equivalent outdoor air** including the effect of filtration and air cleaners) as detailed in the calculation methodology.

Table 6-4 Zone Air Distribution Effectiveness

Air Distribution Configuration	E_z
Well-Mixed Air Distribution Systems	
Ceiling supply of cool air	1.0
Ceiling supply of warm air and floor return	1.0
Ceiling supply of warm air 15°F (8°C) or more above space temperature and ceiling return	0.8
Ceiling supply of warm air less than 15°F (8°C) above average space temperature where the supply air-jet velocity is less than 150 fpm (0.8 m/s) within 4.5 ft (1.4 m) of the floor and ceiling return	0.8
Ceiling supply of warm air less than 15°F (8°C) above average space temperature where the supply air-jet velocity is equal to or greater than 150 fpm (0.8 m/s) within 4.5 ft (1.4 m) of the floor and ceiling return	1.0
Floor supply of warm air and floor return	1.0
Floor supply of warm air and ceiling return	0.7
Makeup supply outlet located more than half the length of the space from the exhaust, return, or both	0.8
Makeup supply outlet located less than half the length of the space from the exhaust, return, or both	0.5
Stratified Air Distribution Systems (Section 6.2.1.2.1)	
Floor supply of cool air where the vertical throw is greater than or equal to 60 fpm (0.25 m/s) at a height of 4.5 ft (1.4 m) above the floor and ceiling return at a height less than or equal to 18 ft (5.5 m) above the floor	1.05
Floor supply of cool air where the vertical throw is less than or equal to 60 fpm (0.25 m/s) at a height of 4.5 ft (1.4 m) above the floor and ceiling return at a height less than or equal to 18 ft (5.5 m) above the floor	1.2
Floor supply of cool air where the vertical throw is less than or equal to 60 fpm (0.25 m/s) at a height of 4.5 ft (1.4 m) above the floor and ceiling return at a height greater than 18 ft (5.5 m) above the floor	1.5
Personalized Ventilation Systems (Section 6.2.1.2.2)	
Personalized air at a height of 4.5 ft (1.4 m) above the floor combined with ceiling supply of cool air and ceiling return	1.40
Personalized air at a height of 4.5 ft (1.4 m) above the floor combined with ceiling supply of warm air and ceiling return	1.40
Personalized air at a height of 4.5 ft (1.4 m) above the floor combined with a stratified air distribution system with nonaspirating floor supply devices and ceiling return	1.20
Personalized air at a height of 4.5 ft (1.4 m) above the floor combined with a stratified air distribution system with aspirating floor supply devices and ceiling return	1.50

ASHRAE Flush-Out Chart



Virus Particle Size Expectation: SARS-CoV-2 Virus is based on Influenza A Studies

- The virus particle itself is very small, less than 0.14 micron
- Filters are rated at capture efficiency in three different ranges of particles
    - E1 is 0.3 to 1 um (micron)
    - E2 is 1 to 3 um (micron)
    - E3 is 3 to 10 um (micron)

Filter Ranges (Particle Size)	Anticipated Distribution of Virus
E1 (0.3 um to 1 um)	20%
E2 (1um to 3 um)	29%
E3 (3 um to 10 um)	51%

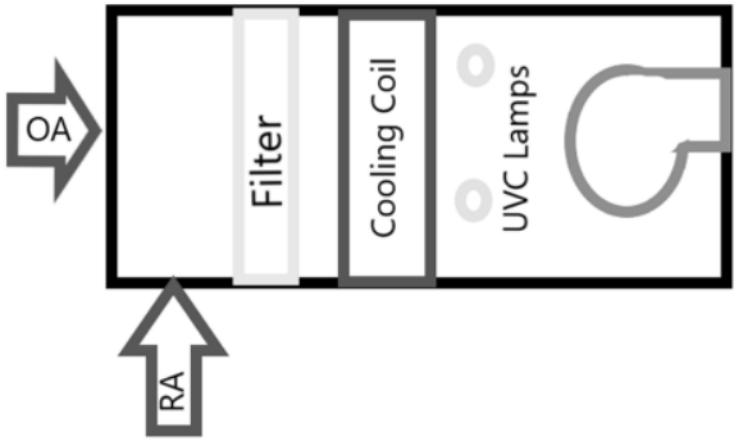
MERV Rating (Based on 52.2-2017)	Filter Droplet Nuclei Efficiency
4	16.80%
5	26.55%
6	32.45%
7	41.13%
8	55.57%
9	62.00%
10	64.65%
11	72.86%
12	83.39%
13	89.93%
14	94.94%
15	96.18%
16	97.40%

The filter's Droplet Nuclei Efficiency can now be used to determine the equivalent outdoor air that it will generate when calculating the time to achieve the Pre or Post - Occupancy Flushing Strategy.

Equivalent Outdoor Air:

Equivalent Outdoor Air is the combination of air introduced from outdoors and that recirculated from the space.

A classroom with 25-30 occupants requires roughly 3 air changes per hour of outdoor air to maintain an acceptable carbon dioxide level in the room.

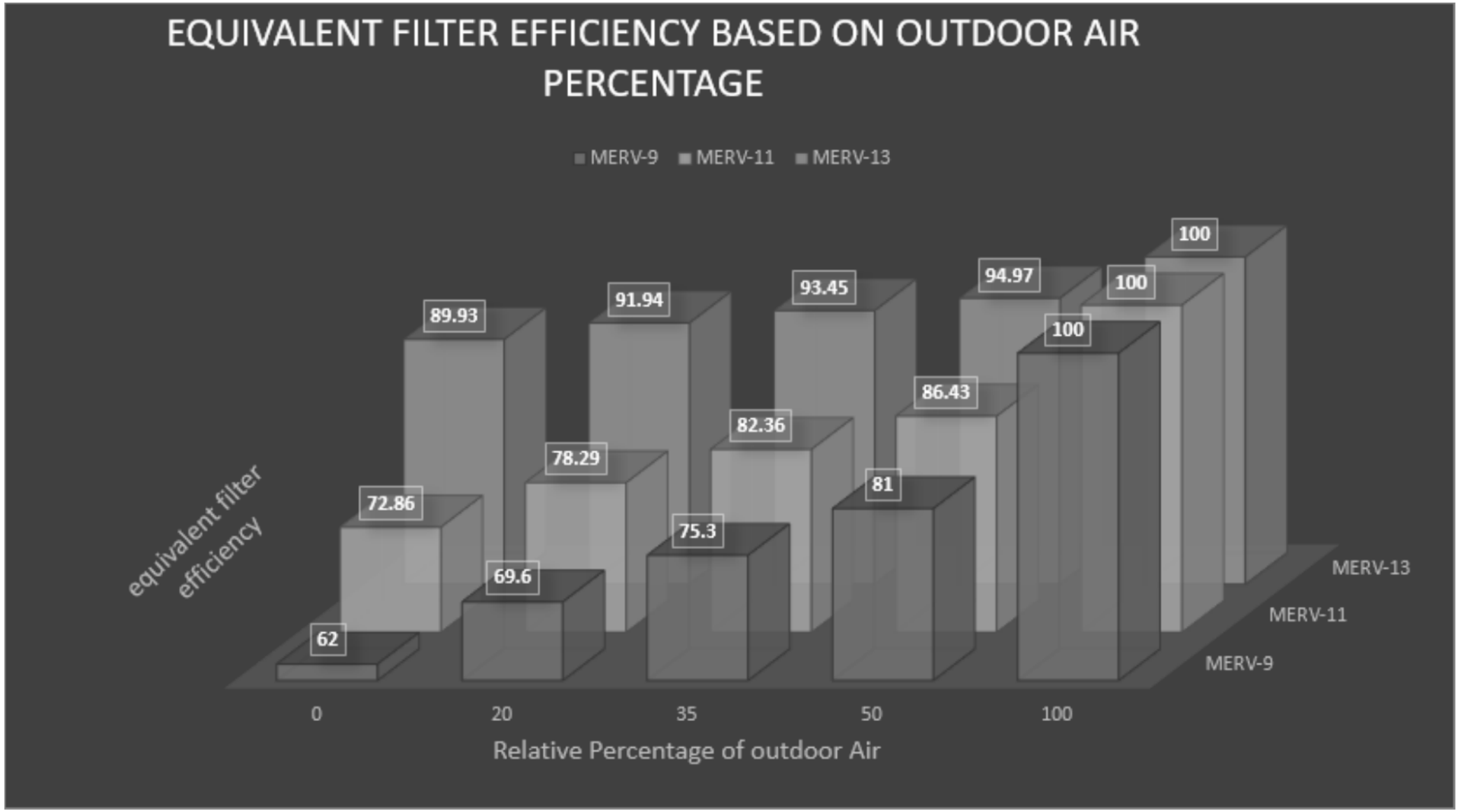


An example of a fairly typical classroom system is 3 AC/hr each of outdoor and recirculated air.

The EQ OA calculation for this would be: **3 AC x (100% efficiency) for the outdoor air + 3 AC x (Filter Efficiency) for recirc air**

For a ventilation system using a MERV 11 filter this would be:
(3 AC) (100%) + (3AC) (72.5%) = 5.175 total AC per hour

For a ventilation system using a MERV 13 filter this would be:
(3 AC) (100%) + (3AC) (90%) = 5.70 total AC per hour


EQUIVALENT FILTER EFFICIENCY BASED ON OUTDOOR AIR PERCENTAGE
MERV-9
MERV-11
MERV-13
equivalent filter efficiency
62
72.86
89.93
69.6
78.29
91.94
75.3
82.36
93.45
81
86.43
94.97
100
100
100
MERV-13
MERV-11
MERV-9
0
20
35
50
100
Relative Percentage of outdoor Air

Mechanical Air Filters

- The fraction of particles removed from air passing through a filter is termed “filter efficiency” and is provided by the Minimum Efficiency Reporting Value (MERV) from an ASHRAE 52.2 test is based on the filter efficiency.
  - MERV ranges from 1 to 16; the higher the MERV, the higher the efficiency
  - HEPA even more efficient than MERV 16 filters.
- Filters must be sealed well to give the expected performance. Ensure the airflow passes through the filter and not around it due to leaks.

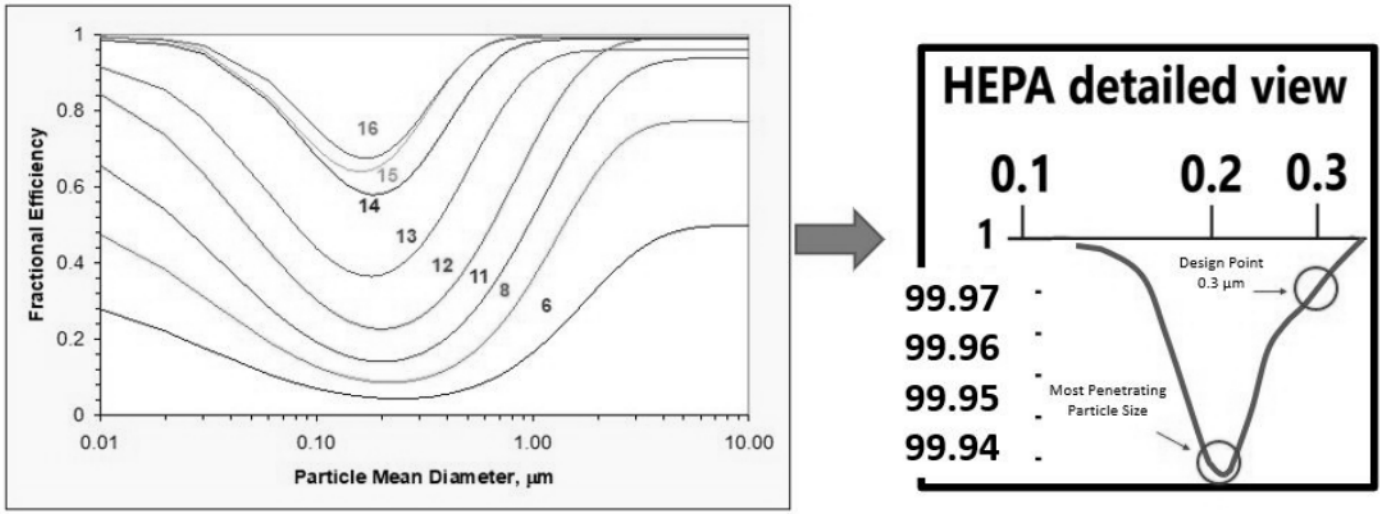
MERV with No Bypass	Gap Size 6.4 mm	19 mm	32 mm
7	6[a]	6	6
11	10	8	8
14	12/13[b]	8	8

[a]Modeled value predicted no decline for U-shaped filter (i.e., MERV 7)
[a]Straight-through = MERV 12, U-shaped = MERV 13

- Some filters have charged media to increase particle removal with lower pressure drop. Since the efficiency of these filters often drops off with initial use, a MERV-A value, if available, will reflect the actual minimum efficiency better than a standard MERV value. (A = ACTUAL)
- Increased filter efficiency generally results in increased pressure drop. Ensure HVAC systems can handle filter upgrades without negative impacts to pressure differentials and/or air flow rates prior to changing filters.
- Generally, particles with an aerodynamic diameter around 0.3 µm are most penetrating; efficiency increases above and below this particle size.

High Efficiency Particulate Air (HEPA) Filters

- By definition, HEPA filters are at least 99.97% efficient at filtering 0.3 µm mass median diameter (MMD) particles in standard tests.
- Most penetrating particle size may be smaller than 0.3 µm, so filtration efficiency of most penetrating particles can be slightly lower.



Note: Numbers in graph represent MERV values.
Kowalski, W.J. and Bahnfleth, W.P., 2002. MERV filter models for aerobiological applications. Air Media, Summer, 1.

- HEPA filter efficiency is higher than MERV 16.
- It is usually not feasible to retrofit existing HVAC systems with HEPA filters due to high pressure drops and the likelihood that systems will need new filter racks to allow sufficient sealing to prevent filter bypass.
- Adding HEPA filters to systems that are not designed for them may cause significant damage.
- To function properly, HEPA filters must be sealed properly in filter racks.
- HEPA filters are often delicate and require careful handling to prevent damage and preserve performance.
- HEPA filters can be located in HVAC systems or in:

  - In-Room or Portable HEPA Air Cleaners
  - Pre-Assembled Systems (e.g., Sidestream bypass systems)
  - On-site Retrofit Assemblies

CDC Position on Emerging Air Cleaning Technologies

- CDC does not provide recommendations for, or against, any manufacturer or product. There are numerous technologies being heavily marketed to provide air cleaning during the ongoing COVID-19 pandemic.
- While variations of these technologies have been around for decades, relative to other air cleaning or disinfection methods, they have a less-documented track record when it comes to cleaning/disinfecting large and fast volumes of moving air within heating, ventilation, and air conditioning (HVAC) systems or even inside individual rooms.
- This does not imply the technologies do not work as advertised. However, in the absence of an established body of peer-reviewed evidence showing proven efficacy and safety, the technologies are still considered by many to be “emerging.”
- As with all emerging technologies, consumers are encouraged to exercise caution and to do their homework.
- Registration alone, with national or local authorities, does not always imply product efficacy or safety.

Electronic Air Cleaners

- Removal typically occurs by electrically charging particles using corona wires or by generating ions (e.g., pin ionizers) and:
- The fraction of particles removed from air by an electronic filter is termed “removal efficiency.” Although the testing methodology of ASHRAE 52.2 can be used to determine the efficiency of many of these devices, they are not officially covered by that standard.

Gas-Phase Air Cleaners

- Gas-phase air cleaners are those used to remove ozone, volatile organic compounds and odors from the air.
- Most contain sorbent materials such as carbon (e.g., activated charcoal).
- While there may be exceptions, most sorbent beds alone are not generally efficient at removing viruses from airstreams.
- Carbon/sorbent impregnated fiber filters will remove particles; check for a MERV rating to show efficiency just as you do with standard particulate filters.

Ultraviolet Energy (UV-C)

- Ultraviolet energy inactivates viral, bacterial and fungal organisms so they are unable to replicate and potentially cause disease.
- The majority of modern UVGI lamps create UV-C energy with an electrical discharge through a low-pressure gas (including mercury vapor) enclosed in a soft glass or quartz tube, similar to fluorescent lamps.
- UV-C light-emitting diodes (LEDs) are emerging for use.
- Types of disinfection systems using UV-C energy:
  - In-duct air disinfection
  - Upper-room or upper-air disinfection
  - In-duct surface disinfection
  - Portable room decontamination
- Requires special PPE to prevent damage to eyes and/or skin from overexposure.
- Exposure to UV-C energy can cause temporary eye and skin damage

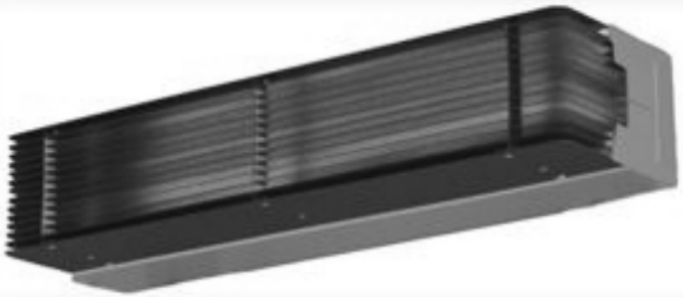


Perpendicular to airflow



Parallel to airflow

Baffled
fixture shown





Typical UV-C
energy pattern
of a baffled
fixture



Case Study – SMcN Project

District Wide Ventilation Audit

METHODOLOGY

In general, ventilation equipment at each site was reviewed from the following perspectives:

Suitability of filtration – Current ASHRAE best practice guidelines recommend that recirculated air from occupied spaces be provided filtration equivalent to MERV 13 performance, at a minimum. MERV (Minimum Efficiency Reporting Value) is a measure of filtration effectiveness and ranges from 1 to 16.

ASHRAE recommendations also state the following: “Outdoor air is considered free of viral particles unless drawn from an area where people may congregate. HVAC filters that only filter outdoor air do not need to be upgraded… If you have pre-filters and filters, you do not need to upgrade both filters. That would be likely to cause unacceptable pressure drop increases.” With that considered, fresh-air-only equipment, such as a makeup air unit serving an array of fan coil units or modular heat pumps, do not recirculate potentially contaminated air. The filter in such equipment is intended only to act as a pre-filter for the system and therefore should not require filtration additional to what is supplied by the manufacturer.

At each facility reviewed, filters in all central air handling units, as well as a sample of terminal units throughout the buildings, were inspected; and observations such as MERV rating, air-tightness, and filter cleanliness were recorded. In buildings with many terminal units, a portion of filters were sampled; with multiple samples taken from each distinct area of the building to provide a representative sample for the entire building. Observations regarding equipment filtration are summarized in the attached appendices.

Operation of outdoor air control dampers (mixing dampers) – On ventilation equipment equipped with actuating outdoor air (mixing) dampers, the function of these dampers was observed directly at the equipment location, while it was being operated remotely via digital controls systems. The test procedure consisted of commanding the full range of motion of each damper, before commanding them back to automatic operation. Observations regarding mixing damper operation are summarized in the attached appendices.

General observations - In addition to the two items above, general observations are made regarding other factors which may impact ventilation effectiveness. These included the following:

- Ability of recirculated air to bypass filter
- Operation of equipment supply fan
- Overall system air balance (relief/return air path and room pressurization)

School District 67 (Okanagan – Skaha) District Wide Ventilation Audit cont.

SUMMARY OF FINDINGS

- Significant proactive effort from the School District has occurred, to implement the recommendations and best practices published by ASHRAE.
- Throughout most of the district, work to improve the existing ventilation systems had already been completed or was in the process of being completed.
- At the time of this review, the following was observed:

  - **Filtration** – Of the different filter classifications observed throughout the school district, the majority of filters on recirculating systems are MERV 13 (or electrostatically-charged MERV 13-equivalent filters). The remainder of filters noted on these systems are either MERV 8, or non-MERV rated washable foam filters.

  - In many cases, the recirculating equipment with filtration not meeting MERV 13 equivalency appears to be in the process of being retrofitted with MERV13 filters. In other cases, it was clear that the configuration of existing equipment created limitations (such as inadequate space to modify the existing filter rack), making a successful retrofit more difficult.

  - In some circumstances fresh-air-only equipment is outfitted with MERV 13 filters. In this scenario air is coming directly from outdoors, and therefore does not pose any realistic risk of carrying viral contaminants. In these limited circumstances, the manufacturer-recommended filter should be used to reduce system pressure loss, increase ventilation, and reduce unnecessary operating and maintenance costs.

  Overall, **8%** of filter ratings were either insufficient, compared to ASHRAE [under-filtration]) or unnecessarily high (over-filtration) for 100% outdoor air systems.

  - A number of retrofitted MERV 13 filters did not form a sufficient seal in the airstream; allowing airflow to bypass the filter.

  - **Outdoor air (mixing) dampers** - **14%** of equipment outdoor air dampers are deemed “inoperable”, either due to poor communication with the building’s DDC system, or a faulty linkage to the actuator.

  - Often, these dampers are locked in the “fully-closed” position, allowing no fresh air into the associated spaces, or they are locked in a “partially” or “fully-open” position, which could result in unnecessary energy usage.

  Non-functional equipment – In one observed instance the supply fan in a rooftop unit serving the gymnasium would not operate. Other occurrences, such as loose belts and improperly balanced motors, are also noted. Although the immediate effect on ventilation is unclear, steps should be taken to prevent future failure of equipment.

District Wide Ventilation Audit cont.

BUILDING CONTROLS

- 75-percent of the schools are equipped with DDC systems with capability to monitor space CO2 concentrations.
- 25-percent are equipped with DDC systems but do not have the ability to monitor space CO2 concentrations.
- Of the sites with CO2 monitoring, 45-percent have terminal ventilation units with modulating mixing dampers.
- Ventilation systems at the other 55-percent of sites, although likely meeting ASHRAE fresh air requirements, are only able to modulate fresh air intake by increasing or decreasing the fan speed at the central air handler. This allows for building-wide CO2 control but does not allow for demand control on a classroom-by-classroom basis. However, upon review of trend log data, these systems are generally able to keep CO2 concentrations in occupied spaces well within acceptable limits. No ability for enhanced ventilation.
- For the remaining sites without CO2 sensors (5 sites), there is currently no realistic way to verify the amount of fresh air entering a given space. These sites have been identified as being suitable for a potential upgrade to allow CO2 monitoring in occupied spaces.

COMMENTS AND RECOMMENDATIONS

- **Filtration** – In commercial and institutional buildings without large sources of grease, dirt or other contaminants in the space, filters in HVAC units serving occupied spaces are typically changed 3-4 times per year, regardless of rating. Replacing them more frequently than this can be cost prohibitive and result in useable filters being thrown away, but it is recommended not to change them less frequently than this. Anecdotally in the HVAC industry, there are suggestions that electrostatically charged filters lose their effectiveness over time and that the associated MERV rating is not correct, but if the filters are changed regularly, this is not likely to be a concern and the filter will maintain close to original effectiveness throughout its lifetime.
- It is worth noting however, that increased filtration capacity has the potential to increase the total static pressure on the system, decreasing the fan's capacity, and potentially reducing the amount of fresh air delivered to a given space. Commercially available data yields the following information:
  - MERV 8 filters are considered clean at 0.25" w.g. and considered dirty at 0.6" w.g.
  - MERV 13 filters are considered clean at 0.30" w.g. and considered dirty at 1.0" w.g.

  Therefore, while the impact of upgrading to a clean or partially dirty MERV 13 filter is relatively small, the change has a greater effect on the system as filters become dirty; potentially impacting system performance if not changed at regular intervals.

Ventilation Technical Advisory Panel

From: Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>
To: Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>
Cc: Whipp, Nathan L EDUC:EX <Nathan.Whipp@gov.bc.ca>
Sent: November 10, 2021 10:16:04 AM PST
Ravnit:

Chris and I touched based with Flavia this AM, to discuss this concept and she saw lots of value – as a community of practice on this topic of shared interest especially considering the limited capacity in some (smaller, rural) districts.

Some points I wanted to relay for the TOR – let's try and get a draft together before end of week, and aim to schedule a first meeting with a core group of representatives we can expand on next week.

Thanks,
Francois

A few points I wanted to relay to inform drafting of TOR:

- Proposed framing should be COVID mitigation first but also more broadly in terms of improvements to promote student success and climate resilience, to ensure outputs last beyond the pandemic

s.13

- Potential representatives
  - Facilities directors or managers from Abbotsford, Maple Ridge and Vancouver
  - Facilities leads from small rural districts (let's check with Chuck, Flavia mentioned Keith? From Powell River)
  - EFMA reps (check with Chuck)
  - Health and safety committee leads such as Collette O'Reilly in Vancouver, and potentially the Surrey person
  - WorksafeBC either as reps or to be brought in every now and then

Francois Bertrand
Executive Director
Capital Management Branch
BC Ministry of Education

Agenda for Ventilation Technical Advisory Panel Meeting on Friday Morning

From:	Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To:	XT:Coughlan, Flavia EDUC:IN <flavia_coughlan@sd42.ca>, Chuck Morris <cmorris@sd61.bc.ca>, coreilly@vsb.bc.ca, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>, Dale Churchill <Dale.Churchill@abbyschools.ca>, Greg Forbes-King <forbes_g@surreyschools.ca>
Cc:	Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>
Sent:	November 24, 2021 3:26:31 PM PST
Attachments:	HVAC Technical Advisory Panel Terms of Reference - Draft_20211118.docx, image001.jpg

Hello all,

Below is the agenda for the initial Ventilation Technical Advisory Panel Meeting on Friday morning:

1. Introductions (FRANCOIS)
2. Overview (FRANCOIS)
3. HVAC Technical Advisory Panel Terms of Reference (DAMIEN/RAVNIT)
4. Mechanical Consultant (DAMIEN/RAVNIT)
5. Next Steps (FRANCOIS)

I've attached a draft Terms of Reference that we'll plan to go over in the meeting. Please contact me if you have any questions or concerns. Thanks,

Damien

Damien Crowell | A/Director | Minor Capital Programs & Finance Unit | Ministry of Education
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca

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VENTILATION TECHNICAL ADVISORY PANEL

TERMS OF REFERENCE – DRAFT

November 18, 2021

BRITISH COLUMBIA | Ministry of Education

Background

In the context of the COVID-19 pandemic, the Ministry of Education has been working with school districts to identify opportunities to improve school ventilation systems as part of overall strategies to mitigate the risk of viral transmission.

A Ventilation Technical Advisory Panel (the Advisory Panel) is being established to take stock of the information that has been collected to date, share information on best practices as well as guidance on additional mitigations that may be required in different contexts, as appropriate.

Purpose

The Advisory Panel will advise the Ministry and school districts on ventilation improvements relating to COVID-19 mitigation, with a view to broader shared objectives relating to student success and climate resiliency, among others.

The Advisory Panel will share advice and recommendations on ventilation systems, strategies, and best practices with BCASBO members, through the BCASBO Executive. Recommendations will be in alignment with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Reopening of Schools and Universities Guidelines to improve indoor air quality and reduce the risk of virus transmission. The panel will consider K-12 Health and Safety guidelines, a range of emerging practices and technologies, current mechanical systems employed by the sector and budget constraints.

Responsibilities

The Advisory Panel will provide the following:

1. Ventilation best practices:
    a) Additional guidance on how to effectively operate ventilation systems to reduce the risk of viral transmission.
    b) Recommendations on cost-effective equipment and/or materials to support ventilation best practices.
    c) Advice on staff training and development to support ventilation recommendations.
    d) Identification of key performance indicators to evaluate effective ventilation strategies that will promote a safe and healthy environment for learning.

2. Ongoing advice to districts on opportunities or priorities for value-added equipment or product procurements.

Advisory Panel deliberations will be guided by ASHRAE Reopening of Schools and Universities Guidelines. Discussions may result in additional sources of

best practices.

Advisory Panel Operations

The Ministry of Education will provide a Co-chair and assist with coordinating meetings, developing meeting agendas, and documenting decisions.

BCASBO is to nominate a Secretary Treasurer as Advisory Panel Co-chair.

Representation

The Advisory Panel will include representation from the Ministry, the sector along with industry technical experts. The Ministry will provide technical expertise to the Advisory Panel in the form of a contracted mechanical engineer with expertise in institutional mechanical ventilation systems.

Three representatives from the Ministry of Education:

- Francois Bertrand, Executive Director, Capital Management
- Damien Crowell, A/Director, Capital Management
- Ravnit Aujla, A/Regional Director, Capital Management

One representative from BCASBO:

- Flavia Coughlan, President and Secretary-Treasurer, SD42

One representative from EFMA:

- Chuck Morris, President and Director of Facility Services, SD61

One representative from the School Safety Association of BC:

- Colette O'Reilly, Director, SD39

Three additional representatives from the sector:

- Dale Churchill, Director of Facilities and Transportation, SD34
- Greg Forbes-King, Director of Facilities and Transportation, SD36
- Steve Hopkins, Secretary-Treasurer, SD47

One technical expert:

- TBC by Ministry of EDUC

Ad Hoc Member:

- WorkSafeBC Representative, TBD

Timelines

The Advisory Panel is expected to meet bi-weekly at first, switching to monthly as appropriate. A decision will be made by April 2022 on whether to extend the Advisory Panel timeline further, and the duration of any extension.

Deliverables

Deliverables will include:

- Identify features of effective ventilation systems and practices, within a COVID mitigation context.
- Guidance on cost-effective mitigations that may be applied in different contexts, to reduce the risk of viral transmission.
- Recommendations on ongoing investments to promote health and safety, with consideration for student success and climate resilience.

Communication

Throughout their work, Advisory Panel representatives may canvas organization members and other K-12 and health sector contacts to identify best practices that should be considered in their Advisory Panel discussions. Advisory Panel members will provide updates to their organizations, as needed.

Ventilation Technical Advisory Panel - Kick-off Meeting

From: Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To: Walker, Brenda MK EDUC:EX <Brenda.Walker@gov.bc.ca>
Cc: Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>
Sent: November 26, 2021 12:28:15 PM PST
Attachments: image001.jpg

Hi Brenda, Could you please book a 1hr meeting during the week of December 6th through December 10th? December 10th afternoon won't work for me. Meeting can be called: "Ventilation Technical Advisory Panel - Kick-off Meeting".

Attendees would include:

Three representatives from the Ministry of Education:

- Francois Bertrand, Executive Director, Capital Management
- Damien Crowell, A/Director, Capital Management
- Ravnit Aujla, A/Regional Director, Capital Management

One representative from BCASBO:

- Patti Dundas, Past President and Assistant Secretary-Treasurer, SD36

One representative from EFMA:

- Chuck Morris, President and Director of Facility Services, SD61

One representative from the School Safety Association of BC:

- Colette O'Reilly, Director, SD39

Three additional representatives from the sector:

- Steve Hopkins, Secretary-Treasurer, SD47
- Bob Beukers, Manager of Electrical & Mechanical, SD34
- Josh Currie, Assistant Director of Operations, SD2

I'll also add a HVAC consultant and representative from the Ministry of Health – just getting the names. Thanks,

Damien

Damien Crowell | A/Director | Minor Capital Programs & Finance Unit | Ministry of Education
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca

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Government Service Agreement - HVAC Consulting Services

From:	Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To:	Stephen McNicholls <stephen@smcn.ca>
Cc:	Bobbie Stenmark <bobbie@smcn.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Whipp, Nathan L EDUC:EX <Nathan.Whipp@gov.bc.ca>
Sent:	December 14, 2021 2:02:00 PM PST
Attachments:	Stephen McNicholls Consulting Inc_C227368_GSA.pdf, image001.jpg, Stephen McNicholls Consulting Inc_C227368_Certificate of Insurance.pdf

Hi Stephen,

Attached is the Government Services Agreement (GSA) and Certificate of Insurance form for HVAC consulting services. Please review the GSA and sign page 13 and return via email to me if you ok with it? Also, we will need a completed Certificate of Insurance form – Part 2 (needs to be completed with 10 business days from contract start date (December 17th, 2021)). Don't hesitate to contact me if you have any questions or concerns. It would be ideal to have the GSA signed-off by Dec 16th. We are looking forward to working with you.

Thanks,
Damien

Damien Crowell | A/Director | Minor Capital Programs & Finance Unit | Ministry of Education
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca

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GENERAL SERVICE AGREEMENT



For Administrative Purposes Only	
Ministry Contract No.: C22-7368 *Requisition No.:* N/A *Solicitation No. (if applicable):* EDU22-513-SRFP *Commodity Code:* 72151204 ***Contractor Information*** *Supplier Name:* Stephen McNicholls Consulting Inc. *Supplier No.:* TBD *Telephone No.: 250.590.3301* *E-mail Address: stephen@smcn.ca* *Website:* https://www.smcn.ca/	***Financial Information*** *Client:* *062* *Responsibility Centre:* *22422* *Service Line:* *06500* *STOB:* *60* *Project:* *2200000* ***Template version:*** *February 20, 2020*

TABLE OF CONTENTS

No.	Heading		Page
1.	**Definitions**		1
	1.1	General	1
	1.2	Meaning of "record"	2
2.	**Services**		2
	2.1	Provision of services	2
	2.2	Term	2
	2.3	Supply of various items	2
	2.4	Standard of care	2
	2.5	Standards in relation to persons performing Services	2
	2.6	Instructions by Province	2
	2.7	Confirmation of non-written instructions	2
	2.8	Effectiveness of non-written instructions	2
	2.9	Applicable laws	2
3.	**Payment**		3
	3.1	Fees and expenses	3
	3.2	Statements of accounts	3
	3.3	Withholding of amounts	3
	3.4	Appropriation	3
	3.5	Currency	3
	3.6	Non-resident income tax	3
	3.7	Prohibition against committing money	3
	3.8	Refunds of taxes	4
4.	**Representations and Warranties**		4
5.	**Privacy, Security and Confidentiality**		4
	5.1	Privacy	4
	5.2	Security	4
	5.3	Confidentiality	4
	5.4	Public announcements	5
	5.5	Restrictions on promotion	5
6.	**Material and Intellectual Property**		5
	6.1	Access to Material	5
	6.2	Ownership and delivery of Material	5
	6.3	Matters respecting intellectual property	5
	6.4	Rights relating to Incorporated Material	5
7.	**Records and Reports**		6
	7.1	Work reporting	6
	7.2	Time and expense records	6
8.	**Audit**		6

9. **Indemnity and Insurance** 6
   - 9.1 Indemnity 6
   - 9.2 Insurance 6
   - 9.3 Workers compensation 6
   - 9.4 Personal optional protection 6
   - 9.5 Evidence of coverage 7

10. **Force Majeure** 7
   - 10.1 Definitions relating to force majeure 7
   - 10.2 Consequence of Event of Force Majeure 7
   - 10.3 Duties of Affected Party 7

11. **Default and Termination** 7
   - 11.1 Definitions relating to default and termination 7
   - 11.2 Province's options on default 8
   - 11.3 Delay not a waiver 8
   - 11.4 Province's right to terminate other than for default 8
   - 11.5 Payment consequences of termination 8
   - 11.6 Discharge of liability 8
   - 11.7 Notice in relation to Events of Default 9

12. **Dispute Resolution** 9
   - 12.1 Dispute resolution process 9
   - 12.2 Location of arbitration or mediation 9
   - 12.3 Costs of mediation or arbitration 9

13. **Miscellaneous** 9
   - 13.1 Delivery of notices 9
   - 13.2 Change of address or email address 10
   - 13.3 Assignment 10
   - 13.4 Subcontracting 10
   - 13.5 Waiver 10
   - 13.6 Modifications 10
   - 13.7 Entire agreement 10
   - 13.8 Survival of certain provisions 10
   - 13.9 Schedules 10
   - 13.10 Independent contractor 11
   - 13.11 Personnel not to be employees of Province 11
   - 13.12 Key Personnel 11
   - 13.13 Pertinent Information 11
   - 13.14 Conflict of interest 11
   - 13.15 Time 11
   - 13.16 Conflicts among provisions 11
   - 13.17 Agreement not permit nor fetter 11
   - 13.18 Remainder not affected by invalidity 12
   - 13.19 Further assurances 12
   - 13.20 Additional terms 12
   - 13.21 Tax Verification 12
   - 13.22 Governing law 12

14. **Interpretation** 12

15. **Execution and Delivery of Agreement** 12

SCHEDULE A – SERVICES

Part 1 - Term
Part 2 - Services
Part 3 - Related Documentation
Part 4 - Key Personnel

SCHEDULE B – FEES AND EXPENSES

Part 1 - Maximum Amount Payable
Part 2 - Fees
Part 3 - Expenses
Part 4 - Statements of Account
Part 5 - Payments Due

SCHEDULE C – APPROVED SUBCONTRACTOR(S)

SCHEDULE D – INSURANCE

SCHEDULE E – PRIVACY PROTECTION SCHEDULE

SCHEDULE F – ADDITIONAL TERMS

SCHEDULE G – SECURITY SCHEDULE

SCHEDULE H – TAX VERIFICATION

THIS AGREEMENT is dated for reference the 14th day of December, 2021.

BETWEEN:

Stephen McNicholls Consulting Inc. (the "Contractor") with the following specified address and email address:
101-1335 Bear Mountain Parkway
Victoria, BC V9B 6T9
stephen@smcn.ca

AND:

HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA, as represented by the Minister of Education (the "Province") with the following specified address and email address:
PO Box 9045, Stn Prov Govt
Victoria, BC V8W 9E2
Damien.crowell@gov.bc.ca

The Province wishes to retain the Contractor to provide the services specified in Schedule A and, in consideration for the remuneration set out in Schedule B, the Contractor has agreed to provide those services, on the terms and conditions set out in this Agreement.

As a result, the Province and the Contractor agree as follows:

1 DEFINITIONS

General

1.1 In this Agreement, unless the context otherwise requires:

(a) "Business Day" means a day, other than a Saturday or Sunday, on which Provincial government offices are open for normal business in British Columbia;

(b) "Incorporated Material" means any material in existence prior to the start of the Term or developed independently of this Agreement, and that is incorporated or embedded in the Produced Material by the Contractor or a Subcontractor;

(c) "Material" means the Produced Material and the Received Material;

(d) "Produced Material" means records, software and other material, whether complete or not, that, as a result of this Agreement, are produced or provided by the Contractor or a Subcontractor and includes the Incorporated Material;

(e) "Received Material" means records, software and other material, whether complete or not, that, as a result of this Agreement, are received by the Contractor or a Subcontractor from the Province or any other person;

(f) "Services" means the services described in Part 2 of Schedule A;

(g) "Subcontractor" means a person described in paragraph (a) or (b) of section 13.4; and

(h) "Term" means the term of the Agreement described in Part 1 of Schedule A subject to that term ending earlier in accordance with this Agreement.

Meaning of "record"

1.2 The definition of "record" in the *Interpretation Act* is incorporated into this Agreement and "records" will bear a corresponding meaning.

2 SERVICES

Provision of services

2.1 The Contractor must provide the Services in accordance with this Agreement.

Term

2.2 Regardless of the date of execution or delivery of this Agreement, the Contractor must provide the Services during the Term.

Supply of various items

2.3 Unless the parties otherwise agree in writing, the Contractor must supply and pay for all labour, materials, equipment, tools, facilities, approvals and licenses necessary or advisable to perform the Contractor's obligations under this Agreement, including the license under section 6.4.

Standard of care

2.4 Unless otherwise specified in this Agreement, the Contractor must perform the Services to a standard of care, skill and diligence maintained by persons providing, on a commercial basis, services similar to the Services.

Standards in relation to persons performing Services

2.5 The Contractor must ensure that all persons employed or retained to perform the Services are qualified and competent to perform them and are properly trained, instructed and supervised.

Instructions by Province

2.6 The Province may from time to time give the Contractor reasonable instructions (in writing or otherwise) as to the performance of the Services. The Contractor must comply with those instructions but, unless otherwise specified in this Agreement, the Contractor may determine the manner in which the instructions are carried out.

Confirmation of non-written instructions

2.7 If the Province provides an instruction under section 2.6 other than in writing, the Contractor may request that the instruction be confirmed by the Province in writing, which request the Province must comply with as soon as it is reasonably practicable to do so.

Effectiveness of non-written instructions

2.8 Requesting written confirmation of an instruction under section 2.7 does not relieve the Contractor from complying with the instruction at the time the instruction was given.

Applicable laws

2.9 In the performance of the Contractor's obligations under this Agreement, the Contractor must comply with all applicable laws.

3 PAYMENT

Fees and expenses

3.1 If the Contractor complies with this Agreement, then the Province must pay to the Contractor at the times and on the conditions set out in Schedule B:

(a) the fees described in that Schedule;

(b) the expenses, if any, described in that Schedule if they are supported, where applicable, by proper receipts and, in the Province's opinion, are necessarily incurred by the Contractor in providing the Services; and

(c) any applicable taxes payable by the Province under law or agreement with the relevant taxation authorities on the fees and expenses described in paragraphs (a) and (b).

The Province is not obliged to pay to the Contractor more than the "Maximum Amount" specified in Schedule B on account of fees and expenses.

Statements of accounts

3.2 In order to obtain payment of any fees and expenses under this Agreement, the Contractor must submit to the Province a written statement of account in a form satisfactory to the Province upon completion of the Services or at other times described in Schedule B.

Withholding of amounts

3.3 Without limiting section 9.1, the Province may withhold from any payment due to the Contractor an amount sufficient to indemnify, in whole or in part, the Province and its employees and agents against any liens or other third-party claims that have arisen or could arise in connection with the provision of the Services. An amount withheld under this section must be promptly paid by the Province to the Contractor upon the basis for withholding the amount having been fully resolved to the satisfaction of the Province.

Appropriation

3.4 The Province's obligation to pay money to the Contractor is subject to the *Financial Administration Act*, which makes that obligation subject to an appropriation being available in the fiscal year of the Province during which payment becomes due.

Currency

3.5 Unless otherwise specified in this Agreement, all references to money are to Canadian dollars.

Non-resident income tax

3.6 If the Contractor is not a resident in Canada, the Contractor acknowledges that the Province may be required by law to withhold income tax from the fees described in Schedule B and then to remit that tax to the Receiver General of Canada on the Contractor's behalf.

Prohibition against committing money

3.7 Without limiting section 13.10(a), the Contractor must not in relation to performing the Contractor's obligations under this Agreement commit or purport to commit the Province to pay any money except as may be expressly provided for in this Agreement.

Refunds of taxes

3.8 The Contractor must:

(a) apply for, and use reasonable efforts to obtain, any available refund, credit, rebate or remission of federal, provincial or other tax or duty imposed on the Contractor as a result of this Agreement that the Province has paid or reimbursed to the Contractor or agreed to pay or reimburse to the Contractor under this Agreement; and

(b) immediately on receiving, or being credited with, any amount applied for under paragraph (a), remit that amount to the Province.

4 REPRESENTATIONS AND WARRANTIES

4.1 As at the date this Agreement is executed and delivered by, or on behalf of, the parties, the Contractor represents and warrants to the Province as follows:

(a) except to the extent the Contractor has previously disclosed otherwise in writing to the Province,

(i) all information, statements, documents and reports furnished or submitted by the Contractor to the Province in connection with this Agreement (including as part of any competitive process resulting in this Agreement being entered into) are in all material respects true and correct,

(ii) the Contractor has sufficient trained staff, facilities, materials, appropriate equipment and approved subcontractual or other agreements in place and available to enable the Contractor to fully perform the Services and to grant any licenses under this Agreement, and

(iii) the Contractor holds all permits, licenses, approvals and statutory authorities issued by any government or government agency that are necessary for the performance of the Contractor's obligations under this Agreement; and

(b) if the Contractor is not an individual,

(i) the Contractor has the power and capacity to enter into this Agreement and to observe, perform and comply with the terms of this Agreement and all necessary corporate or other proceedings have been taken and done to authorize the execution and delivery of this Agreement by, or on behalf of, the Contractor, and

(ii) this Agreement has been legally and properly executed by, or on behalf of, the Contractor and is legally binding upon and enforceable against the Contractor in accordance with its terms except as enforcement may be limited by bankruptcy, insolvency or other laws affecting the rights of creditors generally and except that equitable remedies may be granted only in the discretion of a court of competent jurisdiction.

5 PRIVACY, SECURITY AND CONFIDENTIALITY

Privacy

5.1 The Contractor must comply with the Privacy Protection Schedule attached as Schedule E.

Security

5.2 The Contractor must:

(a) make reasonable security arrangements to protect the Material from unauthorized access, collection, use, disclosure, alteration or disposal; and

(b) comply with the Security Schedule attached as Schedule G.

Confidentiality

5.3 The Contractor must treat as confidential all information in the Material and all other information accessed or obtained by the Contractor or a Subcontractor (whether verbally, electronically or otherwise) as a result of this Agreement, and not permit its disclosure or use without the Province's prior written consent except:

(a) as required to perform the Contractor's obligations under this Agreement or to comply with applicable laws;

(b) if it is information that is generally known to the public other than as result of a breach of this Agreement; or

(c) if it is information in any Incorporated Material.

Public announcements

5.4 Any public announcement relating to this Agreement will be arranged by the Province and, if such consultation is reasonably practicable, after consultation with the Contractor.

Restrictions on promotion

5.5 The Contractor must not, without the prior written approval of the Province, refer for promotional purposes to the Province being a customer of the Contractor or the Province having entered into this Agreement.

6 MATERIAL AND INTELLECTUAL PROPERTY

Access to Material

6.1 If the Contractor receives a request for access to any of the Material from a person other than the Province, and this Agreement does not require or authorize the Contractor to provide that access, the Contractor must promptly advise the person to make the request to the Province.

Ownership and delivery of Material

6.2 The Province exclusively owns all property rights in the Material which are not intellectual property rights. The Contractor must deliver any Material to the Province immediately upon the Province's request.

Matters respecting intellectual property

6.3 The Province exclusively owns all intellectual property rights, including copyright, in:

(a) Received Material that the Contractor receives from the Province; and

(b) Produced Material, other than any Incorporated Material.

Upon the Province's request, the Contractor must deliver to the Province documents satisfactory to the Province that irrevocably waive in the Province's favour any moral rights which the Contractor (or employees of the Contractor) or a Subcontractor (or employees of a Subcontractor) may have in the Produced Material and that confirm the vesting in the Province of the copyright in the Produced Material, other than any Incorporated Material.

Rights in relation to Incorporated Material

6.4 Upon any Incorporated Material being embedded or incorporated in the Produced Material and to the extent that it remains so embedded or incorporated, the Contractor grants to the Province:

(a) a non-exclusive, perpetual, irrevocable, royalty-free, worldwide license to exercise, in respect of that Incorporated Material, the rights set out in the *Copyright Act* (Canada), including the right to use, reproduce, modify, publish and distribute that Incorporated Material; and

(b) the right to sublicense or assign to third-parties any or all of the rights granted to the Province under section 6.4(a).

7 RECORDS AND REPORTS

Work reporting

7.1 Upon the Province's request, the Contractor must fully inform the Province of all work done by the Contractor or a Subcontractor in connection with providing the Services.

Time and expense records

7.2 If Schedule B provides for the Contractor to be paid fees at a daily or hourly rate or for the Contractor to be paid or reimbursed for expenses, the Contractor must maintain time records and books of account, invoices, receipts and vouchers of expenses in support of those payments, in form and content satisfactory to the Province. Unless otherwise specified in this Agreement, the Contractor must retain such documents for a period of not less than seven years after this Agreement ends.

8 AUDIT

8.1 In addition to any other rights of inspection the Province may have under statute or otherwise, the Province may at any reasonable time and on reasonable notice to the Contractor, enter on the Contractor's premises to inspect and, at the Province's discretion, copy any of the Material and the Contractor must permit, and provide reasonable assistance to, the exercise by the Province of the Province's rights under this section.

9 INDEMNITY AND INSURANCE

Indemnity

9.1 The Contractor must indemnify and save harmless the Province and the Province's employees and agents from any loss, claim (including any claim of infringement of third-party intellectual property rights), damage award, action, cause of action, cost or expense that the Province or any of the Province's employees or agents may sustain, incur, suffer or be put to at any time, either before or after this Agreement ends, (each a "Loss") to the extent the Loss is directly or indirectly caused or contributed to by:

(a) any act or omission by the Contractor or by any of the Contractor's agents, employees, officers, directors or Subcontractors in connection with this Agreement; or

(b) any representation or warranty of the Contractor being or becoming untrue or incorrect.

Insurance

9.2 The Contractor must comply with the Insurance Schedule attached as Schedule D.

Workers compensation

9.3 Without limiting the generality of section 2.9, the Contractor must comply with, and must ensure that any Subcontractors comply with, all applicable occupational health and safety laws in relation to the performance of the Contractor's obligations under this Agreement, including the *Workers Compensation Act* in British Columbia or similar laws in other jurisdictions.

Personal optional protection

9.4 The Contractor must apply for and maintain personal optional protection insurance (consisting of income replacement and medical care coverage) during the Term at the Contractor's expense if:

(a) the Contractor is an individual or a partnership of individuals and does not have the benefit of mandatory workers compensation coverage under the *Workers Compensation Act* or similar laws in other jurisdictions; and

(b) such personal optional protection insurance is available for the Contractor from WorkSafeBC or other sources.

Evidence of coverage

9.5 Within 10 Business Days of being requested to do so by the Province, the Contractor must provide the Province with evidence of the Contractor's compliance with sections 9.3 and 9.4.

10 FORCE MAJEURE

Definitions relating to force majeure

10.1 In this section and sections 10.2 and 10.3:

(a) "Event of Force Majeure" means one of the following events:

(i) a natural disaster, fire, flood, storm, epidemic or power failure,

(ii) a war (declared and undeclared), insurrection or act of terrorism or piracy,

(iii) a strike (including illegal work stoppage or slowdown) or lockout, or

(iv) a freight embargo

if the event prevents a party from performing the party's obligations in accordance with this Agreement and is beyond the reasonable control of that party; and

(b) "Affected Party" means a party prevented from performing the party's obligations in accordance with this Agreement by an Event of Force Majeure.

Consequence of Event of Force Majeure

10.2 An Affected Party is not liable to the other party for any failure or delay in the performance of the Affected Party's obligations under this Agreement resulting from an Event of Force Majeure and any time periods for the performance of such obligations are automatically extended for the duration of the Event of Force Majeure provided that the Affected Party complies with the requirements of section 10.3.

Duties of Affected Party

10.3 An Affected Party must promptly notify the other party in writing upon the occurrence of the Event of Force Majeure and make all reasonable efforts to prevent, control or limit the effect of the Event of Force Majeure so as to resume compliance with the Affected Party's obligations under this Agreement as soon as possible.

11 DEFAULT AND TERMINATION

Definitions relating to default and termination

11.1 In this section and sections 11.2 to 11.4:

(a) "Event of Default" means any of the following:

(i) an Insolvency Event,

(ii) the Contractor fails to perform any of the Contractor's obligations under this Agreement, or

(iii) any representation or warranty made by the Contractor in this Agreement is untrue or incorrect; and

(b) "Insolvency Event" means any of the following:

(i) an order is made, a resolution is passed or a petition is filed, for the Contractor's liquidation or winding up,

(ii) the Contractor commits an act of bankruptcy, makes an assignment for the benefit of the Contractor's creditors or otherwise acknowledges the Contractor's insolvency,

(iii) a bankruptcy petition is filed or presented against the Contractor or a proposal under the *Bankruptcy and Insolvency Act* (Canada) is made by the Contractor,

(iv) a compromise or arrangement is proposed in respect of the Contractor under the *Companies' Creditors Arrangement Act* (Canada),

(v) a receiver or receiver-manager is appointed for any of the Contractor's property, or

(vi) the Contractor ceases, in the Province's reasonable opinion, to carry on business as a going concern.

Province's options on default

11.2 On the happening of an Event of Default, or at any time thereafter, the Province may, at its option, elect to do any one or more of the following:

(a) by written notice to the Contractor, require that the Event of Default be remedied within a time period specified in the notice;

(b) pursue any remedy or take any other action available to it at law or in equity; or

(c) by written notice to the Contractor, terminate this Agreement with immediate effect or on a future date specified in the notice, subject to the expiration of any time period specified under section 11.2(a).

Delay not a waiver

11.3 No failure or delay on the part of the Province to exercise its rights in relation to an Event of Default will constitute a waiver by the Province of such rights.

Province's right to terminate other than for default

11.4 In addition to the Province's right to terminate this Agreement under section 11.2(c) on the happening of an Event of Default, the Province may terminate this Agreement for any reason by giving at least 10 days' written notice of termination to the Contractor.

Payment consequences of termination

11.5 Unless Schedule B otherwise provides, if the Province terminates this Agreement under section 11.4:

(a) the Province must, within 30 days of such termination, pay to the Contractor any unpaid portion of the fees and expenses described in Schedule B which corresponds with the portion of the Services that was completed to the Province's satisfaction before termination of this Agreement; and

(b) the Contractor must, within 30 days of such termination, repay to the Province any paid portion of the fees and expenses described in Schedule B which corresponds with the portion of the Services that the Province has notified the Contractor in writing was not completed to the Province's satisfaction before termination of this Agreement.

Discharge of liability

11.6 The payment by the Province of the amount described in section 11.5(a) discharges the Province from all liability to make payments to the Contractor under this Agreement.

Notice in relation to Events of Default

11.7 If the Contractor becomes aware that an Event of Default has occurred or anticipates that an Event of Default is likely to occur, the Contractor must promptly notify the Province of the particulars of the Event of Default or anticipated Event of Default. A notice under this section as to the occurrence of an Event of Default must also specify the steps the Contractor proposes to take to address, or prevent recurrence of, the Event of Default. A notice under this section as to an anticipated Event of Default must specify the steps the Contractor proposes to take to prevent the occurrence of the anticipated Event of Default.

12 DISPUTE RESOLUTION

Dispute resolution process

12.1 In the event of any dispute between the parties arising out of or in connection with this Agreement, the following dispute resolution process will apply unless the parties otherwise agree in writing:

(a) the parties must initially attempt to resolve the dispute through collaborative negotiation;

(b) if the dispute is not resolved through collaborative negotiation within 15 Business Days of the dispute arising, the parties must then attempt to resolve the dispute through mediation under the rules of the Mediate BC Society; and

(c) if the dispute is not resolved through mediation within 30 Business Days of the commencement of mediation, the dispute must be referred to and finally resolved by arbitration under the *Arbitration Act*.

Location of arbitration or mediation

12.2 Unless the parties otherwise agree in writing, an arbitration or mediation under section 12.1 will be held in Victoria, British Columbia.

Costs of mediation or arbitration

12.3 Unless the parties otherwise agree in writing or, in the case of an arbitration, the arbitrator otherwise orders, the parties must share equally the costs of a mediation or arbitration under section 12.1 other than those costs relating to the production of expert evidence or representation by counsel.

13 MISCELLANEOUS

Delivery of notices

13.1 Any notice contemplated by this Agreement, to be effective, must be in writing and delivered as follows:

(a) by email to the addressee's email address specified on the first page of this Agreement, in which case it will be deemed to be received on the day of transmittal unless transmitted after the normal business hours of the addressee or on a day that is not a Business Day, in which cases it will be deemed to be received on the next following Business Day;

(b) by hand to the addressee's address specified on the first page of this Agreement, in which case it will be deemed to be received on the day of its delivery; or

(c) by prepaid post to the addressee's address specified on the first page of this Agreement, in which case if mailed during any period when normal postal services prevail, it will be deemed to be received on the fifth Business Day after its mailing.

Change of address or email address

13.2 Either party may from time to time give notice to the other party of a substitute address or email address, which from the date such notice is given will supersede for purposes of section 13.1 any previous address or email address specified for the party giving the notice.

Assignment

13.3 The Contractor must not assign any of the Contractor's rights or obligations under this Agreement without the Province's prior written consent. Upon providing written notice to the Contractor, the Province may assign to any person any of the Province's rights under this Agreement and may assign to any "government corporation", as defined in the *Financial Administration Act*, any of the Province's obligations under this Agreement.

Subcontracting

13.4 The Contractor must not subcontract any of the Contractor's obligations under this Agreement to any person without the Province's prior written consent, excepting persons listed in the attached Schedule C. No subcontract, whether consented to or not, relieves the Contractor from any obligations under this Agreement. The Contractor must ensure that:

(a) any person retained by the Contractor to perform obligations under this Agreement; and

(b) any person retained by a person described in paragraph (a) to perform those obligations

fully complies with this Agreement in performing the subcontracted obligations.

Waiver

13.5 A waiver of any term or breach of this Agreement is effective only if it is in writing and signed by, or on behalf of, the waiving party and is not a waiver of any other term or breach.

Modifications

13.6 No modification of this Agreement is effective unless it is in writing and signed by, or on behalf of, the parties.

Entire agreement

13.7 This Agreement (including any modification of it) constitutes the entire agreement between the parties as to performance of the Services.

Survival of certain provisions

13.8 Sections 2.9, 3.1 to 3.4, 3.7, 3.8, 5.1 to 5.5, 6.1 to 6.4, 7.1, 7.2, 8.1, 9.1, 9.2, 9.5, 10.1 to 10.3, 11.2, 11.3, 11.5, 11.6, 12.1 to 12.3, 13.1, 13.2, 13.8, and 13.10, any accrued but unpaid payment obligations, and any other sections of this Agreement (including schedules) which, by their terms or nature, are intended to survive the completion of the Services or termination of this Agreement, will continue in force indefinitely subject to any applicable limitation period prescribed by law, even after this Agreement ends.

Schedules

13.9 The schedules to this Agreement (including any appendices or other documents attached to, or incorporated by reference into, those schedules) are part of this Agreement.

Independent contractor

13.10 In relation to the performance of the Contractor's obligations under this Agreement, the Contractor is an independent contractor and not:

(a) an employee or partner of the Province; or

(b) an agent of the Province except as may be expressly provided for in this Agreement.

The Contractor must not act or purport to act contrary to this section.

Personnel not to be employees of Province

13.11 The Contractor must not do anything that would result in personnel hired or used by the Contractor or a Subcontractor in relation to providing the Services being considered employees of the Province.

Key Personnel

13.12 If one or more individuals are specified as "Key Personnel" of the Contractor in Part 4 of Schedule A, the Contractor must cause those individuals to perform the Services on the Contractor's behalf, unless the Province otherwise approves in writing, which approval must not be unreasonably withheld.

Pertinent information

13.13 The Province must make available to the Contractor all information in the Province's possession which the Province considers pertinent to the performance of the Services.

Conflict of interest

13.14 The Contractor must not provide any services to any person in circumstances which, in the Province's reasonable opinion, could give rise to a conflict of interest between the Contractor's duties to that person and the Contractor's duties to the Province under this Agreement.

Time

13.15 Time is of the essence in this Agreement and, without limitation, will remain of the essence after any modification or extension of this Agreement, whether or not expressly restated in the document effecting the modification or extension.

Conflicts among provisions

13.16 Conflicts among provisions of this Agreement will be resolved as follows:

(a) a provision in the body of this Agreement will prevail over any conflicting provision in, attached to or incorporated by reference into a schedule, unless that conflicting provision expressly states otherwise; and

(b) a provision in a schedule will prevail over any conflicting provision in a document attached to or incorporated by reference into a schedule, unless the schedule expressly states otherwise.

Agreement not permit nor fetter

13.17 This Agreement does not operate as a permit, license, approval or other statutory authority which the Contractor may be required to obtain from the Province or any of its agencies in order to provide the Services. Nothing in this Agreement is to be construed as interfering with, or fettering in any manner, the exercise by the Province or its agencies of any statutory, prerogative, executive or legislative power or duty.

Remainder not affected by invalidity

13.18 If any provision of this Agreement or the application of it to any person or circumstance is invalid or unenforceable to any extent, the remainder of this Agreement and the application of such provision to any other person or circumstance will not be affected or impaired and will be valid and enforceable to the extent permitted by law.

Further assurances

13.19 Each party must perform the acts, execute and deliver the writings, and give the assurances as may be reasonably necessary to give full effect to this Agreement.

Additional terms

13.20 Any additional terms set out in the attached Schedule F apply to this Agreement.

Tax Verification

13.21 Any terms set out in the attached Schedule H apply to this Agreement.

Governing law

13.22 This Agreement is governed by, and is to be interpreted and construed in accordance with, the laws applicable in British Columbia.

14 INTERPRETATION

14.1 In this Agreement:

(a) "includes" and "including" are not intended to be limiting;

(b) unless the context otherwise requires, references to sections by number are to sections of this Agreement;

(c) the Contractor and the Province are referred to as "the parties" and each of them as a "party";

(d) "attached" means attached to this Agreement when used in relation to a schedule;

(e) unless otherwise specified, a reference to a statute by name means the statute of British Columbia by that name, as amended or replaced from time to time;

(f) the headings have been inserted for convenience of reference only and are not intended to describe, enlarge or restrict the scope or meaning of this Agreement or any provision of it;

(g) "person" includes an individual, partnership, corporation or legal entity of any nature; and

(h) unless the context otherwise requires, words expressed in the singular include the plural and *vice versa*.

15 EXECUTION AND DELIVERY OF AGREEMENT

15.1 This Agreement may be entered into by a separate copy of this Agreement being executed by, or on behalf of, each party and that executed copy being delivered to the other party by a method provided for in section 13.1 or any other method agreed to by the parties.

The parties have executed this Agreement as follows:

SIGNED on the _____ day of December, 2021 by the Contractor (or, if not an individual, on its behalf by its authorized signatory or signatories): _____ Signature(s) _____ Print Name(s) _____ Print Title(s)	SIGNED on the _____ day of December, 2021 on behalf of the Province by its duly authorized representative: _____ Signature _____ Print Name _____ Print Title

Schedule A – Services

PART 1. TERM:

1. Subject to section 2 of this Part 1, the term of this Agreement commences on December 17, 2021 and ends on April 17, 2022.
2. At the sole discretion of the Province, this Agreement may be extended up to one (1) additional three-month term.

PART 2. SERVICES:

Background

The Ministry of Education has been working with school districts to identify opportunities on improving the ventilation systems in schools and mitigate the risks of viral transmission (e.g. COVID-19). This work will support student success and address other shared priorities, including climate change.

The Ministry of Education is seeking the support of an HVAC Technical Advisor to assess school ventilation systems across BC, evaluate data collected by the Ministry on current approaches to ventilation in schools, and recommend cost-effective solutions as needed.

The HVAC Technical Advisor will work alongside the Ministry, school districts, and the Technical Advisory Panel to provide expertise on ventilation systems, risk mitigation strategies, and best practices.

Outputs

The Contractor must:

- Evaluate the current HVAC systems in schools throughout BC.
- Identify the current approach to ventilation in schools and COVID-19 mitigation efforts.
- Identify opportunities to improve the ventilation systems in schools to mitigate transmission of COVID-19.
- Provide detailed guidance and analysis that may be applied in different contexts to further reduce the risks of viral transmission through ventilation systems in schools.
- Develop reports for the Ministry, school districts, and the public, as directed.

Inputs

The Contractor must provide the time, materials, equipment, and expertise required to provide the deliverables, as stated above.

Outcomes

Through the delivery of the Services the Province wishes to realize the following outcomes and, without limiting the obligation of the Contractor to comply with other provisions of this Part, the Contractor must use commercially reasonable efforts to achieve them:

- Identify features of effective ventilation systems and practices, within a COVID mitigation context.
- Guidance on cost-effective mitigations that may be applied in different contexts, to reduce the risk of viral transmission.
- Recommendations on ongoing investments to promote health and safety, with consideration for student success and climate resilience

The parties acknowledge that the Contractor does not warrant that these outcomes will be achieved.

Reporting requirements
Draft report on evaluation of HVAC systems in schools throughout BC to be completed by February 28, 2022.

PART 3. RELATED DOCUMENTATION:
Not applicable

PART 4. KEY PERSONNEL:
1. The Key Personnel of the Contractor are as follows:

   (a) Stephen McNicholls

Schedule B – Fees and Expenses

1. MAXIMUM AMOUNT PAYABLE:

Maximum Amount: Despite sections 2 and 3 of this Schedule, $74,500.00 is the maximum amount which the Province is obliged to pay to the Contractor for fees and expenses under this Agreement (exclusive of any applicable taxes described in section 3.1(c) of this Agreement).

2. FEES:

Hourly Rate

Fees: at a rate of $150 per hour for those hours during the Term when the Contractor provides the Services.

3. EXPENSES:

Expenses:

a. travel, accommodation and meal expenses for travel greater than 32 kilometers away from 101-1335 Bear mountain Parkway, Victoria, BC on the same basis as the Province pays its Group I employees when they are on travel status; and

b. the Contractor's actual long-distance telephone, postage and other identifiable communication expenses.

excluding goods and services tax ("GST") or other applicable tax paid or payable by the Contractor on expenses described in (a) and (b) above to the extent that the Contractor is entitled to claim credits (including GST input tax credits), rebates, refunds or remissions of the tax from the relevant taxation authorities.

4. STATEMENTS OF ACCOUNT:

Statements of Account: In order to obtain payment of any fees and expenses under this Agreement for a period from and including the 1st day of a month to and including the last day of that month (each a "Billing Period"), the Contractor must deliver to the Province on a date after the Billing Period (each a "Billing Date"), a written statement of account in a form satisfactory to the Province containing:

(a) the Contractor's legal name and address;

(b) the date of the statement, and the Billing Period to which the statement pertains;

(c) the Contractor's calculation of all fees claimed for that Billing Period, including a declaration by the Contractor of all hours worked during the Billing Period;

(d) a chronological listing, in reasonable detail, of any expenses claimed by the Contractor for the Billing Period with receipts attached, if applicable, and, if the Contractor is claiming reimbursement of any GST or other applicable taxes paid or payable by the Contractor in relation to those expenses, a description of any credits, rebates, refunds or remissions the Contractor is entitled to from the relevant taxation authorities in relation to those taxes;

(e) the Contractor's calculation of any applicable taxes payable by the Province in relation to the Services for the Billing Period;

(f) a description of this Agreement;

(g) a statement number for identification; and

(h) any other billing information reasonably requested by the Province.

5. PAYMENTS DUE:

Payments Due: Within 30 days of the Province's receipt of the Contractor's written statement of account delivered in accordance with this Schedule, the Province must pay the Contractor the fees and expenses (plus all applicable taxes) claimed in the statement if they are in accordance with this Schedule. Statements of account or contract invoices offering an early payment discount may be paid by the Province as required to obtain the discount.

Schedule C – Approved Subcontractor(s)

Not applicable.

Schedule D – Insurance

1. The Contractor must, without limiting the Contractor's obligations or liabilities and at the Contractor's own expense, purchase and maintain throughout the Term the following insurances with insurers licensed in Canada in forms and amounts acceptable to the Province:

   (a) Commercial General Liability in an amount not less than $2,000,000.00 inclusive per occurrence against bodily injury, personal injury and property damage and including liability assumed under this Agreement and this insurance must

      (i) include the Province as an additional insured,

      (ii) be endorsed to provide the Province with 30 days advance written notice of cancellation or material change, and

      (iii) include a cross liability clause.

2. All insurance described in section 1 of this Schedule must:

   (a) be primary; and

   (b) not require the sharing of any loss by any insurer of the Province.

3. The Contractor must provide the Province with evidence of all required insurance as follows:

   (a) within 10 Business Days of commencement of the Services, the Contractor must provide to the Province evidence of all required insurance in the form of a completed Province of British Columbia Certificate of Insurance;

   (b) if any required insurance policy expires before the end of the Term, the Contractor must provide to the Province within 10 Business Days of the policy's expiration, evidence of a new or renewal policy meeting the requirements of the expired insurance in the form of a completed Province of British Columbia Certificate of Insurance; and

   (c) despite paragraph (a) or (b) above, if requested by the Province at any time, the Contractor must provide to the Province certified copies of the required insurance policies.

4. The Contractor must obtain, maintain and pay for any additional insurance which the Contractor is required by law to carry, or which the Contractor considers necessary to cover risks not otherwise covered by insurance specified in this Schedule in the Contractor's sole discretion.

Schedule E – Privacy Protection Schedule

Definitions

1. In this Schedule,

   (a) "**access**" means disclosure by the provision of access;

   (b) "**Act**" means the *Freedom of Information and Protection of Privacy Act*;

   (c) "**contact information**" means information to enable an individual at a place of business to be contacted and includes the name, position name or title, business telephone number, business address, business email or business fax number of the individual;

   (d) "**personal information**" means recorded information about an identifiable individual, other than contact information, collected or created by the Contractor as a result of the Agreement or any previous agreement between the Province and the Contractor dealing with the same subject matter as the Agreement but excluding any such information that, if this Schedule did not apply to it, would not be under the "control of a public body" within the meaning of the Act; and

   (e) "**privacy course**" means the Province's online privacy and information sharing training course.

Purpose

2. The purpose of this Schedule is to:

   (a) enable the Province to comply with the Province's statutory obligations under the Act with respect to personal information; and

   (b) ensure that, as a service provider, the Contractor is aware of and complies with the Contractor's statutory obligations under the Act with respect to personal information.

Collection of personal information

3. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor may only collect or create personal information that is necessary for the performance of the Contractor's obligations, or the exercise of the Contractor's rights, under the Agreement.

4. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor must collect personal information directly from the individual the information is about.

5. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor must tell an individual from whom the Contractor collects personal information:

   (a) the purpose for collecting it;

   (b) the legal authority for collecting it; and

   (c) the title, business address and business telephone number of the person designated by the Province to answer questions about the Contractor's collection of personal information.

Privacy Training

6. The Contractor must ensure that each person who will provide services under the Agreement that involve the collection or creation of personal information will complete, at the Contractor's expense, the privacy course prior to that person providing those services.

7. The requirement in section 6 will only apply to persons who have not previously completed the privacy course.

Accuracy of personal information

8. The Contractor must make every reasonable effort to ensure the accuracy and completeness of any personal information to be used by the Contractor or the Province to make a decision that directly affects the individual the information is about.

Requests for access to personal information

9. If the Contractor receives a request for access to personal information from a person other than the Province, the Contractor must promptly advise the person to make the request to the Province unless the Agreement expressly requires the Contractor to provide such access and, if the Province has advised the Contractor of the name or title and contact information of an official of the Province to whom such requests are to be made, the Contractor must also promptly provide that official's name or title and contact information to the person making the request.

Correction of personal information

10. Within 5 Business Days of receiving a written direction from the Province to correct or annotate any personal information, the Contractor must annotate or correct the information in accordance with the direction.

11. When issuing a written direction under section 10, the Province must advise the Contractor of the date the correction request to which the direction relates was received by the Province in order that the Contractor may comply with section 12.

12. Within 5 Business Days of correcting or annotating any personal information under section 10, the Contractor must provide the corrected or annotated information to any party to whom, within one year prior to the date the correction request was made to the Province, the Contractor disclosed the information being corrected or annotated.

13. If the Contractor receives a request for correction of personal information from a person other than the Province, the Contractor must promptly advise the person to make the request to the Province and, if the Province has advised the Contractor of the name or title and contact information of an official of the Province to whom such requests are to be made, the Contractor must also promptly provide that official's name or title and contact information to the person making the request.

Protection of personal information

14. The Contractor must protect personal information by making reasonable security arrangements against such risks as unauthorized access, collection, use, disclosure or disposal, including any expressly set out in the Agreement.

Storage and access to personal information

15. Unless the Province otherwise directs in writing, the Contractor must not store personal information outside Canada or permit access to personal information from outside Canada.

Retention of personal information

16. Unless the Agreement otherwise specifies, the Contractor must retain personal information until directed by the Province in writing to dispose of it or deliver it as specified in the direction.

Use of personal information

17. Unless the Province otherwise directs in writing, the Contractor may only use personal information if that use is for the performance of the Contractor's obligations, or the exercise of the Contractor's rights, under the Agreement.

Disclosure of personal information

18. Unless the Province otherwise directs in writing, the Contractor may only disclose personal information inside Canada to any person other than the Province if the disclosure is for the performance of the Contractor's obligations, or the exercise of the Contractor's rights, under the Agreement.

19. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor must not disclose personal information outside Canada.

Notice of foreign demands for disclosure

20. In addition to any obligation the Contractor may have to provide the notification contemplated by section 30.2 of the Act, if in relation to personal information in the custody or under the control of the Contractor, the Contractor:

    (a) receives a foreign demand for disclosure;

    (b) receives a request to disclose, produce or provide access that the Contractor knows or has reason to suspect is for the purpose of responding to a foreign demand for disclosure; or

    (c) has reason to suspect that an unauthorized disclosure of personal information has occurred in response to a foreign demand for disclosure

    the Contractor must immediately notify the Province and, in so doing, provide the information described in section 30.2(3) of the Act. In this section, the phrases "foreign demand for disclosure" and "unauthorized disclosure of personal information" will bear the same meanings as in section 30.2 of the Act.

Notice of unauthorized disclosure

21. In addition to any obligation the Contractor may have to provide the notification contemplated by section 30.5 of the Act, if the Contractor knows that there has been an unauthorized disclosure of personal information in the custody or under the control of the Contractor, the Contractor must immediately notify the Province. In this section, the phrase "unauthorized disclosure of personal information" will bear the same meaning as in section 30.5 of the Act.

Inspection of personal information

22. In addition to any other rights of inspection the Province may have under the Agreement or under statute, the Province may, at any reasonable time and on reasonable notice to the Contractor, enter on the Contractor's premises to inspect any personal information in the possession of the Contractor or any of the Contractor's information management policies or practices relevant to the Contractor's management of personal information or the Contractor's compliance with this Schedule and the Contractor must permit, and provide reasonable assistance to, any such inspection.

Compliance with the Act and directions

23. The Contractor must in relation to personal information comply with:

    (a) the requirements of the Act applicable to the Contractor as a service provider, including any applicable order of the commissioner under the Act; and

    (b) any direction given by the Province under this Schedule.

24. The Contractor acknowledges that it is familiar with the requirements of the Act governing personal information that are applicable to it as a service provider.

Notice of non-compliance

25. If for any reason the Contractor does not comply, or anticipates that it will be unable to comply, with a provision in this Schedule in any respect, the Contractor must promptly notify the Province of the particulars of the non-compliance or anticipated non-compliance and what steps it proposes to take to address, or prevent recurrence of, the non-compliance or anticipated non-compliance.

Termination of Agreement

26. In addition to any other rights of termination which the Province may have under the Agreement or otherwise at law, the Province may, subject to any provisions in the Agreement establishing mandatory cure periods for defaults by the Contractor, terminate the Agreement by giving written notice of such termination to the Contractor, upon any failure of the Contractor to comply with this Schedule in a material respect.

Interpretation

27. In this Schedule, references to sections by number are to sections of this Schedule unless otherwise specified in this Schedule.

28. Any reference to the "Contractor" in this Schedule includes any subcontractor or agent retained by the Contractor to perform obligations under the Agreement and the Contractor must ensure that any such subcontractors and agents comply with this Schedule.

29. The obligations of the Contractor in this Schedule will survive the termination of the Agreement.

30. If a provision of the Agreement (including any direction given by the Province under this Schedule) conflicts with a requirement of the Act or an applicable order of the commissioner under the Act, the conflicting provision of the Agreement (or direction) will be inoperative to the extent of the conflict.

31. The Contractor must comply with the provisions of this Schedule despite any conflicting provision of this Agreement or, subject to section 32, the law of any jurisdiction outside Canada.

32. Nothing in this Schedule requires the Contractor to contravene the law of any jurisdiction outside Canada unless such contravention is required to comply with the Act.

Schedule F – Additional Terms

Not applicable.

Schedule G – Security Schedule

Definitions

1. In this Schedule:

(a) "**Device**" means any device to manage, operate or provide the Services or to connect to any Systems or any Province system or network, or that is capable of storing any Protected Information, and includes any workstation or handheld device the Contractor authorizes Personnel to use in relation to this Agreement;

(b) "**Facilities**" means the physical locations (excluding those of the Province) the Contractor uses to provide the Services, or to house Systems or records containing Protected Information;

(c) "**Least Privilege**" means the principle requiring that each subject in a system be granted the most restrictive set of privileges (or lowest clearance) needed for the performance of authorized tasks so as to limit the damage that can result from accident, error or unauthorized use;

(d) "**Need-to-Know**" means the principle where access is restricted to authorized individuals whose duties require such access and not merely because of status, rank or office;

(e) "**Personnel**" means all individuals hired or used by the Contractor and Subcontractors to perform the Contractor's obligations under this Agreement, including unpaid volunteers and the Contractor or a Subcontractor if an individual;

(f) "**Policies**" means the intentions and directions of an organization or part of it, as expressed in record form by its top management (including, for example, policies, directions, standards, practices, procedures and guidelines);

(g) "**Protected Information**" means any and all:

(i) "personal information" as defined in the Privacy Protection Schedule if attached;

(ii) information and records of information the Contractor is required to treat as confidential under this Agreement; and

(iii) records, the integrity or availability of which are to be preserved by the Contractor under this Agreement, which in the case of records not falling within (i) or (ii), are marked or instructed by the Province to be so preserved or otherwise treated as "Protected Information" under this Agreement;

(h) "**Security Event Logs**" means any logs (also known as audit records) of events, notifications or alerts that any component of any Device or other device (not limited to security device), or any Systems or other system or software is technically capable of producing in relation to its status, functions and activities that may be used for such purposes as security investigations, auditing, monitoring and determining security incidents (examples of components capable of producing such logs include firewalls, intrusion prevention systems, routers, switches, content filtering, network traffic flow logs, networks, authentication services, directory services, dynamic host configuration protocols, dynamic naming services, hardware platforms, virtualization platforms, servers, operating systems, web servers, databases, applications, application firewalls);

(i) "**Systems**" means any systems, subsystems, equipment, infrastructure, networks, management networks, servers, hardware and software the Contractor uses in relation to this Agreement, including for managing, operating or providing the Services, but excluding any the Province owns or makes available to the Contractor for the Contractor to use in relation to this Agreement;

(j) "**Tenancy**" means those components of the Systems that:

(i) directly access and store Protected Information,

(ii) relate to Protected Information or the Province's tenancy activities, or

(iii) are customer facing and managed by the Province in its use of the Services; and

(k) "**Tenancy Security Event Logs**" means Security Event Logs that relate to Tenancy, including:

(i) log-on/log-off information about Province user activities, and

(ii) application logs, web server log, file server logs, database logs of applications, web servers, file servers or database servers or any other logs that directly store, access or contain Protected Information.

Additional obligations

2. The Contractor must comply with Appendix G1 if attached.

PERSONNEL

Confidentiality agreements

3. The Contractor must not permit any person the Contractor hires or uses to access or obtain any Protected Information unless that person is contractually bound to the Contractor in writing to keep Protected Information confidential on terms no less protective than the terms applicable to the Contractor under this Agreement.

Personnel security screening

4. The Contractor may only permit individual Personnel to have access to any Protected Information or other asset of the Province (including to any system, network or device the Province makes available to the Contractor) in relation to this Agreement, if, after:

(a) verifying their identity and relevant education, professional qualifications and employment history;

(b) completing a criminal record check that is updated at least every five years;

(c) requiring Personnel to proactively disclose criminal offences to the Contractor unless prohibited by applicable law;

(d) performing any additional screening this Agreement or applicable law may require; and

(e) performing any additional background checks the Contractor considers appropriate,

the Contractor is satisfied that the individual does not constitute an unreasonable security risk.

5. If any criminal record check or proactive disclosure reveals a prior criminal offence or pending criminal matter, the Contractor must make a reasonable determination of whether the applicable person constitutes an unreasonable security risk, taking into consideration the duties of the individual and the type and sensitivity of information to which the individual may be exposed.

6. If the Contractor is an individual, the Province may subject the Contractor to the screening requirements in this Schedule.

Personnel information security training

7. Unless otherwise specified in this Agreement, the Contractor must ensure all Personnel complete any relevant information security training, at the Contractor's expense, before they provide any Services, or receive or are given access to any Protected Information or any system, device or secure facility of the Province, and thereafter at least annually.

Security contact

8. If not set out elsewhere in this Agreement, the Contractor (but not a Subcontractor) must provide in writing to the Province the contact information for the individual who will coordinate compliance by the Contractor and all Subcontractors and act as a direct contact for the Province on matters relating to this Schedule.

Supply chain

9. The Contractor must ensure that the security requirements of those in its upstream and downstream supply chain are documented, followed, reviewed, and updated on an ongoing basis as applicable to this Agreement.

GENERAL POLICIES AND PRACTICES

Information security policy

10. The Contractor must have an information security Policy that is:

    (a) based on recognized industry standards; and

    (b) reviewed and updated at least every three years.

Compliance and Standard for Security Controls

11. Unless this Agreement otherwise specifies, the Contractor must apply controls and security management practices to manage or operate Protected Information and Systems, Devices, and Facilities that are compliant with or equivalent to the following Province's Policies accessible at https://www2.gov.bc.ca/gov/content/governments/services-for-government/policies-procedures:

    (a) "Information Security Policy";

    (b) government wide IM/IT Standards; and

    (c) sector or ministry specific IM/IT Standards, if any applicable to the Province ministry, agency or other representative receiving the Services.

Contractor security risk assessments

12. The Contractor must undertake a security threat and risk assessment against an industry security standard before placing any new or materially changed Systems or services into production.

Change control and management

13. The Contractor must:

(a) implement and maintain change control processes for Facilities, Systems and Devices in line with applicable security best practices to reduce security-related risks with respect to implemented significant changes; and

(b) ensure that adequate testing of any change is completed before the change is put into production.

Backups and restores

14. The Contractor must ensure that:

(a) it has a backup Policy that is followed and is reviewed, updated and tested at least annually;

(b) backups are taken and tested in accordance with the Contractor's backup Policy, but in any event at least annually; and

(c) frequency and completeness of backups is based on reasonable industry practice.

Business continuity plan and disaster recovery plan

15. The Contractor must ensure that it has a documented business continuity plan and a disaster recovery plan that is reviewed at least annually.

16. The Contractor must ensure that Facilities and Systems are protected from loss, damage or other occurrence, including fire and environmental hazards and power interruptions, that may result in any of those Facilities and Systems being unavailable when required to provide the Services.

Security Incident Response and Management

17. The Contractor must ensure that it has a security incident management Policy and response plan that is reviewed at least annually.

PROTECTED INFORMATION AND DATA SECURITY

Encryption

18. The Contractor must ensure that:

(a) encryption of data at rest is implemented and is maintained in effect, uninterrupted, and active at all times, even in the case of equipment or technology failure, for all Protected Information stored on Systems and Devices; and

(b) encryption end-to-end is implemented for all Protected Information in transit.

No storage on unencrypted portable media

19. The Contractor must ensure that no Protected Information is stored on portable media for transport outside of the Facilities or Systems without both the prior written approval of the Province and ensuring that the portable media and the Protected Information are encrypted.

Encryption standard

20. For sections 18 and 19, encryption must comply with the Province's "Cryptographic Standards for Information Protection" accessible at https://www2.gov.bc.ca/gov/content/governments/services-for-government/policies-procedures.

Isolation controls and logical isolation of data

21. The Contractor must implement and maintain the logical isolation of Protected Information, in effect, uninterrupted, and active at all times, even in the case of equipment or technology failure.

ACCESS AND AUTHENTICATION

User Identifiers

22. The Contractor must assign and ensure that user identifiers are unique and personal for log in to Systems and Devices.

Access

23. The Contractor must implement, follow, and regularly review and update, access control Policies that address, without limitation, onboarding, off-boarding, transition between roles, regular access reviews, limit and control use of administrator privileges and inactivity timeouts for Facilities, Systems and Devices within the Contractor's control.

24. The Contactor must ensure that all access to Protected Information and to Facilities, Systems and Devices is based Least Privilege and Need-to-Know" based on role and responsibilities. The Contractor must identify and segregate conflicting duties and areas of responsibility to reduce incidents of fraud and other abuse.

25. The Contractor must verify an individual's identity before assigning the individual a unique identifier that would give them access to Facilities, Systems or Devices.

26. The Contractor must implement a formal user registration process for Personnel that includes:

    (a) verification of access levels;

    (b) creating and maintaining records of access privileges;

    (c) audit processes; and

    (d) actions to ensure access is not given before approval is granted by the Contractor.

27. The Contractor must maintain a current and accurate inventory of computer accounts and review the inventory on a regular basis to identify dormant, fictitious or unused accounts.

28. The Contractor must implement a monitoring process to oversee, manage and review Personnel access rights and roles at regular intervals.

29. The Contractor must ensure that all Systems and Devices:

    (a) are configured in alignment with industry standards;

    (b) enforce a limit of consecutive invalid logon attempts by a user during a predetermined time period;

    (c) automatically lock the applicable account and Systems after failed logon failures;

    (d) limit the number of concurrent sessions;

    (e) prevent further access to Systems by initiating a session lock; and

    (f) provide the capability of disconnecting or disabling remote access to the Systems.

Authentication

30. The Contractor must use or require complex passwords or personal identification numbers (PINs) that are not shared, default or blank and that are encrypted (not displayed) when entered, biometric accesses, keys, smart cards, other logical or access controls, or combinations of them, to control access to Protected Information and to Systems and Devices.

31. The Contractor must ensure that Systems for password-based authentication:

    (a) enforce minimum password complexity, including requiring passwords to be case sensitive, contain a minimum of eight characters and a combination of upper-case letters, lower-case letters, numbers, and/or special characters;

    (b) change authentication passwords regularly at predetermined intervals, but at a minimum semi-annually;

    (c) store and transmit only encrypted representations of passwords;

    (d) enforce password minimum and maximum lifetime restrictions;

    (e) prohibit password reuse;

    (f) prevent reuse of identifiers; and

    (g) disable the identifier after ninety days of inactivity.

Highly sensitive Protected Information

32. If this Agreement or the Province under this Agreement indicates that any Protected Information is highly sensitive, the Contractor must also ensure that Systems enforce with respect to that Protected Information:

    (a) two-factor authentication for access;

    (b) enhanced logging that logs all accesses;

    (c) request based access; and

    (d) no standing access rights.

SECURITY EVENT LOGS

Log generation, log retention and monitoring

33. The Contractor must ensure that logging of Security Event Logs is enabled on all applicable Systems components

34. The Contractor must retain Security Event Logs for the Systems online for a minimum of 90 days and either online or off-line for an additional period of time adequate to enable the Contractor to conduct effective security investigations into suspected or actual security incidents.

35. The Contractor must retain Tenancy Security Event Logs online for a minimum of 90 days and either:
    (a) such additional period of time as the Province may instruct; or
    (b) ensure that the Tenancy offers the technical capability for the Province to retain the Tenancy Security Event Logs,

to enable the Province to comply with an information schedule approved under the *Information Management Act* or other retention period required by law.

36. Upon the Province's request, the Contractor must ensure that the Tenancy offers the technical capability for the Province to enable or configure the forwarding, extraction, backup of Tenancy Security Event Logs from the Tenancy to the Province's security information and event management system or to an external log storage and retention system.

37. The Contractor must review Security Event Logs regularly to detect potential security incidents, using automated tools or equivalent processes for the monitoring, review, correlating and alerting of Security Event Logs.

PROVINCE PROPERTY

Access to Province facilities, systems or networks

38. If the Province makes available any facilities, systems, networks or devices for use of the Contractor in relation to this Agreement, the Contractor must comply with, and permit access on its behalf only by those authorized Personnel who have been instructed to comply with, the Province's Policies then applicable to their acceptable use, access and protection accessible at https://www2.gov.bc.ca/gov/content/governments/services-for-government/policies-procedures, including:

    (a) "Appropriate Use Policy" (as also referenced in chapter 12 of the Province's "Core Policy and Procedures Manual");

    (b) "Information Security Policy";

    (c) government wide IM/IT Standards; and

    (d) sector or ministry specific IM/IT Standards, if any applicable to the Province ministry, agency or other representative receiving the Services.

39. The Province has the rights to:

    (a) not make any particular Province facility, system, network or device available before the Contractor or individual Personnel or both agree to a form of agreement acceptable to the Province on acceptable use, protection of, and access to, such facility, system, network or device, or at all;

    (b) not permit connection to any particular Province system or network until satisfied with the controls applied and the security status of the Device to be connected;

    (c) keep facilities access logs and Security Event Logs, and to otherwise monitor and analyze use of Province facilities, systems and networks to verify compliance, investigate suspected or actual breaches or information incidents and protect the Province's assets, including records, in compliance with applicable laws, including the *Freedom of Information and Protection of Privacy Act* and *Information Management Act*, and the Province's Policies; and

    (d) limit or revoke access to any Province systems, facility or device at its discretion.

Application development

40. If the Services include software development, the Contractor must ensure that the applications and programming interfaces are developed according to industry standards and Province's Policies applicable to application development standards. The Contractor must use secure application development practices for the development of the software.

FACILITIES, SYSTEMS, DATABASE AND DEVICE SECURITY

Physical security

41. The Contractor must ensure that adequate physical controls and processes are implemented to ensure that only authorized persons have physical access to the Facilities and Systems.

42. The Contractor must develop, document, and disseminate a physical and environmental protection Policy that it reviews at least annually.

43. The Contractor must review physical access logs at least once monthly.

44. The Contractor must ensure that physical security of any Systems or Facilities being used or capable of being used to house Protected Information meets a standard as would be reasonably expected to provide adequate protection based on the value of the data being protected and the environment in which the Systems or Facilities are located. At a minimum, this should include:

    (a) hardening of the perimeter of the Facilities;

    (b) physical separation of public and restricted spaces;

    (c) Intrusion Alarm System (IAS) partitioned to ensure areas containing Protected Information are protected at all times;

    (d) Access Control Systems (ACS) and/or Key Management processes; and

    (e) visitor and identity management processes – including access logs and identification badges.

Separation of production from test environments

45. The Contractor must not use any production data in any development, test or training environments used for the Services without the Province's prior written consent. If the Province gives such consent, the production data must, at minimum, be obfuscated (for example, by using data masking functionality).

46. The Contractor must keep its development, test and training environments separate from its production environments used for the Services at all times, even in case of failure.

Systems (including servers) hardening

47. The Contractor must:

    (a) harden all Systems against attack and misuse, using appropriate security best practices for the hardening of the specific deployed platform, before placing those Systems into production;

    (b) ensure that all unsecured and unneeded ports, services, applications, protocols and network communicating applications are uninstalled or disabled on all Systems;

    (c) applying Least Privilege, ensure that the Contractor only configures and makes operational ports, services, applications, protocols and network communicating applications based on the functional requirements of the respective Systems;

    (d) ensure that default passwords and shared accounts are not used for any Systems; and

(e) in relation to Systems, implement server hardening using configuration security best practices (for example, Center for Internet Security, Inc. (CIS) Benchmarks or equivalent) for any server operating systems, server virtualization, server middleware (for example, web servers and database servers) and application servers.

Perimeter controls (firewall and intrusion prevention system) and network security

48. The Contractor must:

(a) implement stateful packet inspection firewalls to control traffic flow to and from Systems and Tenancy at all times, and configure the stateful packet inspection firewalls applying security best practices and Least Privilege;

(b) implement an intrusion prevention System to control and filter traffic flow leaving and entering Systems and Tenancy at all times, and configure the intrusion prevention System applying security best practices; and

(c) implement a secure network perimeter and network segmentation for Systems, with ingress and egress points that are known and controlled.

Application firewall

49. The Contractor must implement application layer firewalls on Systems:

(a) at such level of protection as the Province may instruct ; and

(b) to detect and mitigate application attacks (for example, brute force, OWASP Top 10, SQL injection, cross site scripting).

Management network

50. The Contractor must ensure that for any Systems:

(a) the management network remains logically separated from any other zone and is not directly accessible from the Internet;

(b) the management network is internally segmented, with each server's dedicated network interface on its own segmented network and that interfaces on the management network do not have visibility to each other; and

(c) all access to the management network is strictly controlled and exclusively enforced though a secure access gateway, bastion host or equivalent.

Remote management and secure access gateway

51. The Contractor must perform any remote management of Systems or Devices in a secure manner, using encrypted communication channels and adequate access controls.

Database security

52. The Contractor must ensure that for any Systems:

(a) database maintenance utilities that bypass controls are restricted and monitored;

(b) there is a formal approval process in place for handling requests for disclosure of database contents or for database access, including steps to evaluate privacy impacts and security risks of such requests; and

(c) methods to check and maintain the integrity of the data are implemented (for example, consistency checks and checksums).

53. For database security, the Contractor must implement logical isolation and encryption of Protected Information.

Device security and antivirus scanning

54. The Contractor must ensure all Devices:

(a) have antivirus and malware protection as appropriate for the particular Device active at all times;

(b) are configured to perform antivirus scans at least once per week;

(c) have host based firewall configured, enabled and active at all times; and

(d) have all patches and appropriate security updates installed for the operating system and all installed software.

VULNERABILITY PREVENTION, SCANNING AND MANAGEMENT

Proactive management

55. The Contractor must:

(a) obtain information in a timely basis about technical vulnerabilities relating to Systems and Devices; and

(b) implement processes to stay current with security threats.

Patching

56. The Contractor must patch all Systems regularly in line with security best practices and ensure that current software, operating systems and application patching levels are maintained.

57. The Contractor must ensure that all Systems have all patches installed on a regular schedule, within the time frame recommended by the manufacturer unless the Province otherwise consents in writing.

58. The Contractor must ensure that vulnerabilities are remedied and patches installed on an accelerated basis for zero-day, critical and high vulnerabilities. For zero-day vulnerabilities, the Contractor must implement appropriate mitigation measures promptly on notification of the zero-day vulnerability. The Contractor must remediate zero-day, high and critical vulnerabilities through patching, decommission, or compensating controls.

59. The Contractor must patch high vulnerabilities within 30 days or less of discovery and patch medium vulnerabilities within 90 days or less of discovery.

Vulnerability Scanning

60. The Contractor must ensure that a vulnerability scan is completed on components of all Systems:

(a) with any identified vulnerabilities remedied, before being placed into production; and

(b) on a regular schedule, set at a minimum of one scan per quarter, unless the Province otherwise consents in writing.

Web application vulnerability scanning

61. The Contractor must ensure that a vulnerability scan is completed on any web applications used for Tenancy or in any other Systems:

(a) and on any major changes to such web applications, with any identified vulnerabilities remedied, before being placed into production; and

(b) on a regular schedule, set at a minimum of one scan per quarter, unless the Province otherwise consents in writing.

Antivirus and malware scanning

62. The Contractor must ensure that all Systems servers:

(a) have antivirus and malware protection configured, active and enabled at all times;

(b) have antivirus and malware definitions updated at least once a day; and

(c) are configured to undergo a full anti-virus scan for latent infections (to detect infections missed by the real-time agent) at least once a week.

DISPOSALS

Asset disposal

63. The Contractor must ensure that all disposals of assets used in providing or relating to the Services are done in a secure manner that ensures that Protected Information cannot be recovered.

Asset management

64. The Contractor must have asset management and disposal Policies that are followed, and reviewed and updated regularly in line with security best practices, and that address hardware, software and other critical business assets.

65. The Contractor must keep an asset management inventory that includes the name of the System, location, purpose, owner, and criticality, with assets added to inventory on commission and removed on decommission.

Information destruction and disposal

66. Unless this Agreement otherwise specifies, the Contractor must retain all records containing Protected Information in the Contractor's possession until instructed by the Province in writing to dispose or deliver them as instructed.

67. The Contractor must securely erase:

(a) records that contain Protected Information and Tenancy Security Event Logs when instructed in writing by the Province; and

(b) any backup, transitory and extra copies of records that contain Protected Information or Tenancy Security Event Logs when no longer needed in relation to this Agreement.

68. The Contractor must ensure that Protected Information and Tenancy Security Event Logs on magnetic media are securely wiped by overwriting using procedures and adequate media wiping solutions, degaussing, or other method in line with security best practices for disposal of media.

NOTICES, INCIDENTS AND INVESTIGATIONS

Notice of demands for disclosure

69. In addition to any obligation the Contractor may have to notify or assist the Province under applicable law or this Agreement, including the Privacy Protection Schedule if attached, if the Contractor is required (including under an enactment or a subpoena, warrant, order, demand or other request from a court, government agency or other legal authority) to produce, provide access to or otherwise disclose any Protected Information, the Contractor must, unless prohibited by applicable law, immediately notify and provide reasonable assistance to the Province so the Province may seek a protective order or other remedy to prevent or limit the disclosure.

E-discovery and legal holds

70. The Contractor must fully co-operate with the Province to enable the Province to comply with e-discovery and legal hold obligations.

Incidents

71. In addition to any obligation the Contractor may have under applicable law, including the *Freedom of Information and Protection of Privacy Act*, or this Agreement, if, during or after the Term, the Contractor discovers a suspected or actual unwanted or unexpected event or series of events that threaten the privacy or security of Protected Information (including its unauthorized access, collection, use, disclosure, alteration, storage or disposal) or Tenancy, whether accidental or deliberate, the Contractor must:

(a) immediately report the particulars of such incident to, and follow the instructions of, the Province, confirming any oral report with a notice in writing to the Province as soon as reasonably practicable (if unable to contact the Province's contract manager or other designated contact for this Agreement, the Contractor must follow the procedure for reporting and managing information incidents on the Province's website at https://www2.gov.bc.ca/gov/content/governments/services-for-government/information-management-technology/information-security/information-incidents; and

(b) make every reasonable effort to recover the records containing Protected Information and contain and remediate such incident, following such reasonable instructions as the Province may give.

Investigations support and security investigations

72. The Contractor must:

(a) conduct security investigations in the case of incidents (including any security breach or compromise) affecting Devices, Facilities, Systems, Tenancy or Protected Information, collecting evidence, undertaking forensic activities and taking such other actions as needed;

(b) provide the Province with any related investigation reports, which the Contractor may sanitize first;

(c) upon the Province's request, provide the Province with any logs relating to such investigation reports as validation/confirmation of such investigation, which the Contractor may sanitize first; and

(d) maintain a chain of custody in all such security investigations it undertakes.

73. Upon the Province's request, the Contractor must:

(a) provide investigative support to the Province to enable the Province to conduct its own security investigations into incidents (including security breaches or compromises) affecting the Tenancy or Protected Information;

(b) provide the Province with timely access via an on-line, real-time GUI (Graphic User Interface) facility to any Tenancy Security Event Logs and to other Security Event Logs for Systems (the latter of which the Contractor may sanitize first to mask or remove, for example, data pertaining to the Contractor's customers) to assist the Province in conducting the Province's security investigations, or in case of technical limitations, other method acceptable to the Province (for example, on-site visits to enable direct access to those Security Event Logs).

74. The Contractor must work with and support the Province if the Province needs assistance in legal proceedings in relation to security investigations related to Protected Information or Tenancy.

Province Security Threat and Risk Assessment ("STRA") support

75. The Contractor must, via its technical and security resources, support the Province in completing a STRA for the Services and to otherwise assess the risks associated with the Services, including by providing all information and documentation (for example, architecture diagrams, service architecture, controls architecture and technical information), which the Contractor may sanitize first and that the Province may reasonably require for such purpose.

Notification of changes

76. The Contractor must notify the Province of any changes to its security Policies, management practices and security controls described in this Agreement that may potentially negatively impact the security of Tenancy, Protected Information, or those Systems providing the Services.

Compliance verification

77. Upon the Province's request, the Contractor must provide, at no additional cost, the following security reports to the Province at least every six months during the Term:
(a) vulnerability scan reports of those Systems providing the Services; and
(b) patch status reports for those Systems providing the Services.

78. In addition to any other rights of inspection the Province may have under this Agreement or under statute, the Province has the rights, at any reasonable time and on reasonable notice to the Contractor, to:

(a) request the Contractor to verify compliance with this Schedule and to keep security controls documentation or records to support compliance; and
(b) enter on the Contractor premises and Facilities to inspect and to validate the Contractor's compliance with the security obligations under this Agreement

79. The Contractor must permit, and provide reasonable assistance to, the exercise by the Province of the Province's rights under this section. If any non-compliance or deficiency is found, the Province may (in addition to any other rights it may have) require the Contractor, at the Contractor's expense, to develop and implement a corrective action plan within a reasonable time.

Notice of non-compliance

80. If for any reason the Contractor does not comply, or anticipates that it will be unable to comply, with a provision in this Schedule in any respect, the Contractor must promptly notify the Province of the particulars

of the non-compliance or anticipated non-compliance and what steps it proposes to take to address, or prevent recurrence of, the non-compliance or anticipated non-compliance.

MISCELLANEOUS

Interpretation

81. In this Schedule, unless otherwise specified, references to sections by number are to sections of this Schedule.

82. Any reference to the "Contractor" in this Schedule includes any subcontractor or agent retained by the Contractor to perform obligations under this Agreement and the Contractor must ensure that any such subcontractors and agents comply with this Schedule.

83. Any reference to a specified Policy refers to it as may be revised or replaced from time to time.

84. If a provision of this Schedule conflicts with a documented process required by this Schedule to be created or maintained by the Contractor, the provision of the Schedule will prevail to the extent of the conflict.

Referenced documents

85. Policies and other documents of the Province referenced in this Schedule may be updated or replaced by the Province from time to time without notice, and if not found at the hyperlink or URL provided or via the Province's main website at http://www.gov.bc.ca, be obtained from the Province's contact for this Agreement.

Survival

86. Sections 63, 66, 67, 68, 69, 70, and 71 and other obligations of the Contractor in this Schedule which, by their terms or nature, are intended to survive the completion of the Services or the termination of this Agreement, will continue in force indefinitely subject to any applicable limitation period prescribed by law, even after this Agreement ends.

Schedule H – Tax Verification Schedule

Not applicable.

BRITISH COLUMBIA

CERTIFICATE OF INSURANCE

Freedom of Information and Protection of Privacy Act
The personal information requested on this form is collected under the authority of and used for the purpose of administering the *Financial Administration Act.* Questions about the collection and use of this information can be directed to the Director, Client Services, Core Government and Crowns at 250 356-8915, PO Box 9405 STN PROV GOVT, Victoria BC V8W 9V1.
Please refer *all other questions* to the contact named in Part 1.

Part 1 To be completed by the Province

THIS CERTIFICATE IS REQUESTED BY and ISSUED TO *(Name of office)*	AGREEMENT IDENTIFICATION NO.
PROVINCE'S CONTACT PERSON NAME & TITLE	PHONE NO. FAX NO.
MAILING ADDRESS	POSTAL CODE
CONTRACTOR NAME	
CONTRACTOR ADDRESS	POSTAL CODE

Part 2 To be completed by the Insurance Agent or Broker

INSURED	NAME	
	ADDRESS	POSTAL CODE
OPERATIONS INSURED	PROVIDE DETAILS	

TYPE OF INSURANCE *List each separately*	COMPANY NAME, POLICY NO. & BRIEF DESCRIPTION	EXPIRY DATE YYYY/MM/DD	LIMIT OF LIABILITY/AMOUNT

This certificate certifies that policies of insurance described herein are in full force and effective as of the date of this certificate and comply with the insurance requirements of the Agreement identified above, except as follows:

AGENT OR BROKER COMMENTS:

AGENCY OR BROKERAGE FIRM	ADDRESS	PHONE NO.
NAME OF AUTHORIZED AGENT OR BROKER (PRINT)	SIGNATURE OF AGENT OR BROKER ON BEHALF OF THE ABOVE INSURER(S)	DATE SIGNED

GENERAL SERVICE AGREEMENT



For Administrative Purposes Only	
Ministry Contract No.: C22-7368 *Requisition No.:* N/A *Solicitation No. (if applicable):* EDU22-513-SRFP *Commodity Code:* 72151204 ***Contractor Information*** *Supplier Name:* Stephen McNicholls Consulting Inc. *Supplier No.:* TBD *Telephone No.: 250.590.3301* *E-mail Address: stephen@smcn.ca* *Website:* https://www.smcn.ca/	***Financial Information*** *Client:* *062* *Responsibility Centre:* *22422* *Service Line:* *06500* *STOB:* *60* *Project:* *2200000* ***Template version:*** *February 20, 2020*

TABLE OF CONTENTS

No.	Heading		Page
1.	**Definitions**		1
	1.1	General	1
	1.2	Meaning of "record"	2
2.	**Services**		2
	2.1	Provision of services	2
	2.2	Term	2
	2.3	Supply of various items	2
	2.4	Standard of care	2
	2.5	Standards in relation to persons performing Services	2
	2.6	Instructions by Province	2
	2.7	Confirmation of non-written instructions	2
	2.8	Effectiveness of non-written instructions	2
	2.9	Applicable laws	2
3.	**Payment**		3
	3.1	Fees and expenses	3
	3.2	Statements of accounts	3
	3.3	Withholding of amounts	3
	3.4	Appropriation	3
	3.5	Currency	3
	3.6	Non-resident income tax	3
	3.7	Prohibition against committing money	3
	3.8	Refunds of taxes	4
4.	**Representations and Warranties**		4
5.	**Privacy, Security and Confidentiality**		4
	5.1	Privacy	4
	5.2	Security	4
	5.3	Confidentiality	4
	5.4	Public announcements	5
	5.5	Restrictions on promotion	5
6.	**Material and Intellectual Property**		5
	6.1	Access to Material	5
	6.2	Ownership and delivery of Material	5
	6.3	Matters respecting intellectual property	5
	6.4	Rights relating to Incorporated Material	5
7.	**Records and Reports**		6
	7.1	Work reporting	6
	7.2	Time and expense records	6
8.	**Audit**		6

9. **Indemnity and Insurance** 6
   - 9.1 Indemnity 6
   - 9.2 Insurance 6
   - 9.3 Workers compensation 6
   - 9.4 Personal optional protection 6
   - 9.5 Evidence of coverage 7

10. **Force Majeure** 7
   - 10.1 Definitions relating to force majeure 7
   - 10.2 Consequence of Event of Force Majeure 7
   - 10.3 Duties of Affected Party 7

11. **Default and Termination** 7
   - 11.1 Definitions relating to default and termination 7
   - 11.2 Province's options on default 8
   - 11.3 Delay not a waiver 8
   - 11.4 Province's right to terminate other than for default 8
   - 11.5 Payment consequences of termination 8
   - 11.6 Discharge of liability 8
   - 11.7 Notice in relation to Events of Default 9

12. **Dispute Resolution** 9
   - 12.1 Dispute resolution process 9
   - 12.2 Location of arbitration or mediation 9
   - 12.3 Costs of mediation or arbitration 9

13. **Miscellaneous** 9
   - 13.1 Delivery of notices 9
   - 13.2 Change of address or email address 10
   - 13.3 Assignment 10
   - 13.4 Subcontracting 10
   - 13.5 Waiver 10
   - 13.6 Modifications 10
   - 13.7 Entire agreement 10
   - 13.8 Survival of certain provisions 10
   - 13.9 Schedules 10
   - 13.10 Independent contractor 11
   - 13.11 Personnel not to be employees of Province 11
   - 13.12 Key Personnel 11
   - 13.13 Pertinent Information 11
   - 13.14 Conflict of interest 11
   - 13.15 Time 11
   - 13.16 Conflicts among provisions 11
   - 13.17 Agreement not permit nor fetter 11
   - 13.18 Remainder not affected by invalidity 12
   - 13.19 Further assurances 12
   - 13.20 Additional terms 12
   - 13.21 Tax Verification 12
   - 13.22 Governing law 12

14. **Interpretation** 12

15. **Execution and Delivery of Agreement** 12

SCHEDULE A – SERVICES

Part 1 - Term
Part 2 - Services
Part 3 - Related Documentation
Part 4 - Key Personnel

SCHEDULE B – FEES AND EXPENSES

Part 1 - Maximum Amount Payable
Part 2 - Fees
Part 3 - Expenses
Part 4 - Statements of Account
Part 5 - Payments Due

SCHEDULE C – APPROVED SUBCONTRACTOR(S)

SCHEDULE D – INSURANCE

SCHEDULE E – PRIVACY PROTECTION SCHEDULE

SCHEDULE F – ADDITIONAL TERMS

SCHEDULE G – SECURITY SCHEDULE

SCHEDULE H – TAX VERIFICATION

THIS AGREEMENT is dated for reference the 14th day of December, 2021.

BETWEEN:

Stephen McNicholls Consulting Inc. (the "Contractor") with the following specified address and email address:
101-1335 Bear Mountain Parkway
Victoria, BC V9B 6T9
stephen@smcn.ca

AND:

HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA, as represented by the Minister of Education (the "Province") with the following specified address and email address:
PO Box 9045, Stn Prov Govt
Victoria, BC V8W 9E2
Damien.crowell@gov.bc.ca

The Province wishes to retain the Contractor to provide the services specified in Schedule A and, in consideration for the remuneration set out in Schedule B, the Contractor has agreed to provide those services, on the terms and conditions set out in this Agreement.

As a result, the Province and the Contractor agree as follows:

1 DEFINITIONS

General

1.1 In this Agreement, unless the context otherwise requires:

(a) "Business Day" means a day, other than a Saturday or Sunday, on which Provincial government offices are open for normal business in British Columbia;

(b) "Incorporated Material" means any material in existence prior to the start of the Term or developed independently of this Agreement, and that is incorporated or embedded in the Produced Material by the Contractor or a Subcontractor;

(c) "Material" means the Produced Material and the Received Material;

(d) "Produced Material" means records, software and other material, whether complete or not, that, as a result of this Agreement, are produced or provided by the Contractor or a Subcontractor and includes the Incorporated Material;

(e) "Received Material" means records, software and other material, whether complete or not, that, as a result of this Agreement, are received by the Contractor or a Subcontractor from the Province or any other person;

(f) "Services" means the services described in Part 2 of Schedule A;

(g) "Subcontractor" means a person described in paragraph (a) or (b) of section 13.4; and

(h) "Term" means the term of the Agreement described in Part 1 of Schedule A subject to that term ending earlier in accordance with this Agreement.

Meaning of "record"

1.2 The definition of "record" in the *Interpretation Act* is incorporated into this Agreement and "records" will bear a corresponding meaning.

2 SERVICES

Provision of services

2.1 The Contractor must provide the Services in accordance with this Agreement.

Term

2.2 Regardless of the date of execution or delivery of this Agreement, the Contractor must provide the Services during the Term.

Supply of various items

2.3 Unless the parties otherwise agree in writing, the Contractor must supply and pay for all labour, materials, equipment, tools, facilities, approvals and licenses necessary or advisable to perform the Contractor's obligations under this Agreement, including the license under section 6.4.

Standard of care

2.4 Unless otherwise specified in this Agreement, the Contractor must perform the Services to a standard of care, skill and diligence maintained by persons providing, on a commercial basis, services similar to the Services.

Standards in relation to persons performing Services

2.5 The Contractor must ensure that all persons employed or retained to perform the Services are qualified and competent to perform them and are properly trained, instructed and supervised.

Instructions by Province

2.6 The Province may from time to time give the Contractor reasonable instructions (in writing or otherwise) as to the performance of the Services. The Contractor must comply with those instructions but, unless otherwise specified in this Agreement, the Contractor may determine the manner in which the instructions are carried out.

Confirmation of non-written instructions

2.7 If the Province provides an instruction under section 2.6 other than in writing, the Contractor may request that the instruction be confirmed by the Province in writing, which request the Province must comply with as soon as it is reasonably practicable to do so.

Effectiveness of non-written instructions

2.8 Requesting written confirmation of an instruction under section 2.7 does not relieve the Contractor from complying with the instruction at the time the instruction was given.

Applicable laws

2.9 In the performance of the Contractor's obligations under this Agreement, the Contractor must comply with all applicable laws.

3 PAYMENT

Fees and expenses

3.1 If the Contractor complies with this Agreement, then the Province must pay to the Contractor at the times and on the conditions set out in Schedule B:

(a) the fees described in that Schedule;

(b) the expenses, if any, described in that Schedule if they are supported, where applicable, by proper receipts and, in the Province's opinion, are necessarily incurred by the Contractor in providing the Services; and

(c) any applicable taxes payable by the Province under law or agreement with the relevant taxation authorities on the fees and expenses described in paragraphs (a) and (b).

The Province is not obliged to pay to the Contractor more than the "Maximum Amount" specified in Schedule B on account of fees and expenses.

Statements of accounts

3.2 In order to obtain payment of any fees and expenses under this Agreement, the Contractor must submit to the Province a written statement of account in a form satisfactory to the Province upon completion of the Services or at other times described in Schedule B.

Withholding of amounts

3.3 Without limiting section 9.1, the Province may withhold from any payment due to the Contractor an amount sufficient to indemnify, in whole or in part, the Province and its employees and agents against any liens or other third-party claims that have arisen or could arise in connection with the provision of the Services. An amount withheld under this section must be promptly paid by the Province to the Contractor upon the basis for withholding the amount having been fully resolved to the satisfaction of the Province.

Appropriation

3.4 The Province's obligation to pay money to the Contractor is subject to the *Financial Administration Act*, which makes that obligation subject to an appropriation being available in the fiscal year of the Province during which payment becomes due.

Currency

3.5 Unless otherwise specified in this Agreement, all references to money are to Canadian dollars.

Non-resident income tax

3.6 If the Contractor is not a resident in Canada, the Contractor acknowledges that the Province may be required by law to withhold income tax from the fees described in Schedule B and then to remit that tax to the Receiver General of Canada on the Contractor's behalf.

Prohibition against committing money

3.7 Without limiting section 13.10(a), the Contractor must not in relation to performing the Contractor's obligations under this Agreement commit or purport to commit the Province to pay any money except as may be expressly provided for in this Agreement.

Refunds of taxes

3.8 The Contractor must:

(a) apply for, and use reasonable efforts to obtain, any available refund, credit, rebate or remission of federal, provincial or other tax or duty imposed on the Contractor as a result of this Agreement that the Province has paid or reimbursed to the Contractor or agreed to pay or reimburse to the Contractor under this Agreement; and

(b) immediately on receiving, or being credited with, any amount applied for under paragraph (a), remit that amount to the Province.

4 REPRESENTATIONS AND WARRANTIES

4.1 As at the date this Agreement is executed and delivered by, or on behalf of, the parties, the Contractor represents and warrants to the Province as follows:

(a) except to the extent the Contractor has previously disclosed otherwise in writing to the Province,

(i) all information, statements, documents and reports furnished or submitted by the Contractor to the Province in connection with this Agreement (including as part of any competitive process resulting in this Agreement being entered into) are in all material respects true and correct,

(ii) the Contractor has sufficient trained staff, facilities, materials, appropriate equipment and approved subcontractual or other agreements in place and available to enable the Contractor to fully perform the Services and to grant any licenses under this Agreement, and

(iii) the Contractor holds all permits, licenses, approvals and statutory authorities issued by any government or government agency that are necessary for the performance of the Contractor's obligations under this Agreement; and

(b) if the Contractor is not an individual,

(i) the Contractor has the power and capacity to enter into this Agreement and to observe, perform and comply with the terms of this Agreement and all necessary corporate or other proceedings have been taken and done to authorize the execution and delivery of this Agreement by, or on behalf of, the Contractor, and

(ii) this Agreement has been legally and properly executed by, or on behalf of, the Contractor and is legally binding upon and enforceable against the Contractor in accordance with its terms except as enforcement may be limited by bankruptcy, insolvency or other laws affecting the rights of creditors generally and except that equitable remedies may be granted only in the discretion of a court of competent jurisdiction.

5 PRIVACY, SECURITY AND CONFIDENTIALITY

Privacy

5.1 The Contractor must comply with the Privacy Protection Schedule attached as Schedule E.

Security

5.2 The Contractor must:

(a) make reasonable security arrangements to protect the Material from unauthorized access, collection, use, disclosure, alteration or disposal; and

(b) comply with the Security Schedule attached as Schedule G.

Confidentiality

5.3 The Contractor must treat as confidential all information in the Material and all other information accessed or obtained by the Contractor or a Subcontractor (whether verbally, electronically or otherwise) as a result of this Agreement, and not permit its disclosure or use without the Province's prior written consent except:

(a) as required to perform the Contractor's obligations under this Agreement or to comply with applicable laws;

(b) if it is information that is generally known to the public other than as result of a breach of this Agreement; or

(c) if it is information in any Incorporated Material.

Public announcements

5.4 Any public announcement relating to this Agreement will be arranged by the Province and, if such consultation is reasonably practicable, after consultation with the Contractor.

Restrictions on promotion

5.5 The Contractor must not, without the prior written approval of the Province, refer for promotional purposes to the Province being a customer of the Contractor or the Province having entered into this Agreement.

6 MATERIAL AND INTELLECTUAL PROPERTY

Access to Material

6.1 If the Contractor receives a request for access to any of the Material from a person other than the Province, and this Agreement does not require or authorize the Contractor to provide that access, the Contractor must promptly advise the person to make the request to the Province.

Ownership and delivery of Material

6.2 The Province exclusively owns all property rights in the Material which are not intellectual property rights. The Contractor must deliver any Material to the Province immediately upon the Province's request.

Matters respecting intellectual property

6.3 The Province exclusively owns all intellectual property rights, including copyright, in:

(a) Received Material that the Contractor receives from the Province; and

(b) Produced Material, other than any Incorporated Material.

Upon the Province's request, the Contractor must deliver to the Province documents satisfactory to the Province that irrevocably waive in the Province's favour any moral rights which the Contractor (or employees of the Contractor) or a Subcontractor (or employees of a Subcontractor) may have in the Produced Material and that confirm the vesting in the Province of the copyright in the Produced Material, other than any Incorporated Material.

Rights in relation to Incorporated Material

6.4 Upon any Incorporated Material being embedded or incorporated in the Produced Material and to the extent that it remains so embedded or incorporated, the Contractor grants to the Province:

(a) a non-exclusive, perpetual, irrevocable, royalty-free, worldwide license to exercise, in respect of that Incorporated Material, the rights set out in the *Copyright Act* (Canada), including the right to use, reproduce, modify, publish and distribute that Incorporated Material; and

(b) the right to sublicense or assign to third-parties any or all of the rights granted to the Province under section 6.4(a).

7 RECORDS AND REPORTS

Work reporting

7.1 Upon the Province's request, the Contractor must fully inform the Province of all work done by the Contractor or a Subcontractor in connection with providing the Services.

Time and expense records

7.2 If Schedule B provides for the Contractor to be paid fees at a daily or hourly rate or for the Contractor to be paid or reimbursed for expenses, the Contractor must maintain time records and books of account, invoices, receipts and vouchers of expenses in support of those payments, in form and content satisfactory to the Province. Unless otherwise specified in this Agreement, the Contractor must retain such documents for a period of not less than seven years after this Agreement ends.

8 AUDIT

8.1 In addition to any other rights of inspection the Province may have under statute or otherwise, the Province may at any reasonable time and on reasonable notice to the Contractor, enter on the Contractor's premises to inspect and, at the Province's discretion, copy any of the Material and the Contractor must permit, and provide reasonable assistance to, the exercise by the Province of the Province's rights under this section.

9 INDEMNITY AND INSURANCE

Indemnity

9.1 The Contractor must indemnify and save harmless the Province and the Province's employees and agents from any loss, claim (including any claim of infringement of third-party intellectual property rights), damage award, action, cause of action, cost or expense that the Province or any of the Province's employees or agents may sustain, incur, suffer or be put to at any time, either before or after this Agreement ends, (each a "Loss") to the extent the Loss is directly or indirectly caused or contributed to by:

(a) any act or omission by the Contractor or by any of the Contractor's agents, employees, officers, directors or Subcontractors in connection with this Agreement; or

(b) any representation or warranty of the Contractor being or becoming untrue or incorrect.

Insurance

9.2 The Contractor must comply with the Insurance Schedule attached as Schedule D.

Workers compensation

9.3 Without limiting the generality of section 2.9, the Contractor must comply with, and must ensure that any Subcontractors comply with, all applicable occupational health and safety laws in relation to the performance of the Contractor's obligations under this Agreement, including the *Workers Compensation Act* in British Columbia or similar laws in other jurisdictions.

Personal optional protection

9.4 The Contractor must apply for and maintain personal optional protection insurance (consisting of income replacement and medical care coverage) during the Term at the Contractor's expense if:

(a) the Contractor is an individual or a partnership of individuals and does not have the benefit of mandatory workers compensation coverage under the *Workers Compensation Act* or similar laws in other jurisdictions; and

(b) such personal optional protection insurance is available for the Contractor from WorkSafeBC or other sources.

Evidence of coverage

9.5 Within 10 Business Days of being requested to do so by the Province, the Contractor must provide the Province with evidence of the Contractor's compliance with sections 9.3 and 9.4.

10 FORCE MAJEURE

Definitions relating to force majeure

10.1 In this section and sections 10.2 and 10.3:

(a) "Event of Force Majeure" means one of the following events:

(i) a natural disaster, fire, flood, storm, epidemic or power failure,

(ii) a war (declared and undeclared), insurrection or act of terrorism or piracy,

(iii) a strike (including illegal work stoppage or slowdown) or lockout, or

(iv) a freight embargo

if the event prevents a party from performing the party's obligations in accordance with this Agreement and is beyond the reasonable control of that party; and

(b) "Affected Party" means a party prevented from performing the party's obligations in accordance with this Agreement by an Event of Force Majeure.

Consequence of Event of Force Majeure

10.2 An Affected Party is not liable to the other party for any failure or delay in the performance of the Affected Party's obligations under this Agreement resulting from an Event of Force Majeure and any time periods for the performance of such obligations are automatically extended for the duration of the Event of Force Majeure provided that the Affected Party complies with the requirements of section 10.3.

Duties of Affected Party

10.3 An Affected Party must promptly notify the other party in writing upon the occurrence of the Event of Force Majeure and make all reasonable efforts to prevent, control or limit the effect of the Event of Force Majeure so as to resume compliance with the Affected Party's obligations under this Agreement as soon as possible.

11 DEFAULT AND TERMINATION

Definitions relating to default and termination

11.1 In this section and sections 11.2 to 11.4:

(a) "Event of Default" means any of the following:

(i) an Insolvency Event,

(ii) the Contractor fails to perform any of the Contractor's obligations under this Agreement, or

(iii) any representation or warranty made by the Contractor in this Agreement is untrue or incorrect; and

(b) "Insolvency Event" means any of the following:

(i) an order is made, a resolution is passed or a petition is filed, for the Contractor's liquidation or winding up,

(ii) the Contractor commits an act of bankruptcy, makes an assignment for the benefit of the Contractor's creditors or otherwise acknowledges the Contractor's insolvency,

(iii) a bankruptcy petition is filed or presented against the Contractor or a proposal under the *Bankruptcy and Insolvency Act* (Canada) is made by the Contractor,

(iv) a compromise or arrangement is proposed in respect of the Contractor under the *Companies' Creditors Arrangement Act* (Canada),

(v) a receiver or receiver-manager is appointed for any of the Contractor's property, or

(vi) the Contractor ceases, in the Province's reasonable opinion, to carry on business as a going concern.

Province's options on default

11.2 On the happening of an Event of Default, or at any time thereafter, the Province may, at its option, elect to do any one or more of the following:

(a) by written notice to the Contractor, require that the Event of Default be remedied within a time period specified in the notice;

(b) pursue any remedy or take any other action available to it at law or in equity; or

(c) by written notice to the Contractor, terminate this Agreement with immediate effect or on a future date specified in the notice, subject to the expiration of any time period specified under section 11.2(a).

Delay not a waiver

11.3 No failure or delay on the part of the Province to exercise its rights in relation to an Event of Default will constitute a waiver by the Province of such rights.

Province's right to terminate other than for default

11.4 In addition to the Province's right to terminate this Agreement under section 11.2(c) on the happening of an Event of Default, the Province may terminate this Agreement for any reason by giving at least 10 days' written notice of termination to the Contractor.

Payment consequences of termination

11.5 Unless Schedule B otherwise provides, if the Province terminates this Agreement under section 11.4:

(a) the Province must, within 30 days of such termination, pay to the Contractor any unpaid portion of the fees and expenses described in Schedule B which corresponds with the portion of the Services that was completed to the Province's satisfaction before termination of this Agreement; and

(b) the Contractor must, within 30 days of such termination, repay to the Province any paid portion of the fees and expenses described in Schedule B which corresponds with the portion of the Services that the Province has notified the Contractor in writing was not completed to the Province's satisfaction before termination of this Agreement.

Discharge of liability

11.6 The payment by the Province of the amount described in section 11.5(a) discharges the Province from all liability to make payments to the Contractor under this Agreement.

Notice in relation to Events of Default

11.7 If the Contractor becomes aware that an Event of Default has occurred or anticipates that an Event of Default is likely to occur, the Contractor must promptly notify the Province of the particulars of the Event of Default or anticipated Event of Default. A notice under this section as to the occurrence of an Event of Default must also specify the steps the Contractor proposes to take to address, or prevent recurrence of, the Event of Default. A notice under this section as to an anticipated Event of Default must specify the steps the Contractor proposes to take to prevent the occurrence of the anticipated Event of Default.

12 DISPUTE RESOLUTION

Dispute resolution process

12.1 In the event of any dispute between the parties arising out of or in connection with this Agreement, the following dispute resolution process will apply unless the parties otherwise agree in writing:

(a) the parties must initially attempt to resolve the dispute through collaborative negotiation;

(b) if the dispute is not resolved through collaborative negotiation within 15 Business Days of the dispute arising, the parties must then attempt to resolve the dispute through mediation under the rules of the Mediate BC Society; and

(c) if the dispute is not resolved through mediation within 30 Business Days of the commencement of mediation, the dispute must be referred to and finally resolved by arbitration under the *Arbitration Act*.

Location of arbitration or mediation

12.2 Unless the parties otherwise agree in writing, an arbitration or mediation under section 12.1 will be held in Victoria, British Columbia.

Costs of mediation or arbitration

12.3 Unless the parties otherwise agree in writing or, in the case of an arbitration, the arbitrator otherwise orders, the parties must share equally the costs of a mediation or arbitration under section 12.1 other than those costs relating to the production of expert evidence or representation by counsel.

13 MISCELLANEOUS

Delivery of notices

13.1 Any notice contemplated by this Agreement, to be effective, must be in writing and delivered as follows:

(a) by email to the addressee's email address specified on the first page of this Agreement, in which case it will be deemed to be received on the day of transmittal unless transmitted after the normal business hours of the addressee or on a day that is not a Business Day, in which cases it will be deemed to be received on the next following Business Day;

(b) by hand to the addressee's address specified on the first page of this Agreement, in which case it will be deemed to be received on the day of its delivery; or

(c) by prepaid post to the addressee's address specified on the first page of this Agreement, in which case if mailed during any period when normal postal services prevail, it will be deemed to be received on the fifth Business Day after its mailing.

Change of address or email address

13.2 Either party may from time to time give notice to the other party of a substitute address or email address, which from the date such notice is given will supersede for purposes of section 13.1 any previous address or email address specified for the party giving the notice.

Assignment

13.3 The Contractor must not assign any of the Contractor's rights or obligations under this Agreement without the Province's prior written consent. Upon providing written notice to the Contractor, the Province may assign to any person any of the Province's rights under this Agreement and may assign to any "government corporation", as defined in the *Financial Administration Act*, any of the Province's obligations under this Agreement.

Subcontracting

13.4 The Contractor must not subcontract any of the Contractor's obligations under this Agreement to any person without the Province's prior written consent, excepting persons listed in the attached Schedule C. No subcontract, whether consented to or not, relieves the Contractor from any obligations under this Agreement. The Contractor must ensure that:

(a) any person retained by the Contractor to perform obligations under this Agreement; and

(b) any person retained by a person described in paragraph (a) to perform those obligations

fully complies with this Agreement in performing the subcontracted obligations.

Waiver

13.5 A waiver of any term or breach of this Agreement is effective only if it is in writing and signed by, or on behalf of, the waiving party and is not a waiver of any other term or breach.

Modifications

13.6 No modification of this Agreement is effective unless it is in writing and signed by, or on behalf of, the parties.

Entire agreement

13.7 This Agreement (including any modification of it) constitutes the entire agreement between the parties as to performance of the Services.

Survival of certain provisions

13.8 Sections 2.9, 3.1 to 3.4, 3.7, 3.8, 5.1 to 5.5, 6.1 to 6.4, 7.1, 7.2, 8.1, 9.1, 9.2, 9.5, 10.1 to 10.3, 11.2, 11.3, 11.5, 11.6, 12.1 to 12.3, 13.1, 13.2, 13.8, and 13.10, any accrued but unpaid payment obligations, and any other sections of this Agreement (including schedules) which, by their terms or nature, are intended to survive the completion of the Services or termination of this Agreement, will continue in force indefinitely subject to any applicable limitation period prescribed by law, even after this Agreement ends.

Schedules

13.9 The schedules to this Agreement (including any appendices or other documents attached to, or incorporated by reference into, those schedules) are part of this Agreement.

Independent contractor

13.10 In relation to the performance of the Contractor's obligations under this Agreement, the Contractor is an independent contractor and not:

(a) an employee or partner of the Province; or

(b) an agent of the Province except as may be expressly provided for in this Agreement.

The Contractor must not act or purport to act contrary to this section.

Personnel not to be employees of Province

13.11 The Contractor must not do anything that would result in personnel hired or used by the Contractor or a Subcontractor in relation to providing the Services being considered employees of the Province.

Key Personnel

13.12 If one or more individuals are specified as "Key Personnel" of the Contractor in Part 4 of Schedule A, the Contractor must cause those individuals to perform the Services on the Contractor's behalf, unless the Province otherwise approves in writing, which approval must not be unreasonably withheld.

Pertinent information

13.13 The Province must make available to the Contractor all information in the Province's possession which the Province considers pertinent to the performance of the Services.

Conflict of interest

13.14 The Contractor must not provide any services to any person in circumstances which, in the Province's reasonable opinion, could give rise to a conflict of interest between the Contractor's duties to that person and the Contractor's duties to the Province under this Agreement.

Time

13.15 Time is of the essence in this Agreement and, without limitation, will remain of the essence after any modification or extension of this Agreement, whether or not expressly restated in the document effecting the modification or extension.

Conflicts among provisions

13.16 Conflicts among provisions of this Agreement will be resolved as follows:

(a) a provision in the body of this Agreement will prevail over any conflicting provision in, attached to or incorporated by reference into a schedule, unless that conflicting provision expressly states otherwise; and

(b) a provision in a schedule will prevail over any conflicting provision in a document attached to or incorporated by reference into a schedule, unless the schedule expressly states otherwise.

Agreement not permit nor fetter

13.17 This Agreement does not operate as a permit, license, approval or other statutory authority which the Contractor may be required to obtain from the Province or any of its agencies in order to provide the Services. Nothing in this Agreement is to be construed as interfering with, or fettering in any manner, the exercise by the Province or its agencies of any statutory, prerogative, executive or legislative power or duty.

Remainder not affected by invalidity

13.18 If any provision of this Agreement or the application of it to any person or circumstance is invalid or unenforceable to any extent, the remainder of this Agreement and the application of such provision to any other person or circumstance will not be affected or impaired and will be valid and enforceable to the extent permitted by law.

Further assurances

13.19 Each party must perform the acts, execute and deliver the writings, and give the assurances as may be reasonably necessary to give full effect to this Agreement.

Additional terms

13.20 Any additional terms set out in the attached Schedule F apply to this Agreement.

Tax Verification

13.21 Any terms set out in the attached Schedule H apply to this Agreement.

Governing law

13.22 This Agreement is governed by, and is to be interpreted and construed in accordance with, the laws applicable in British Columbia.

14 INTERPRETATION

14.1 In this Agreement:

(a) "includes" and "including" are not intended to be limiting;

(b) unless the context otherwise requires, references to sections by number are to sections of this Agreement;

(c) the Contractor and the Province are referred to as "the parties" and each of them as a "party";

(d) "attached" means attached to this Agreement when used in relation to a schedule;

(e) unless otherwise specified, a reference to a statute by name means the statute of British Columbia by that name, as amended or replaced from time to time;

(f) the headings have been inserted for convenience of reference only and are not intended to describe, enlarge or restrict the scope or meaning of this Agreement or any provision of it;

(g) "person" includes an individual, partnership, corporation or legal entity of any nature; and

(h) unless the context otherwise requires, words expressed in the singular include the plural and *vice versa*.

15 EXECUTION AND DELIVERY OF AGREEMENT

15.1 This Agreement may be entered into by a separate copy of this Agreement being executed by, or on behalf of, each party and that executed copy being delivered to the other party by a method provided for in section 13.1 or any other method agreed to by the parties.

The parties have executed this Agreement as follows:

SIGNED on the 16 day of December, 2021 by the Contractor (or, if not an individual, on its behalf by its authorized signatory or signatories):	SIGNED on the 17 day of December, 2021 on behalf of the Province by its duly authorized representative:
	
Signature(s)	Signature
Stephen McNicholls, P.Eng.	**Francois Bertrand**
Print Name(s)	Print Name
President	**Executive Director, Capital Management Branch**
Print Title(s)	Print Title

Schedule A – Services

PART 1. TERM:

1. Subject to section 2 of this Part 1, the term of this Agreement commences on December 17, 2021 and ends on April 17, 2022.
2. At the sole discretion of the Province, this Agreement may be extended up to one (1) additional three-month term.

PART 2. SERVICES:

Background

The Ministry of Education has been working with school districts to identify opportunities on improving the ventilation systems in schools and mitigate the risks of viral transmission (e.g. COVID-19). This work will support student success and address other shared priorities, including climate change.

The Ministry of Education is seeking the support of an HVAC Technical Advisor to assess school ventilation systems across BC, evaluate data collected by the Ministry on current approaches to ventilation in schools, and recommend cost-effective solutions as needed.

The HVAC Technical Advisor will work alongside the Ministry, school districts, and the Technical Advisory Panel to provide expertise on ventilation systems, risk mitigation strategies, and best practices.

Outputs

The Contractor must:

- Evaluate the current HVAC systems in schools throughout BC.
- Identify the current approach to ventilation in schools and COVID-19 mitigation efforts.
- Identify opportunities to improve the ventilation systems in schools to mitigate transmission of COVID-19.
- Provide detailed guidance and analysis that may be applied in different contexts to further reduce the risks of viral transmission through ventilation systems in schools.
- Develop reports for the Ministry, school districts, and the public, as directed.

Inputs

The Contractor must provide the time, materials, equipment, and expertise required to provide the deliverables, as stated above.

Outcomes

Through the delivery of the Services the Province wishes to realize the following outcomes and, without limiting the obligation of the Contractor to comply with other provisions of this Part, the Contractor must use commercially reasonable efforts to achieve them:

- Identify features of effective ventilation systems and practices, within a COVID mitigation context.
- Guidance on cost-effective mitigations that may be applied in different contexts, to reduce the risk of viral transmission.
- Recommendations on ongoing investments to promote health and safety, with consideration for student success and climate resilience

The parties acknowledge that the Contractor does not warrant that these outcomes will be achieved.

Reporting requirements
Draft report on evaluation of HVAC systems in schools throughout BC to be completed by February 28, 2022.

PART 3. RELATED DOCUMENTATION:
Not applicable

PART 4. KEY PERSONNEL:
1. The Key Personnel of the Contractor are as follows:

   (a) Stephen McNicholls

Schedule B – Fees and Expenses

1. MAXIMUM AMOUNT PAYABLE:

Maximum Amount: Despite sections 2 and 3 of this Schedule, $74,500.00 is the maximum amount which the Province is obliged to pay to the Contractor for fees and expenses under this Agreement (exclusive of any applicable taxes described in section 3.1(c) of this Agreement).

2. FEES:

Hourly Rate

Fees: at a rate of $150 per hour for those hours during the Term when the Contractor provides the Services.

3. EXPENSES:

Expenses:

a. travel, accommodation and meal expenses for travel greater than 32 kilometers away from 101-1335 Bear mountain Parkway, Victoria, BC on the same basis as the Province pays its Group I employees when they are on travel status; and

b. the Contractor's actual long-distance telephone, postage and other identifiable communication expenses.

excluding goods and services tax ("GST") or other applicable tax paid or payable by the Contractor on expenses described in (a) and (b) above to the extent that the Contractor is entitled to claim credits (including GST input tax credits), rebates, refunds or remissions of the tax from the relevant taxation authorities.

4. STATEMENTS OF ACCOUNT:

Statements of Account: In order to obtain payment of any fees and expenses under this Agreement for a period from and including the 1st day of a month to and including the last day of that month (each a "Billing Period"), the Contractor must deliver to the Province on a date after the Billing Period (each a "Billing Date"), a written statement of account in a form satisfactory to the Province containing:

(a) the Contractor's legal name and address;

(b) the date of the statement, and the Billing Period to which the statement pertains;

(c) the Contractor's calculation of all fees claimed for that Billing Period, including a declaration by the Contractor of all hours worked during the Billing Period;

(d) a chronological listing, in reasonable detail, of any expenses claimed by the Contractor for the Billing Period with receipts attached, if applicable, and, if the Contractor is claiming reimbursement of any GST or other applicable taxes paid or payable by the Contractor in relation to those expenses, a description of any credits, rebates, refunds or remissions the Contractor is entitled to from the relevant taxation authorities in relation to those taxes;

(e) the Contractor's calculation of any applicable taxes payable by the Province in relation to the Services for the Billing Period;

(f) a description of this Agreement;

(g) a statement number for identification; and

(h) any other billing information reasonably requested by the Province.

5. PAYMENTS DUE:

Payments Due: Within 30 days of the Province's receipt of the Contractor's written statement of account delivered in accordance with this Schedule, the Province must pay the Contractor the fees and expenses (plus all applicable taxes) claimed in the statement if they are in accordance with this Schedule. Statements of account or contract invoices offering an early payment discount may be paid by the Province as required to obtain the discount.

Schedule C – Approved Subcontractor(s)

Not applicable.

Schedule D – Insurance

1. The Contractor must, without limiting the Contractor's obligations or liabilities and at the Contractor's own expense, purchase and maintain throughout the Term the following insurances with insurers licensed in Canada in forms and amounts acceptable to the Province:

   (a) Commercial General Liability in an amount not less than $2,000,000.00 inclusive per occurrence against bodily injury, personal injury and property damage and including liability assumed under this Agreement and this insurance must

      (i) include the Province as an additional insured,

      (ii) be endorsed to provide the Province with 30 days advance written notice of cancellation or material change, and

      (iii) include a cross liability clause.

2. All insurance described in section 1 of this Schedule must:

   (a) be primary; and

   (b) not require the sharing of any loss by any insurer of the Province.

3. The Contractor must provide the Province with evidence of all required insurance as follows:

   (a) within 10 Business Days of commencement of the Services, the Contractor must provide to the Province evidence of all required insurance in the form of a completed Province of British Columbia Certificate of Insurance;

   (b) if any required insurance policy expires before the end of the Term, the Contractor must provide to the Province within 10 Business Days of the policy's expiration, evidence of a new or renewal policy meeting the requirements of the expired insurance in the form of a completed Province of British Columbia Certificate of Insurance; and

   (c) despite paragraph (a) or (b) above, if requested by the Province at any time, the Contractor must provide to the Province certified copies of the required insurance policies.

4. The Contractor must obtain, maintain and pay for any additional insurance which the Contractor is required by law to carry, or which the Contractor considers necessary to cover risks not otherwise covered by insurance specified in this Schedule in the Contractor's sole discretion.

Schedule E – Privacy Protection Schedule

Definitions

1. In this Schedule,

   (a) "**access**" means disclosure by the provision of access;

   (b) "**Act**" means the *Freedom of Information and Protection of Privacy Act*;

   (c) "**contact information**" means information to enable an individual at a place of business to be contacted and includes the name, position name or title, business telephone number, business address, business email or business fax number of the individual;

   (d) "**personal information**" means recorded information about an identifiable individual, other than contact information, collected or created by the Contractor as a result of the Agreement or any previous agreement between the Province and the Contractor dealing with the same subject matter as the Agreement but excluding any such information that, if this Schedule did not apply to it, would not be under the "control of a public body" within the meaning of the Act; and

   (e) "**privacy course**" means the Province's online privacy and information sharing training course.

Purpose

2. The purpose of this Schedule is to:

   (a) enable the Province to comply with the Province's statutory obligations under the Act with respect to personal information; and

   (b) ensure that, as a service provider, the Contractor is aware of and complies with the Contractor's statutory obligations under the Act with respect to personal information.

Collection of personal information

3. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor may only collect or create personal information that is necessary for the performance of the Contractor's obligations, or the exercise of the Contractor's rights, under the Agreement.

4. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor must collect personal information directly from the individual the information is about.

5. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor must tell an individual from whom the Contractor collects personal information:

   (a) the purpose for collecting it;

   (b) the legal authority for collecting it; and

   (c) the title, business address and business telephone number of the person designated by the Province to answer questions about the Contractor's collection of personal information.

Privacy Training

6. The Contractor must ensure that each person who will provide services under the Agreement that involve the collection or creation of personal information will complete, at the Contractor's expense, the privacy course prior to that person providing those services.

7. The requirement in section 6 will only apply to persons who have not previously completed the privacy course.

Accuracy of personal information

8. The Contractor must make every reasonable effort to ensure the accuracy and completeness of any personal information to be used by the Contractor or the Province to make a decision that directly affects the individual the information is about.

Requests for access to personal information

9. If the Contractor receives a request for access to personal information from a person other than the Province, the Contractor must promptly advise the person to make the request to the Province unless the Agreement expressly requires the Contractor to provide such access and, if the Province has advised the Contractor of the name or title and contact information of an official of the Province to whom such requests are to be made, the Contractor must also promptly provide that official's name or title and contact information to the person making the request.

Correction of personal information

10. Within 5 Business Days of receiving a written direction from the Province to correct or annotate any personal information, the Contractor must annotate or correct the information in accordance with the direction.

11. When issuing a written direction under section 10, the Province must advise the Contractor of the date the correction request to which the direction relates was received by the Province in order that the Contractor may comply with section 12.

12. Within 5 Business Days of correcting or annotating any personal information under section 10, the Contractor must provide the corrected or annotated information to any party to whom, within one year prior to the date the correction request was made to the Province, the Contractor disclosed the information being corrected or annotated.

13. If the Contractor receives a request for correction of personal information from a person other than the Province, the Contractor must promptly advise the person to make the request to the Province and, if the Province has advised the Contractor of the name or title and contact information of an official of the Province to whom such requests are to be made, the Contractor must also promptly provide that official's name or title and contact information to the person making the request.

Protection of personal information

14. The Contractor must protect personal information by making reasonable security arrangements against such risks as unauthorized access, collection, use, disclosure or disposal, including any expressly set out in the Agreement.

Storage and access to personal information

15. Unless the Province otherwise directs in writing, the Contractor must not store personal information outside Canada or permit access to personal information from outside Canada.

Retention of personal information

16. Unless the Agreement otherwise specifies, the Contractor must retain personal information until directed by the Province in writing to dispose of it or deliver it as specified in the direction.

Use of personal information

17. Unless the Province otherwise directs in writing, the Contractor may only use personal information if that use is for the performance of the Contractor's obligations, or the exercise of the Contractor's rights, under the Agreement.

Disclosure of personal information

18. Unless the Province otherwise directs in writing, the Contractor may only disclose personal information inside Canada to any person other than the Province if the disclosure is for the performance of the Contractor's obligations, or the exercise of the Contractor's rights, under the Agreement.

19. Unless the Agreement otherwise specifies or the Province otherwise directs in writing, the Contractor must not disclose personal information outside Canada.

Notice of foreign demands for disclosure

20. In addition to any obligation the Contractor may have to provide the notification contemplated by section 30.2 of the Act, if in relation to personal information in the custody or under the control of the Contractor, the Contractor:

    (a) receives a foreign demand for disclosure;

    (b) receives a request to disclose, produce or provide access that the Contractor knows or has reason to suspect is for the purpose of responding to a foreign demand for disclosure; or

    (c) has reason to suspect that an unauthorized disclosure of personal information has occurred in response to a foreign demand for disclosure

    the Contractor must immediately notify the Province and, in so doing, provide the information described in section 30.2(3) of the Act. In this section, the phrases "foreign demand for disclosure" and "unauthorized disclosure of personal information" will bear the same meanings as in section 30.2 of the Act.

Notice of unauthorized disclosure

21. In addition to any obligation the Contractor may have to provide the notification contemplated by section 30.5 of the Act, if the Contractor knows that there has been an unauthorized disclosure of personal information in the custody or under the control of the Contractor, the Contractor must immediately notify the Province. In this section, the phrase "unauthorized disclosure of personal information" will bear the same meaning as in section 30.5 of the Act.

Inspection of personal information

22. In addition to any other rights of inspection the Province may have under the Agreement or under statute, the Province may, at any reasonable time and on reasonable notice to the Contractor, enter on the Contractor's premises to inspect any personal information in the possession of the Contractor or any of the Contractor's information management policies or practices relevant to the Contractor's management of personal information or the Contractor's compliance with this Schedule and the Contractor must permit, and provide reasonable assistance to, any such inspection.

Compliance with the Act and directions

23. The Contractor must in relation to personal information comply with:

    (a) the requirements of the Act applicable to the Contractor as a service provider, including any applicable order of the commissioner under the Act; and

    (b) any direction given by the Province under this Schedule.

24. The Contractor acknowledges that it is familiar with the requirements of the Act governing personal information that are applicable to it as a service provider.

Notice of non-compliance

25. If for any reason the Contractor does not comply, or anticipates that it will be unable to comply, with a provision in this Schedule in any respect, the Contractor must promptly notify the Province of the particulars of the non-compliance or anticipated non-compliance and what steps it proposes to take to address, or prevent recurrence of, the non-compliance or anticipated non-compliance.

Termination of Agreement

26. In addition to any other rights of termination which the Province may have under the Agreement or otherwise at law, the Province may, subject to any provisions in the Agreement establishing mandatory cure periods for defaults by the Contractor, terminate the Agreement by giving written notice of such termination to the Contractor, upon any failure of the Contractor to comply with this Schedule in a material respect.

Interpretation

27. In this Schedule, references to sections by number are to sections of this Schedule unless otherwise specified in this Schedule.

28. Any reference to the "Contractor" in this Schedule includes any subcontractor or agent retained by the Contractor to perform obligations under the Agreement and the Contractor must ensure that any such subcontractors and agents comply with this Schedule.

29. The obligations of the Contractor in this Schedule will survive the termination of the Agreement.

30. If a provision of the Agreement (including any direction given by the Province under this Schedule) conflicts with a requirement of the Act or an applicable order of the commissioner under the Act, the conflicting provision of the Agreement (or direction) will be inoperative to the extent of the conflict.

31. The Contractor must comply with the provisions of this Schedule despite any conflicting provision of this Agreement or, subject to section 32, the law of any jurisdiction outside Canada.

32. Nothing in this Schedule requires the Contractor to contravene the law of any jurisdiction outside Canada unless such contravention is required to comply with the Act.

Schedule F – Additional Terms

Not applicable.

Schedule G – Security Schedule

Definitions

1. In this Schedule:

(a) "**Device**" means any device to manage, operate or provide the Services or to connect to any Systems or any Province system or network, or that is capable of storing any Protected Information, and includes any workstation or handheld device the Contractor authorizes Personnel to use in relation to this Agreement;

(b) "**Facilities**" means the physical locations (excluding those of the Province) the Contractor uses to provide the Services, or to house Systems or records containing Protected Information;

(c) "**Least Privilege**" means the principle requiring that each subject in a system be granted the most restrictive set of privileges (or lowest clearance) needed for the performance of authorized tasks so as to limit the damage that can result from accident, error or unauthorized use;

(d) "**Need-to-Know**" means the principle where access is restricted to authorized individuals whose duties require such access and not merely because of status, rank or office;

(e) "**Personnel**" means all individuals hired or used by the Contractor and Subcontractors to perform the Contractor's obligations under this Agreement, including unpaid volunteers and the Contractor or a Subcontractor if an individual;

(f) "**Policies**" means the intentions and directions of an organization or part of it, as expressed in record form by its top management (including, for example, policies, directions, standards, practices, procedures and guidelines);

(g) "**Protected Information**" means any and all:

(i) "personal information" as defined in the Privacy Protection Schedule if attached;

(ii) information and records of information the Contractor is required to treat as confidential under this Agreement; and

(iii) records, the integrity or availability of which are to be preserved by the Contractor under this Agreement, which in the case of records not falling within (i) or (ii), are marked or instructed by the Province to be so preserved or otherwise treated as "Protected Information" under this Agreement;

(h) "**Security Event Logs**" means any logs (also known as audit records) of events, notifications or alerts that any component of any Device or other device (not limited to security device), or any Systems or other system or software is technically capable of producing in relation to its status, functions and activities that may be used for such purposes as security investigations, auditing, monitoring and determining security incidents (examples of components capable of producing such logs include firewalls, intrusion prevention systems, routers, switches, content filtering, network traffic flow logs, networks, authentication services, directory services, dynamic host configuration protocols, dynamic naming services, hardware platforms, virtualization platforms, servers, operating systems, web servers, databases, applications, application firewalls);

(i) "**Systems**" means any systems, subsystems, equipment, infrastructure, networks, management networks, servers, hardware and software the Contractor uses in relation to this Agreement, including for managing, operating or providing the Services, but excluding any the Province owns or makes available to the Contractor for the Contractor to use in relation to this Agreement;

(j) "**Tenancy**" means those components of the Systems that:

(i) directly access and store Protected Information,

(ii) relate to Protected Information or the Province's tenancy activities, or

(iii) are customer facing and managed by the Province in its use of the Services; and

(k) "**Tenancy Security Event Logs**" means Security Event Logs that relate to Tenancy, including:

(i) log-on/log-off information about Province user activities, and

(ii) application logs, web server log, file server logs, database logs of applications, web servers, file servers or database servers or any other logs that directly store, access or contain Protected Information.

Additional obligations

2. The Contractor must comply with Appendix G1 if attached.

PERSONNEL

Confidentiality agreements

3. The Contractor must not permit any person the Contractor hires or uses to access or obtain any Protected Information unless that person is contractually bound to the Contractor in writing to keep Protected Information confidential on terms no less protective than the terms applicable to the Contractor under this Agreement.

Personnel security screening

4. The Contractor may only permit individual Personnel to have access to any Protected Information or other asset of the Province (including to any system, network or device the Province makes available to the Contractor) in relation to this Agreement, if, after:

(a) verifying their identity and relevant education, professional qualifications and employment history;

(b) completing a criminal record check that is updated at least every five years;

(c) requiring Personnel to proactively disclose criminal offences to the Contractor unless prohibited by applicable law;

(d) performing any additional screening this Agreement or applicable law may require; and

(e) performing any additional background checks the Contractor considers appropriate,

the Contractor is satisfied that the individual does not constitute an unreasonable security risk.

5. If any criminal record check or proactive disclosure reveals a prior criminal offence or pending criminal matter, the Contractor must make a reasonable determination of whether the applicable person constitutes an unreasonable security risk, taking into consideration the duties of the individual and the type and sensitivity of information to which the individual may be exposed.

6. If the Contractor is an individual, the Province may subject the Contractor to the screening requirements in this Schedule.

Personnel information security training

7. Unless otherwise specified in this Agreement, the Contractor must ensure all Personnel complete any relevant information security training, at the Contractor's expense, before they provide any Services, or receive or are given access to any Protected Information or any system, device or secure facility of the Province, and thereafter at least annually.

Security contact

8. If not set out elsewhere in this Agreement, the Contractor (but not a Subcontractor) must provide in writing to the Province the contact information for the individual who will coordinate compliance by the Contractor and all Subcontractors and act as a direct contact for the Province on matters relating to this Schedule.

Supply chain

9. The Contractor must ensure that the security requirements of those in its upstream and downstream supply chain are documented, followed, reviewed, and updated on an ongoing basis as applicable to this Agreement.

GENERAL POLICIES AND PRACTICES

Information security policy

10. The Contractor must have an information security Policy that is:

    (a) based on recognized industry standards; and

    (b) reviewed and updated at least every three years.

Compliance and Standard for Security Controls

11. Unless this Agreement otherwise specifies, the Contractor must apply controls and security management practices to manage or operate Protected Information and Systems, Devices, and Facilities that are compliant with or equivalent to the following Province's Policies accessible at https://www2.gov.bc.ca/gov/content/governments/services-for-government/policies-procedures:

    (a) "Information Security Policy";

    (b) government wide IM/IT Standards; and

    (c) sector or ministry specific IM/IT Standards, if any applicable to the Province ministry, agency or other representative receiving the Services.

Contractor security risk assessments

12. The Contractor must undertake a security threat and risk assessment against an industry security standard before placing any new or materially changed Systems or services into production.

Change control and management

13. The Contractor must:

(a) implement and maintain change control processes for Facilities, Systems and Devices in line with applicable security best practices to reduce security-related risks with respect to implemented significant changes; and

(b) ensure that adequate testing of any change is completed before the change is put into production.

Backups and restores

14. The Contractor must ensure that:

(a) it has a backup Policy that is followed and is reviewed, updated and tested at least annually;

(b) backups are taken and tested in accordance with the Contractor's backup Policy, but in any event at least annually; and

(c) frequency and completeness of backups is based on reasonable industry practice.

Business continuity plan and disaster recovery plan

15. The Contractor must ensure that it has a documented business continuity plan and a disaster recovery plan that is reviewed at least annually.

16. The Contractor must ensure that Facilities and Systems are protected from loss, damage or other occurrence, including fire and environmental hazards and power interruptions, that may result in any of those Facilities and Systems being unavailable when required to provide the Services.

Security Incident Response and Management

17. The Contractor must ensure that it has a security incident management Policy and response plan that is reviewed at least annually.

PROTECTED INFORMATION AND DATA SECURITY

Encryption

18. The Contractor must ensure that:

(a) encryption of data at rest is implemented and is maintained in effect, uninterrupted, and active at all times, even in the case of equipment or technology failure, for all Protected Information stored on Systems and Devices; and

(b) encryption end-to-end is implemented for all Protected Information in transit.

No storage on unencrypted portable media

19. The Contractor must ensure that no Protected Information is stored on portable media for transport outside of the Facilities or Systems without both the prior written approval of the Province and ensuring that the portable media and the Protected Information are encrypted.

Encryption standard

20. For sections 18 and 19, encryption must comply with the Province's "Cryptographic Standards for Information Protection" accessible at https://www2.gov.bc.ca/gov/content/governments/services-for-government/policies-procedures.

Isolation controls and logical isolation of data

21. The Contractor must implement and maintain the logical isolation of Protected Information, in effect, uninterrupted, and active at all times, even in the case of equipment or technology failure.

ACCESS AND AUTHENTICATION

User Identifiers

22. The Contractor must assign and ensure that user identifiers are unique and personal for log in to Systems and Devices.

Access

23. The Contractor must implement, follow, and regularly review and update, access control Policies that address, without limitation, onboarding, off-boarding, transition between roles, regular access reviews, limit and control use of administrator privileges and inactivity timeouts for Facilities, Systems and Devices within the Contractor's control.

24. The Contactor must ensure that all access to Protected Information and to Facilities, Systems and Devices is based Least Privilege and Need-to-Know" based on role and responsibilities. The Contractor must identify and segregate conflicting duties and areas of responsibility to reduce incidents of fraud and other abuse.

25. The Contractor must verify an individual's identity before assigning the individual a unique identifier that would give them access to Facilities, Systems or Devices.

26. The Contractor must implement a formal user registration process for Personnel that includes:

    (a) verification of access levels;

    (b) creating and maintaining records of access privileges;

    (c) audit processes; and

    (d) actions to ensure access is not given before approval is granted by the Contractor.

27. The Contractor must maintain a current and accurate inventory of computer accounts and review the inventory on a regular basis to identify dormant, fictitious or unused accounts.

28. The Contractor must implement a monitoring process to oversee, manage and review Personnel access rights and roles at regular intervals.

29. The Contractor must ensure that all Systems and Devices:

    (a) are configured in alignment with industry standards;

    (b) enforce a limit of consecutive invalid logon attempts by a user during a predetermined time period;

    (c) automatically lock the applicable account and Systems after failed logon failures;

    (d) limit the number of concurrent sessions;

    (e) prevent further access to Systems by initiating a session lock; and

    (f) provide the capability of disconnecting or disabling remote access to the Systems.

Authentication

30. The Contractor must use or require complex passwords or personal identification numbers (PINs) that are not shared, default or blank and that are encrypted (not displayed) when entered, biometric accesses, keys, smart cards, other logical or access controls, or combinations of them, to control access to Protected Information and to Systems and Devices.

31. The Contractor must ensure that Systems for password-based authentication:

    (a) enforce minimum password complexity, including requiring passwords to be case sensitive, contain a minimum of eight characters and a combination of upper-case letters, lower-case letters, numbers, and/or special characters;

    (b) change authentication passwords regularly at predetermined intervals, but at a minimum semi-annually;

    (c) store and transmit only encrypted representations of passwords;

    (d) enforce password minimum and maximum lifetime restrictions;

    (e) prohibit password reuse;

    (f) prevent reuse of identifiers; and

    (g) disable the identifier after ninety days of inactivity.

Highly sensitive Protected Information

32. If this Agreement or the Province under this Agreement indicates that any Protected Information is highly sensitive, the Contractor must also ensure that Systems enforce with respect to that Protected Information:

    (a) two-factor authentication for access;

    (b) enhanced logging that logs all accesses;

    (c) request based access; and

    (d) no standing access rights.

SECURITY EVENT LOGS

Log generation, log retention and monitoring

33. The Contractor must ensure that logging of Security Event Logs is enabled on all applicable Systems components

34. The Contractor must retain Security Event Logs for the Systems online for a minimum of 90 days and either online or off-line for an additional period of time adequate to enable the Contractor to conduct effective security investigations into suspected or actual security incidents.

35. The Contractor must retain Tenancy Security Event Logs online for a minimum of 90 days and either:
    (a) such additional period of time as the Province may instruct; or
    (b) ensure that the Tenancy offers the technical capability for the Province to retain the Tenancy Security Event Logs,

to enable the Province to comply with an information schedule approved under the *Information Management Act* or other retention period required by law.

36. Upon the Province's request, the Contractor must ensure that the Tenancy offers the technical capability for the Province to enable or configure the forwarding, extraction, backup of Tenancy Security Event Logs from the Tenancy to the Province's security information and event management system or to an external log storage and retention system.

37. The Contractor must review Security Event Logs regularly to detect potential security incidents, using automated tools or equivalent processes for the monitoring, review, correlating and alerting of Security Event Logs.

PROVINCE PROPERTY

Access to Province facilities, systems or networks

38. If the Province makes available any facilities, systems, networks or devices for use of the Contractor in relation to this Agreement, the Contractor must comply with, and permit access on its behalf only by those authorized Personnel who have been instructed to comply with, the Province's Policies then applicable to their acceptable use, access and protection accessible at https://www2.gov.bc.ca/gov/content/governments/services-for-government/policies-procedures, including:

    (a) "Appropriate Use Policy" (as also referenced in chapter 12 of the Province's "Core Policy and Procedures Manual");

    (b) "Information Security Policy";

    (c) government wide IM/IT Standards; and

    (d) sector or ministry specific IM/IT Standards, if any applicable to the Province ministry, agency or other representative receiving the Services.

39. The Province has the rights to:

    (a) not make any particular Province facility, system, network or device available before the Contractor or individual Personnel or both agree to a form of agreement acceptable to the Province on acceptable use, protection of, and access to, such facility, system, network or device, or at all;

    (b) not permit connection to any particular Province system or network until satisfied with the controls applied and the security status of the Device to be connected;

    (c) keep facilities access logs and Security Event Logs, and to otherwise monitor and analyze use of Province facilities, systems and networks to verify compliance, investigate suspected or actual breaches or information incidents and protect the Province's assets, including records, in compliance with applicable laws, including the *Freedom of Information and Protection of Privacy Act* and *Information Management Act*, and the Province's Policies; and

    (d) limit or revoke access to any Province systems, facility or device at its discretion.

Application development

40. If the Services include software development, the Contractor must ensure that the applications and programming interfaces are developed according to industry standards and Province's Policies applicable to application development standards. The Contractor must use secure application development practices for the development of the software.

FACILITIES, SYSTEMS, DATABASE AND DEVICE SECURITY

Physical security

41. The Contractor must ensure that adequate physical controls and processes are implemented to ensure that only authorized persons have physical access to the Facilities and Systems.

42. The Contractor must develop, document, and disseminate a physical and environmental protection Policy that it reviews at least annually.

43. The Contractor must review physical access logs at least once monthly.

44. The Contractor must ensure that physical security of any Systems or Facilities being used or capable of being used to house Protected Information meets a standard as would be reasonably expected to provide adequate protection based on the value of the data being protected and the environment in which the Systems or Facilities are located. At a minimum, this should include:

    (a) hardening of the perimeter of the Facilities;

    (b) physical separation of public and restricted spaces;

    (c) Intrusion Alarm System (IAS) partitioned to ensure areas containing Protected Information are protected at all times;

    (d) Access Control Systems (ACS) and/or Key Management processes; and

    (e) visitor and identity management processes – including access logs and identification badges.

Separation of production from test environments

45. The Contractor must not use any production data in any development, test or training environments used for the Services without the Province's prior written consent. If the Province gives such consent, the production data must, at minimum, be obfuscated (for example, by using data masking functionality).

46. The Contractor must keep its development, test and training environments separate from its production environments used for the Services at all times, even in case of failure.

Systems (including servers) hardening

47. The Contractor must:

    (a) harden all Systems against attack and misuse, using appropriate security best practices for the hardening of the specific deployed platform, before placing those Systems into production;

    (b) ensure that all unsecured and unneeded ports, services, applications, protocols and network communicating applications are uninstalled or disabled on all Systems;

    (c) applying Least Privilege, ensure that the Contractor only configures and makes operational ports, services, applications, protocols and network communicating applications based on the functional requirements of the respective Systems;

    (d) ensure that default passwords and shared accounts are not used for any Systems; and

(e) in relation to Systems, implement server hardening using configuration security best practices (for example, Center for Internet Security, Inc. (CIS) Benchmarks or equivalent) for any server operating systems, server virtualization, server middleware (for example, web servers and database servers) and application servers.

Perimeter controls (firewall and intrusion prevention system) and network security

48. The Contractor must:

(a) implement stateful packet inspection firewalls to control traffic flow to and from Systems and Tenancy at all times, and configure the stateful packet inspection firewalls applying security best practices and Least Privilege;

(b) implement an intrusion prevention System to control and filter traffic flow leaving and entering Systems and Tenancy at all times, and configure the intrusion prevention System applying security best practices; and

(c) implement a secure network perimeter and network segmentation for Systems, with ingress and egress points that are known and controlled.

Application firewall

49. The Contractor must implement application layer firewalls on Systems:

(a) at such level of protection as the Province may instruct ; and

(b) to detect and mitigate application attacks (for example, brute force, OWASP Top 10, SQL injection, cross site scripting).

Management network

50. The Contractor must ensure that for any Systems:

(a) the management network remains logically separated from any other zone and is not directly accessible from the Internet;

(b) the management network is internally segmented, with each server's dedicated network interface on its own segmented network and that interfaces on the management network do not have visibility to each other; and

(c) all access to the management network is strictly controlled and exclusively enforced though a secure access gateway, bastion host or equivalent.

Remote management and secure access gateway

51. The Contractor must perform any remote management of Systems or Devices in a secure manner, using encrypted communication channels and adequate access controls.

Database security

52. The Contractor must ensure that for any Systems:

(a) database maintenance utilities that bypass controls are restricted and monitored;

(b) there is a formal approval process in place for handling requests for disclosure of database contents or for database access, including steps to evaluate privacy impacts and security risks of such requests; and

(c) methods to check and maintain the integrity of the data are implemented (for example, consistency checks and checksums).

53. For database security, the Contractor must implement logical isolation and encryption of Protected Information.

Device security and antivirus scanning

54. The Contractor must ensure all Devices:

(a) have antivirus and malware protection as appropriate for the particular Device active at all times;

(b) are configured to perform antivirus scans at least once per week;

(c) have host based firewall configured, enabled and active at all times; and

(d) have all patches and appropriate security updates installed for the operating system and all installed software.

VULNERABILITY PREVENTION, SCANNING AND MANAGEMENT

Proactive management

55. The Contractor must:

(a) obtain information in a timely basis about technical vulnerabilities relating to Systems and Devices; and

(b) implement processes to stay current with security threats.

Patching

56. The Contractor must patch all Systems regularly in line with security best practices and ensure that current software, operating systems and application patching levels are maintained.

57. The Contractor must ensure that all Systems have all patches installed on a regular schedule, within the time frame recommended by the manufacturer unless the Province otherwise consents in writing.

58. The Contractor must ensure that vulnerabilities are remedied and patches installed on an accelerated basis for zero-day, critical and high vulnerabilities. For zero-day vulnerabilities, the Contractor must implement appropriate mitigation measures promptly on notification of the zero-day vulnerability. The Contractor must remediate zero-day, high and critical vulnerabilities through patching, decommission, or compensating controls.

59. The Contractor must patch high vulnerabilities within 30 days or less of discovery and patch medium vulnerabilities within 90 days or less of discovery.

Vulnerability Scanning

60. The Contractor must ensure that a vulnerability scan is completed on components of all Systems:

(a) with any identified vulnerabilities remedied, before being placed into production; and

(b) on a regular schedule, set at a minimum of one scan per quarter, unless the Province otherwise consents in writing.

Web application vulnerability scanning

61. The Contractor must ensure that a vulnerability scan is completed on any web applications used for Tenancy or in any other Systems:

(a) and on any major changes to such web applications, with any identified vulnerabilities remedied, before being placed into production; and

(b) on a regular schedule, set at a minimum of one scan per quarter, unless the Province otherwise consents in writing.

Antivirus and malware scanning

62. The Contractor must ensure that all Systems servers:

(a) have antivirus and malware protection configured, active and enabled at all times;

(b) have antivirus and malware definitions updated at least once a day; and

(c) are configured to undergo a full anti-virus scan for latent infections (to detect infections missed by the real-time agent) at least once a week.

DISPOSALS

Asset disposal

63. The Contractor must ensure that all disposals of assets used in providing or relating to the Services are done in a secure manner that ensures that Protected Information cannot be recovered.

Asset management

64. The Contractor must have asset management and disposal Policies that are followed, and reviewed and updated regularly in line with security best practices, and that address hardware, software and other critical business assets.

65. The Contractor must keep an asset management inventory that includes the name of the System, location, purpose, owner, and criticality, with assets added to inventory on commission and removed on decommission.

Information destruction and disposal

66. Unless this Agreement otherwise specifies, the Contractor must retain all records containing Protected Information in the Contractor's possession until instructed by the Province in writing to dispose or deliver them as instructed.

67. The Contractor must securely erase:

(a) records that contain Protected Information and Tenancy Security Event Logs when instructed in writing by the Province; and

(b) any backup, transitory and extra copies of records that contain Protected Information or Tenancy Security Event Logs when no longer needed in relation to this Agreement.

68. The Contractor must ensure that Protected Information and Tenancy Security Event Logs on magnetic media are securely wiped by overwriting using procedures and adequate media wiping solutions, degaussing, or other method in line with security best practices for disposal of media.

NOTICES, INCIDENTS AND INVESTIGATIONS

Notice of demands for disclosure

69. In addition to any obligation the Contractor may have to notify or assist the Province under applicable law or this Agreement, including the Privacy Protection Schedule if attached, if the Contractor is required (including under an enactment or a subpoena, warrant, order, demand or other request from a court, government agency or other legal authority) to produce, provide access to or otherwise disclose any Protected Information, the Contractor must, unless prohibited by applicable law, immediately notify and provide reasonable assistance to the Province so the Province may seek a protective order or other remedy to prevent or limit the disclosure.

E-discovery and legal holds

70. The Contractor must fully co-operate with the Province to enable the Province to comply with e-discovery and legal hold obligations.

Incidents

71. In addition to any obligation the Contractor may have under applicable law, including the *Freedom of Information and Protection of Privacy Act,* or this Agreement, if, during or after the Term, the Contractor discovers a suspected or actual unwanted or unexpected event or series of events that threaten the privacy or security of Protected Information (including its unauthorized access, collection, use, disclosure, alteration, storage or disposal) or Tenancy, whether accidental or deliberate, the Contractor must:

(a) immediately report the particulars of such incident to, and follow the instructions of, the Province, confirming any oral report with a notice in writing to the Province as soon as reasonably practicable (if unable to contact the Province's contract manager or other designated contact for this Agreement, the Contractor must follow the procedure for reporting and managing information incidents on the Province's website at https://www2.gov.bc.ca/gov/content/governments/services-for-government/information-management-technology/information-security/information-incidents; and

(b) make every reasonable effort to recover the records containing Protected Information and contain and remediate such incident, following such reasonable instructions as the Province may give.

Investigations support and security investigations

72. The Contractor must:

(a) conduct security investigations in the case of incidents (including any security breach or compromise) affecting Devices, Facilities, Systems, Tenancy or Protected Information, collecting evidence, undertaking forensic activities and taking such other actions as needed;

(b) provide the Province with any related investigation reports, which the Contractor may sanitize first;

(c) upon the Province's request, provide the Province with any logs relating to such investigation reports as validation/confirmation of such investigation, which the Contractor may sanitize first; and

(d) maintain a chain of custody in all such security investigations it undertakes.

73. Upon the Province's request, the Contractor must:

(a) provide investigative support to the Province to enable the Province to conduct its own security investigations into incidents (including security breaches or compromises) affecting the Tenancy or Protected Information;

(b) provide the Province with timely access via an on-line, real-time GUI (Graphic User Interface) facility to any Tenancy Security Event Logs and to other Security Event Logs for Systems (the latter of which the Contractor may sanitize first to mask or remove, for example, data pertaining to the Contractor's customers) to assist the Province in conducting the Province's security investigations, or in case of technical limitations, other method acceptable to the Province (for example, on-site visits to enable direct access to those Security Event Logs).

74. The Contractor must work with and support the Province if the Province needs assistance in legal proceedings in relation to security investigations related to Protected Information or Tenancy.

Province Security Threat and Risk Assessment ("STRA") support

75. The Contractor must, via its technical and security resources, support the Province in completing a STRA for the Services and to otherwise assess the risks associated with the Services, including by providing all information and documentation (for example, architecture diagrams, service architecture, controls architecture and technical information), which the Contractor may sanitize first and that the Province may reasonably require for such purpose.

Notification of changes

76. The Contractor must notify the Province of any changes to its security Policies, management practices and security controls described in this Agreement that may potentially negatively impact the security of Tenancy, Protected Information, or those Systems providing the Services.

Compliance verification

77. Upon the Province's request, the Contractor must provide, at no additional cost, the following security reports to the Province at least every six months during the Term:
(a) vulnerability scan reports of those Systems providing the Services; and
(b) patch status reports for those Systems providing the Services.

78. In addition to any other rights of inspection the Province may have under this Agreement or under statute, the Province has the rights, at any reasonable time and on reasonable notice to the Contractor, to:

(a) request the Contractor to verify compliance with this Schedule and to keep security controls documentation or records to support compliance; and
(b) enter on the Contractor premises and Facilities to inspect and to validate the Contractor's compliance with the security obligations under this Agreement

79. The Contractor must permit, and provide reasonable assistance to, the exercise by the Province of the Province's rights under this section. If any non-compliance or deficiency is found, the Province may (in addition to any other rights it may have) require the Contractor, at the Contractor's expense, to develop and implement a corrective action plan within a reasonable time.

Notice of non-compliance

80. If for any reason the Contractor does not comply, or anticipates that it will be unable to comply, with a provision in this Schedule in any respect, the Contractor must promptly notify the Province of the particulars

of the non-compliance or anticipated non-compliance and what steps it proposes to take to address, or prevent recurrence of, the non-compliance or anticipated non-compliance.

MISCELLANEOUS

Interpretation

81. In this Schedule, unless otherwise specified, references to sections by number are to sections of this Schedule.

82. Any reference to the "Contractor" in this Schedule includes any subcontractor or agent retained by the Contractor to perform obligations under this Agreement and the Contractor must ensure that any such subcontractors and agents comply with this Schedule.

83. Any reference to a specified Policy refers to it as may be revised or replaced from time to time.

84. If a provision of this Schedule conflicts with a documented process required by this Schedule to be created or maintained by the Contractor, the provision of the Schedule will prevail to the extent of the conflict.

Referenced documents

85. Policies and other documents of the Province referenced in this Schedule may be updated or replaced by the Province from time to time without notice, and if not found at the hyperlink or URL provided or via the Province's main website at http://www.gov.bc.ca, be obtained from the Province's contact for this Agreement.

Survival

86. Sections 63, 66, 67, 68, 69, 70, and 71 and other obligations of the Contractor in this Schedule which, by their terms or nature, are intended to survive the completion of the Services or the termination of this Agreement, will continue in force indefinitely subject to any applicable limitation period prescribed by law, even after this Agreement ends.

Schedule H – Tax Verification Schedule

Not applicable.

Classification of HVAC Systems Efficiency

From: Stephen McNicholls <stephen@smcn.ca>
To: Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>, Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>
Sent: December 17, 2021 12:20:47 PM PST
Attachments: CLASSROOM VENTILATION.docx, image001.png

[EXTERNAL] This email came from an external source. Only open attachments or links that you are expecting from a known sender.

I thought it might be helpful to provide some additional context to my overview of the spectrum of current ventilation systems
I'm guessing my presentation of this on the Zoom call was a lot to absorb in a few minutes

We are closing our office between Dec 23rd and January 3rd, but I am available by my cell phone or e-mail if anything comes up

Below I have highlighted:
Green as the optimal system (good as is, with the ability to provide enhanced outdoor air and good thermal comfort)
Yellow requiring some minor investment
Purple requiring modification of outdoor air intakes (making them larger) – for the specific school I was reviewing earlier this week with SD43 I gave them an estimate of $300k to modify 25 furnaces. Good money after bad in my view however. They would still be stuck with 25 gas-fired furnaces
Red requiring potentially significant investment

Also, in terms of where "other measures" such as self contained HEPA units would be of benefit. The Red category for sure and probably to some degree all the categories except for #1

1. Systems with ability to provide 6-8 AC / Hr and have Digital Controls
2. Systems with capacity to provide 6-8 AC/Hr but without functional / calibrated digital controls
3. Systems with capacity to provide 6-8 AC/Hr but with non-functional outdoor air dampers
   --Old horizontal unit ventilators (Herman-Nelson, AAF, Trane UV's)
4. Systems with overall capacity to provide 6-8 AC / Hr OVERALL SUPPLY AIR but restricted OUTDOOR AIR paths (An example is furnaces)
5. Systems with 3-4 AC / Hr capacity, which therefore cannot provide enhanced OUTDOOR air ventilation

   -Often seen with newer designs which targeted energy reductions
   -Although these may be HRV's, which while not allowing enhanced OUTDOOR ventilation, do not RECIRCULATE air
   -Also seen in a lot of older schools

Systems with NO Ventilation

Stephen McNicholls, P.Eng., LEED AP
SMcN Consulting Inc.
cell: 250-616-3232
stephen@smcn.ca



CLASSROOM DATA

- Floor area 80-90 m2
- Ceiling height 3m
- Volume of 85 m2 room 255 m3 9000 ft3
- 1 air change per hour (AC / Hr) therefore = 150 CFM

To meet ASHRAE Standard 62 requirements for 30 occupants therefore need
3 AC / Hr of OUTDOOR AIR (450 CFM)

Older ventilation systems often range between 800 and 1000 CFM per classroom
(5.5 to 6.5 AC/Hr)

My personal preference has always been to provide the following, so as to provide "FREE" cooling:

- 8 AC / Hr for South, West and East facing classrooms (1200 CFM)
- 7 AC/ Hr for North exposure classrooms (1050 CFM)
- 6 AC/Hr when mechanical cooling is provided (900 CFM)

PANDEMIC VENTILATION TARGET
MAKE THE INDOOR ENVIRONMENT A WARMER VERSION OF OUTDOORS

- Absolute minimum of 3 AC / Hr of OUTDOOR AIR
- Increase amount of OUTDOOR AIR when equipment capacity, outdoor temperature and controlability allows
  - Fan capacity
  - Heating capacity
  - Digital controls that allow modulation of outdoor air without causing freezing or occupant comfort issues
- Provide ALL OUTDOOR AIR and throttle back as required by indoor temperature and/or freeze protection requirements
- Maximize OUTDOOR AIR by resetting space CO2 setpoint to 800 PPM instead of 1000 PPM -this will theoretically INCREASE outdoor air by 50%

  -traditonally using a differential of 600 PPM between OUTDOOR AIR (400 PPM) and INDOOR target of 1000 PPM

  -changes this to a differential of 400 PPM between OUTDOOR AIR (400 PPM) and INDOOR target of 800 PPM

VENTILATION SYSTEMS CLASSIFICATION

1) Systems with ability to provide 6-8 AC / Hr and have Digital Controls

2) Systems with capacity to provide 6-8 AC/Hr but without functional / calibrated digital controls

3) Systems with capacity to provide 6-8 AC/Hr but with non-functional outdoor air dampers
   --Old horizontal unit ventilators (Herman-Nelson, AAF, Trane UV's)

4) Systems with overall capacity to provide 6-8 AC / Hr OVERALL SUPPLY AIR but restricted OUTDOOR AIR paths (An example is furnaces)

5) Systems with 3-4 AC / Hr capacity, which therefore cannot provide enhanced OUTDOOR air ventilation

   -Often seen with newer designs which targeted energy reductions
   -Although these may be HRV's, which while not allowing enhanced OUTDOOR ventilation, do not RECIRCULATE air
   -Also seen in a lot of older schools

6) Systems with NO Ventilation

System capable of

Incremental Funding for School Ventilation Improvements

From:	Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To:	Patti Dundas <dundas_p@surreyschools.ca>, Chuck Morris <cmorris@sd61.bc.ca>, Collette O'Reilly <coreilly@vsb.bc.ca>, Bob Beukers <Bob.Beukers@abbyschools.ca>, josh.currie@sd23.bc.ca, Stephen McNicholls <stephen@smcn.ca>, Sheppard, Grant EDUC:EX <Grant.Sheppard@gov.bc.ca>, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>
Cc:	Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>
Sent:	January 14, 2022 9:58:40 AM PST
Attachments:	FRTCF Jan 13 2021.pdf, image001.jpg

Hello all,

Thank you for joining on the call earlier. Attached is the document we shared during the meeting regarding ventilation funding. Please do not share. Kind regards,

Damien

Damien Crowell | A/Director | Minor Capital Programs & Finance Unit | Ministry of Education
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca

BRITISH COLUMBIA
BC Public Service
Where ideas work
2020 TOP WORK UNIT AWARD

Federal Safe Return to Class Fund Overview & Implementation

Introduction:

On December 14, 2021, the Federal Government announced that additional funding for ventilation is being provided through the Federal Safe Return to Class Fund (SRTCF). The Federal Government has indicated that BC will receive $11.9 million of this funding which must be used for projects with an estimated completion by Fall 2022. $11.1 million will be provided to public schools and $800,000 to independent schools. Government wants to support districts to use the expected federal funding to increase outdoor air intake and/or increase air cleaning immediately, in order to help reduce the transmission of COVID-19.

Implementation:

EDUC will provide the SRTCF funding to public school districts on a proportional basis with a minimum funding level of $50,000 for small districts. School districts will be responsible for expending the funds and completing initiatives by November 2022. SRTCF funds are to be prioritized on the following basis:

Priority	Eligible Expenses
1	Procurement and deployment of standalone HEPA filtration units in occupied classrooms and portables that currently have no access to mechanical ventilation. It is recommended that HEPA filtration units for a standard size classroom (80m2) deliver air filtration of at least 150 cubic feet per minute, or more as deemed appropriate by school districts. **(This priority must be fully addressed with allocated SRTC funds before any balance can be expended on other eligible priorities.)**
2	Improvements to existing ventilation systems and associated control systems that increase the airflow within schools, and can be completed by November 2022.
3	Ventilation filter upgrading and replacement, including equipment and related operating expenses.
4	Utility costs associated with running ventilation systems at a higher throughput, to increase the airflow within a building.
5	Procurement and deployment of standalone HEPA filtration units within other shared spaces within schools, as appropriate.

This new funding will be added to the Federal Safe Return to Class Fund which will continue to be a Special Purpose Fund. School districts are required to report to the Ministry on how the funds have been spent in a reporting template to be made available later. This report will include, among other requests, a confirmation of the number of classrooms with no mechanical ventilation that have been addressed via standalone HEPA filtration units. It is anticipated that the report will need to reflect actual and planned spending as of January 28, 2022, and be submitted to the Ministry by February 11, 2022. The template will capture capital as well as operational expenditures as per the guidance above.

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Contact:

If there are any questions, please contact Damien Crowell, A/Director, Minor Capital & Finance Unit, Capital Management Branch, at damien.crowell@gov.bc.ca or phone 250.893.6477.

Appendix - Detailed Allocation Table

	School District	School Space (M2)	Funding Allocated*
5	Southeast Kootenay	78,513	$123,982
6	Rocky Mountain	54,101	$85,431
8	Kootenay Lake	84,149	$132,882
10	Arrow Lakes	12,079	$50,000
19	Revelstoke	20,360	$50,000
20	Kootenay-Columbia	58,121	$91,779
22	Vernon	95,223	$150,368
23	Central Okanagan	225,805	$355,574
27	Cariboo-Chilcotin	84,512	$133,454
28	Quesnel	54,943	$86,761
33	Chilliwack	131,131	$207,071
34	Abbotsford	201,081	$317,531
35	Langley	218,402	$343,884
36	Surrey	649,651	$1,024,878
37	Delta	189,643	$299,470
38	Richmond	259,206	$408,318
39	Vancouver	710,777	$1,121,404
40	New Westminster	71,425	$112,788
41	Burnaby	287,451	$452,920
42	Maple Ridge-Pitt Meadows	161,035	$253,602
43	Coquitlam	347,619	$547,932
44	North Vancouver	208,771	$329,674
45	West Vancouver	79,247	$125,141
46	Sunshine Coast	45,594	$71,998
47	Powell River	26,811	$50,000
48	Sea to Sky	57,342	$90,549
49	Central Coast	8,132	$50,000
50	Haida Gwaii	19,905	$50,000
51	Boundary	28,352	$50,000
52	Prince Rupert	35,317	$55,771
53	Okanagan Similkameen	34,443	$54,389
54	Bulkley Valley	30,331	$50,000
57	Prince George	194,760	$306,550
58	Nicola-Similkameen	33,975	$53,651
59	Peace River South	63,454	$100,201
60	Peace River North	73,231	$115,640
61	Greater Victoria	280,024	$441,192
62	Sooke	111,469	$176,023
63	Saanich	79,149	$124,986
64	Gulf Islands	32,192	$50,834
67	Okanagan Skaha	90,514	$142,933
68	Nanaimo-Ladysmith	173,914	$274,631

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69	Qualicum	63,868	$100,855
70	Alberni	52,705	$83,228
71	Comox Valley	99,898	$157,751
72	Campbell River	73,389	$115,890
73	Kamloops-Thompson	200,118	$315,011
74	Gold Trail	33,211	$52,444
75	Mission	79,245	$125,138
78	Fraser-Cascade	25,240	$50,000
79	Cowichan Valley	108,045	$170,616
81	Fort Nelson	14,709	$50,000
82	Coast Mountains	107,230	$169,329
83	North Okanagan-Shuswap	100,026	$157,953
84	Vancouver Island West	13,006	$50,000
85	Vancouver Island North	40,735	$64,326
87	Stikine	5,660	$50,000
91	Nechako Lakes	69,978	$110,504
92	Nisga'a	11,670	$50,000
93	Conseil scolaire francophone	71,409	$112,763
	Public School Totals	6,872,294	$11,100,000
	Independent School Totals	N/A	$800,000
	Grand Total	N/A	$11,900,000

*Minimum $50,000 allocation per School District

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Ventilation Technical Advisory Panel - booking meeting #3

From: Walker, Brenda MK EDUC:EX <Brenda.Walker@gov.bc.ca>
To: Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Patti Dundas <dundas_p@surreyschools.ca>, Chuck Morris <cmorris@sd61.bc.ca>, coreilly@vsb.bc.ca, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>, Bob Beukers <Bob.Beukers@abbyschools.ca>, josh.currie@sd23.bc.ca, stephen@smcn.ca, shawn@fisabc.ca, Sheppard, Grant EDUC:EX <Grant.Sheppard@gov.bc.ca>
Sent: January 24, 2022 1:05:15 PM PST
Attachments: image002.jpg

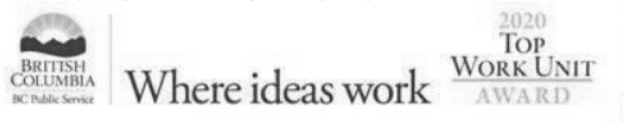
Good afternoon, I am looking to book the next meeting for the Ventilation Technical Advisory Panel. The dates available are as follows.

Wednesday February 9th , 1 hour time between 9:00am – 4:00pm
Thursday February 10th, 9:00am – 10:00am, or 1 hour time between 1: 00 and 4:00pm
Friday February 11th, 1 hour time between 9:00 – 12:00 and 2:00 - 4:00pm

Please advise at your earliest a time that will work for you as well as an alternate time.

Thanks
Brenda

Brenda Walker
Administrative Coordinator | Capital Management Branch |Ministry of Education
Phone: (250) 356-2588 | Cell: (250) 896-9230



FW: Ventilation Technical Advisory Panel - Meeting #3

From: Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To: Graham, Megan 1 EDUC:EX <Megan.1.Graham@gov.bc.ca>, King, Aimee EDUC:EX <Aimee.King@gov.bc.ca>
Cc: Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>
Sent: January 28, 2022 2:24:04 PM PST
Attachments: image001.jpg

FYI – Just a heads up that a doctor from Fraser Health will be joining in on the next VTAP meeting – be good to get their perspective. Cheers

---

From: Walker, Brenda MK EDUC:EX <Brenda.Walker@gov.bc.ca>
Sent: January 28, 2022 8:43 AM
To: Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
Cc: Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>
Subject: FW: Ventilation Technical Advisory Panel - Meeting #3

Damien, can you please advise on below question received regarding the ventilation meeting.

Brenda Walker
Administrative Coordinator | Capital Management Branch |Ministry of Education
Phone: (250) 356-2588 | Cell: (250) 896-9230



-----Original Appointment-----
From: Zbar, Ariella [FH] <ariella.zbar@fraserhealth.ca>
Sent: January 28, 2022 8:41 AM
To: Walker, Brenda MK EDUC:EX
Subject: Tentative: Ventilation Technical Advisory Panel - Meeting #3
When: February 11, 2022 11:00 AM-12:00 PM (UTC-08:00) Pacific Time (US & Canada).
Where: zoom meeting; https://ca01web.zoom.us/j/2801932498?pwd=SkZEaVZSQzBuTG42cUl0TFM5U3Bldz09

[EXTERNAL] This email came from an external source. Only open attachments or links that you are expecting from a known sender.

Good morning,
I received this invitation and am wondering if there is specific input you need from a regional health authority level in advance of this meeting?
Sincerely,
Ariella Zbar MD, CCFP, MPH, MBA, FRCPC
Medical Health Officer, Fraser Health Authority

Ventilation Technical Advisory Panel Agenda

Meeting #04
4/5/2022
1:00pm –2:00pm
Location: Zoom Video Conference Call

Members:	Francois Bertrand, Damien Crowell, Ravnit Aujla, Megan Graham, Aimee King, Patti Dundas, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls, Grant Sheppard, Shawn Chisholm, Matt Foley, Tym Berger
Guests:	N/A
Regrets:	N/A

TIME	TOPIC		LEAD
1:00 – 1:05pm	**1.0 Meeting Agenda & Introductions**	Information	Francois Bertrand
1:05 – 1:30pm	**2.0 Best Practices Document Review**	Information	Damien Crowell
1:30 – 1:40pm	**3.0 Ventilation Minor Capital Projects**	Information	Damien Crowell
1:40 – 1:55pm	**4.0 Roundtable and/or Questions**	Information	All
1:55 – 2:00pm	**5.0 Wrap up/Items for Future Meetings**	Information	Francois Bertrand

Next Meeting: TBD

Ventilation Technical Advisory Panel Agenda

Meeting #05
5/18/2022
1:00pm –2:00pm
Location: Zoom Video Conference Call

Members:	Francois Bertrand, Damien Crowell, Megan Graham, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Stephen McNicholls, Shawn Chisholm, Matt Foley, Tym Berger
Guests:	N/A
Regrets:	Patti Dundas, Ravnit Aujla, Grant Sheppard, Josh Currie, Aimee King

TIME	TOPIC		LEAD
1:00 – 1:05pm	**1.0 Meeting Agenda**	Information	Damien Crowell
1:05 – 1:25pm	**2.0 Draft Best Practices Guidelines**	Information	Stephen McNicholls
1:25 – 1:50pm	**3.0 Draft Guidelines Discussion**	Information	All
1:50 – 1:55pm	**4.0 Roundtable and/or Questions**	Information	All
1:55 – 2:00pm	**5.0 Wrap up/Items for Future Meetings**	Information	Damien Crowell

Next Meeting: TBD

Ventilation Technical Advisory Panel Agenda

Meeting #03
2/11/2022
11:00am –12:00pm
Location: Zoom Video Conference Call

Members:	Francois Bertrand, Damien Crowell, Ravnit Aujla, Megan Graham, Aimee King, Patti Dundas, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls, Grant Sheppard, Shawn Chisholm
Guests:	Dr. Ariella Zbar
Regrets:	N/A

TIME	TOPIC		LEAD
11:00am – 11:10am	**1.0 Meeting Agenda & Introductions**	Information	Francois Bertrand
11:10 – 11:15am	**2.0 Updated Terms of Reference Review**	Information	Damien Crowell
11:15am – 11:25am	**3.0 HVAC Consultant Overview of Ventilation System**	Information	Stephen McNicholls
11:25am – 11:50am	**4.0 Health's & HVAC Specialist Perspective**	Information	Dr. Ariella Zbar / Stephen McNicholls
11:50am – 11:55am	**5.0 Roundtable and/or Questions**	Information	All
11:55am –12:00pm	**6.0 Wrap up/Items for Future Meetings**	Information	Francois Bertrand

Next Meeting: TBD

Ventilation Technical Advisory Panel Meeting - Ministry of Education

From:	Crowell, Damien EDUC:EX
To:	Ariella.Zbar@fraserhealth.ca
Cc:	Docking, Christie M EDUC:EX <Christie.Docking@gov.bc.ca>, Graham, Megan 1 EDUC:EX <Megan.1.Graham@gov.bc.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Alexandra.choi1@vch.ca, Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>
Sent:	February 7, 2022 3:28:14 PM PST
Attachments:	image001.jpg, Consolidated Questions for Health.docx

Hello Dr. Ariella Zbar,

We have our next Ventilation Technical Advisory Panel for Schools meeting this Friday (Feb 11th) from 11am-noon. Attendees include representatives (staff) from the Ministry of Education (school capital funding group), School Districts (mainly facilities management leaders) and a school HVAC specialist (mechanical engineer). Typically, these meetings are held every few weeks and it is a group of about 10 people. I understand that you have tentatively accepted the meeting on Friday and just wondering if you will be able to make it?

Attached are several questions related to ventilation/COVID 19 that the panel members have identified - some are for the school HVAC specialist, and you may also have helpful input on some of them. I could setup a pre-meet with you earlier this week if you wanted to gain a better understanding of the Ventilation Technical Advisory Panel for Schools or discuss some of the questions in advance of the meeting? If so, feel free to suggest a time that works best for you.

Please contact me if you have any questions.

Thank you,

Damien

Damien Crowell | A/Director | Minor Capital Programs & Finance Unit | Ministry of Education
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca

BRITISH COLUMBIA BC Public Service | Where ideas work | 2020 Top Work Unit Award

Questions:

1. What is the general risk of COVID transmission within schools? Are there concerns about ventilation systems in relation to COVID transmission in schools? How does a ventilation system mitigate COVID transmission?
2. What role does filtration within a ventilation system play in reducing COVID transmission? For rooms without ventilation systems, do portable HEPA filter units assist in reducing COVID transmission and are there other measures that may be helpful? Are higher grade filters like MERV 13 better than lower grade filters in reducing COVID transmission?
3. What role does outdoor air exchange within a ventilation system play in reducing COVID transmission? Does public health use CO2 levels to determine risk of COVID transmission in indoor environments?
4. Evolving technologies (UV-C light, negative ionizers, etc.) claim to reduce transmission of COVID – any thoughts on this?
5. Do you know of effective ventilation system mitigation strategies that can be implemented in the short-term to reduce COVID transmission? Are there some better long-term solutions to reduce COVID transmission?
6. Do you have ventilation recommendations specific to increasing occupant engagement, mental health and wellness, and learning capacity?
7. Are you aware of evidence/documents this panel should consider reviewing when considering the above topics?

FW: Ventilation Technical Advisory Panel Meeting - Ministry of Education

From: Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To: Graham, Megan 1 EDUC:EX <Megan.1.Graham@gov.bc.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Docking, Christie M EDUC:EX <Christie.Docking@gov.bc.ca>
Sent: February 7, 2022 4:18:04 PM PST
Attachments: image001.jpg

FYI – Excellent news! Dr. Ariella Zbar will attend Friday's VTAP meeting.

From: Zbar, Ariella [FH] <ariella.zbar@fraserhealth.ca>
Sent: February 7, 2022 3:40 PM
To: Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
Subject: RE: Ventilation Technical Advisory Panel Meeting - Ministry of Education

[EXTERNAL] This email came from an external source. Only open attachments or links that you are expecting from a known sender.

Thanks Damien.

These questions are very helpful and I think they answer my questions brought forward in the email. I'll change my attendance to "accept".

-Ariella

From: Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
Sent: Monday, February 07, 2022 3:28 PM
To: Zbar, Ariella [FH] <ariella.zbar@fraserhealth.ca>
Cc: Docking, Christie M EDUC:EX <Christie.Docking@gov.bc.ca>; Graham, Megan 1 EDUC:EX <Megan.1.Graham@gov.bc.ca>; Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>; Choi, Alexandra [VA] <alexandra.choi1@vch.ca>; Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>
Subject: Ventilation Technical Advisory Panel Meeting - Ministry of Education

EXTERNAL SENDER. If you suspect this message is malicious, please forward to spam@phsa.ca and **do not** open attachments or click on links.

Hello Dr. Ariella Zbar,

We have our next Ventilation Technical Advisory Panel for Schools meeting this Friday (Feb 11th) from 11am-noon. Attendees include representatives (staff) from the Ministry of Education (school capital funding group), School Districts (mainly facilities management leaders) and a school HVAC specialist (mechanical engineer). Typically, these meetings are held every few weeks and it is a group of about 10 people. I understand that you have tentatively accepted the meeting on Friday and just wondering if you will be able to make it?

Attached are several questions related to ventilation/COVID 19 that the panel members have identified - some are for the school HVAC specialist, and you may also have helpful input on some of them. I could setup a pre-meet with you earlier this week if you wanted to gain a better understanding of the Ventilation Technical Advisory Panel for Schools or discuss some of the questions in advance of the meeting? If so, feel free to suggest a time that works best for you.

Please contact me if you have any questions.

Thank you,

Damien

Damien Crowell | A/Director | Minor Capital Programs & Finance Unit | Ministry of Education
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca

Ventilation Technical Advisory Panel - Meeting Documents

From:	Graham, Megan 1 EDUC:EX <Megan.1.Graham@gov.bc.ca>
To:	Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, alexandra.choi@vch.ca, ariella.zbar@fraserhealth.ca, Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Patti Dundas <dundas_p@surreyschools.ca>, cmorris@sd61.bc.ca, coreilly@vsb.bc.ca, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>, bob.beukers@abbyschools.ca, josh.currie@sd23.bc.ca <'josh.currie@sd23.bc.ca'>, stephen@smcn.ca, shawn@fisabc.ca, Sheppard, Grant EDUC:EX <Grant.Sheppard@gov.bc.ca>, tberger@abbotsfordchristian.com <'tberger@abbotsfordchristian.com'>, King, Aimee EDUC:EX <Aimee.King@gov.bc.ca>
Sent:	February 8, 2022 10:02:33 AM PST
Attachments:	HVAC Technical Advisory Panel Terms of Reference - February 2022.pdf, 1.0 VTAP Meeting Agenda - February 2022 Final.pdf, 2.0 Minutes for Meeting #02 - January 14, 2022.pdf

Good morning all,

Please find attached the agenda for the upcoming Ventilation Technical Advisory Panel Meeting on Friday, February 11 at 11:00am. Also, attached is the updated Terms of Reference document (only change is the addition of a few members), as well as the meeting minutes from our last meeting in January.

We look forward to seeing you on Friday. Please feel free to forward any questions to me beforehand, and I will be happy to answer them.

Warmly,

Megan Graham | A/ Planning Analyst
Minor Capital Programs & Finance Unit
Ministry of Education
Phone: (250) 208-0732

VENTILATION TECHNICAL ADVISORY PANEL

TERMS OF REFERENCE – FINAL

Updated – February 1, 2022

BRITISH COLUMBIA | Ministry of Education

Background

In the context of the COVID-19 pandemic, the Ministry of Education has been working with school districts to identify opportunities to enhance school ventilation systems in public schools as part of overall strategies to promote health and safety in schools.

A Ventilation Technical Advisory Panel (the Advisory Panel) is being established to take stock of the information that has been collected to date, share information on best practices and provide guidance on additional mitigations that may be utilized in different contexts, as appropriate.

Purpose

The primary purpose of the Advisory Panel is to advise the Ministry and school districts on ventilation enhancements relating to public health goals, including COVID-19, with a view to broader shared objectives relating to supporting student success and climate preparedness and adaptation, among other priorities.

The Advisory Panel will share advice and recommendations on ventilation systems, strategies, and best practices with BCASBO members, through the BCASBO Executive. Recommendations will be in alignment with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Reopening of Schools and Universities Guidelines to enhance indoor air quality and address the risk of virus transmission. The panel will consider K-12 Health and Safety guidelines, a range of emerging practices and technologies, current mechanical systems employed by the sector and budget constraints.

Responsibilities

The Advisory Panel will provide the following:

1. Ventilation and air circulation best practices:
    a) Additional guidance on how to effectively operate ventilation systems to reduce the risk of viral transmission.
    b) Recommendations on cost-effective equipment and/or materials to support ventilation and air circulation best practices.
    c) Advice on staff training and development to support ventilation recommendations.
    d) Identification of key performance indicators to evaluate effective ventilation strategies that will promote a safe and healthy environment for learning.

2. Ongoing advice to districts on opportunities or priorities for value-added equipment or product procurements.

Advisory Panel deliberations will be guided by ASHRAE Reopening of Schools and Universities Guidelines. Discussions may result in additional sources of

best practices.

Advisory Panel Operations

The Ministry of Education will provide a Co-chair and assist with coordinating meetings, developing meeting agendas, and documenting decisions.

BCASBO is to nominate a Secretary Treasurer as Advisory Panel Co-chair.

Representation

The Advisory Panel will include representation from the Ministry, the sector along with industry technical experts. The Ministry will provide technical expertise to the Advisory Panel in the form of a contracted mechanical engineer with expertise in institutional mechanical ventilation systems.

Six representatives from the Ministry of Education:

- Francois Bertrand, Executive Director, Capital Management
- Damien Crowell, A/Director, Capital Management
- Ravnit Aujla, A/Regional Director, Capital Management
- Grant Sheppard, Director, Independent Schools, Governance and Analytics
- Aimee King, Branch Coordinator, Resource Management
- Megan Graham, Planning Analyst, Capital Management

One representative from BCASBO:

- Patti Dundas, Past President and Assistant Secretary-Treasurer, SD36

One representative from EFMA:

- Chuck Morris, President and Director of Facility Services, SD61

One representative from the School Safety Association of BC:

- Colette O'Reilly, Director, SD39

Three additional representatives from the sector:

- Steve Hopkins, Secretary-Treasurer, SD47
- Bob Beukers, Manager of Electrical & Mechanical, SD34
- Josh Currie, Assistant Director of Operations, SD23

One representative from Federation of Independent Schools (FISA) BC:

- Shawn Chrisholm, Executive Director

One technical expert:

- SMcN Consulting Inc.

Ad Hoc Members:

- Health Representative, Dr. Ariella Zbar or other

- WorkSafeBC Representative, TBD

Timelines

The Advisory Panel is expected to meet bi-weekly at first, switching to monthly as appropriate. A decision will be made by April 2022 on whether to extend the Advisory Panel timeline further, and the duration of any extension.

Deliverables

Deliverables will include:

- Identify features of effective ventilation systems and practices, within a COVID mitigation context.
- Guidance on cost-effective mitigations that may be applied in different contexts, to reduce the risk of viral transmission.
- Recommendations on ongoing investments to promote health and safety, with consideration for student success and climate preparedness and adaptation.

Communication

Throughout their work, Advisory Panel representatives may canvas organization members and other K-12 and health sector contacts to identify best practices that should be considered in their Advisory Panel discussions. Advisory Panel members will provide updates to their organizations, as needed.

Ventilation Technical Advisory Panel Agenda

Meeting #03
2/11/2022
11:00am –12:00pm
Location: Zoom Video Conference Call

Members:	Francois Bertrand, Damien Crowell, Ravnit Aujla, Megan Graham, Aimee King, Patti Dundas, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls, Grant Sheppard, Shawn Chisholm
Guests:	Dr. Ariella Zbar
Regrets:	N/A

TIME	TOPIC		LEAD
11:00am – 11:10am	**1.0 Meeting Agenda & Introductions**	Information	Francois Bertrand
11:10 – 11:15am	**2.0 Updated Terms of Reference Review**	Information	Damien Crowell
11:15am – 11:25am	**3.0 HVAC Consultant Overview of Ventilation System**	Information	Stephen McNicholls
11:25am – 11:50am	**4.0 Health's & HVAC Specialist Perspective**	Information	Dr. Ariella Zbar / Stephen McNicholls
11:50am – 11:55am	**5.0 Roundtable and/or Questions**	Information	All
11:55am –12:00pm	**6.0 Wrap up/Items for Future Meetings**	Information	Francois Bertrand

Next Meeting: TBD

CONFIDENTIAL

Ventilation Technical Advisory Panel
Minutes – Meeting #02

Date: Friday – January 14, 2022
Time: 9:00am to 10:00am
Location: Video Conference Call
Members: Francois Bertrand, Damien Crowell, Ravnit Aujla, Patti Dundas, Chuck Morris, Collette O'Reilly, Bob Beukers, Josh Currie, Stephen McNicholls, Grant Sheppard

Guests: N/A

Regrets Steve Hopkins

Agenda Item	Discussion/Action items
1. Meeting Agenda	• Agenda was circulated in advance of the meeting and no concerns were raised. • Grant Sheppard, Director, Independent Schools from the Ministry will attend Ventilation Technical Advisory Panel meetings.
2. Funds for Ventilation	• Federal funding announced in December and dedicated to ventilation is expected to be distributed to public school districts and independent schools shortly. • The Ministry has identified deployment of portable HEPA filters in occupied classrooms and portables that currently have no access to mechanical ventilation as the top priority for this funding. • Some concerns were raised about the effectiveness of portable HEPA filters. • The Ministry doesn't view HEPA filters as a permanent solution but a temporary measure that can assist with air purification and provide comfort to stakeholders.
3. HEPA Filter & Increased Outdoor Air Supply Experience	• A number of school districts including Abbotsford and Kelowna have purchased portable HEPA filter units. • Jade HEPA filters units that Abbotsford and Kelowna have been installed and operated for a number of months and no significant issues raised by stakeholders at this point.

	• Utility costs as a result of increased outdoor air supply have increased significantly and it is a challenge for school districts. • The HVAC consultant highlighted that HVAC systems need to be viewed holistically and that outdoor air supply and proper functioning controls are key aspects of these systems. • There are some concerns that MERV-13 filters and portable HEPA filters may be seen by some stakeholders and public as the main solution to reducing potential virus transmission and that is not the case.
4. Roundtable	• Ministry is currently trying to find a representative from Health to join the Ventilation Technical Advisory Panel.
5. Wrap-up/Items for Future Meetings	• Meeting #03, TBD • Items for future meetings: Update from Health representative ○ Time: TBD • Location: Video Conference Call
6. Adjournment	• Meeting adjourned at 9:45am

VTAP Draft Meeting Minutes - February 2022

From:	Graham, Megan 1 EDUC:EX <Megan.Graham@gov.bc.ca>
To:	Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>, King, Aimee EDUC:EX <Aimee.King@gov.bc.ca>, Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Zbar, Ariella [FH] <ariella.zbar@fraserhealth.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Patti Dundas <dundas_p@surreyschools.ca>, cmorris@sd61.bc.ca, coreilly@vsb.bc.ca, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>, bob.beukers@abbyschools.ca, josh.currie@sd23.bc.ca, stephen@smcn.ca, shawn@fisabc.ca, Sheppard, Grant EDUC:EX <Grant.Sheppard@gov.bc.ca>, tberger@abbotsfordchristian.com, michael.schwandt@vch.ca, XT:HLTH Taki, Richard <Richard.Taki@vch.ca>, emily.peterson@vch.ca
Sent:	February 14, 2022 11:28:56 AM PST
Attachments:	2.0 Minutes for Meeting #03 - February 11, 2022.docx

Hi all,

Please find draft minutes from Friday's Ventilation Technical Advisory Panel (VTAP) Meeting attached for your review. Please feel free to contact me with any questions or concerns, and I will be happy to address them.

Best,

Megan Graham | A/ Planning Analyst
Minor Capital Programs & Finance Unit
Ministry of Education
Phone: (250) 208-0732

RE: VTAP Draft Meeting Minutes - February 2022

From: Stephen McNicholls <stephen@smcn.ca>
To: Graham, Megan 1 EDUC:EX <Megan.Graham@gov.bc.ca>, Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>, King, Aimee EDUC:EX <Aimee.King@gov.bc.ca>, Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Zbar, Ariella [FH] <ariella.zbar@fraserhealth.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Patti Dundas <dundas_p@surreyschools.ca>, cmorris@sd61.bc.ca, coreilly@vsb.bc.ca, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>, bob.beukers@abbyschools.ca, josh.currie@sd23.bc.ca, shawn@fisabc.ca, Sheppard, Grant EDUC:EX <Grant.Sheppard@gov.bc.ca>, tberger@abbotsfordchristian.com, michael.schwandt@vch.ca, XT:HLTH Taki, Richard <Richard.Taki@vch.ca>, emily.peterson@vch.ca
Sent: February 15, 2022 9:03:53 AM PST
Attachments: image001.png

[EXTERNAL] This email came from an external source. Only open attachments or links that you are expecting from a known sender.

Good morning all – I suggest a minor wording changes for Item #3, as follows:

There is a clause “Concerns raised about noise of filters, which may negatively impact the learning environment”
I suggest revising filters to say “self contained, fan powered, HEPA filtration units”

Stephen McNicholls, P.Eng., LEED AP
SMcN Consulting Inc.
cell: 250-616-3232
stephen@smcn.ca

From: Graham, Megan 1 EDUC:EX <Megan.Graham@gov.bc.ca>
Sent: February 14, 2022 11:29 AM
To: Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>; King, Aimee EDUC:EX <Aimee.King@gov.bc.ca>; Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>; Zbar, Ariella [FH] <ariella.zbar@fraserhealth.ca>; Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>; 'Patti Dundas' <dundas_p@surreyschools.ca>; cmorris@sd61.bc.ca; coreilly@vsb.bc.ca; XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>; bob.beukers@abbyschools.ca; josh.currie@sd23.bc.ca; Stephen McNicholls <stephen@smcn.ca>; shawn@fisabc.ca; Sheppard, Grant EDUC:EX <Grant.Sheppard@gov.bc.ca>; tberger@abbotsfordchristian.com; michael.schwandt@vch.ca; XT:HLTH Taki, Richard <Richard.Taki@vch.ca>; emily.peterson@vch.ca
Subject: VTAP Draft Meeting Minutes - February 2022

[Caution: External Sender] This email originated from outside of the organization. Do not click links, open attachments, or reply unless you recognize the sender and know the content is safe.

Hi all,

Please find draft minutes from Friday’s Ventilation Technical Advisory Panel (VTAP) Meeting attached for your review. Please feel free to contact me with any questions or concerns, and I will be happy to address them.

Best,

Megan Graham | A/ Planning Analyst
Minor Capital Programs & Finance Unit
Ministry of Education
Phone: (250) 208-0732

Preliminary Report #3 on Ventilation Activities
As of February 18, 2022

GENERAL OVERVIEW:

Federal Ventilation Funds Update:

- EDUC staff reached out to 56 of the school districts to gain a better understanding of how the federal ventilation funds will be spent.
- Most districts have determined how they are using the funds, while some are still in the process.
- As the table below indicates, a significant proportion of the funds are going towards standalone HEPA filtration units, which should be sufficient to address all occupied classrooms (including portables) in the province without mechanical ventilation systems.
- The 56 school districts surveyed committed to purchasing 1,687 portable HEPA filtration units and over 60% of the units have already been installed.
- Of the 56 school districts surveyed, less than 5% of these classrooms currently don't have mechanical ventilation systems.
- Funds are also being used to purchase MERV filters, update HVAC system controls and cover increased utility cost associated with greater outdoor air circulation in schools which align with HVAC consultant recommendations and eligible use of funds.
- Detailed reporting from school districts on the use of the funds will follow, but it is too early at this point given that many school districts are still determining how to use the funds.
- See Table 1 for further details on use of federal funds.

School District Ventilation Reporting & BCTF Comments:

- BCTF had comments on school ventilation reporting for 29 school districts and EDUC staff have followed up with all 29 school districts regarding these concerns.
- EDUC staff have reviewed the 500+ school ventilation reports that are on school district websites against comments provided by the BCTF.
- Many school districts have updated their school ventilation reports to address the comments, but 6 are still in the process.
- Detailed information regarding the status of addressing BCTF comments by each school district is included in Table 2.
- EDUC staff will review and report on school ventilation reports of the 31 remaining school districts over the coming weeks.

Ventilation Technical Advisory Panel Update:

- The primary purpose of the Ventilation Technical Advisory Panel is to advise EDUC and school districts on ventilation enhancements relating to public health goals, including mitigation of COVID-19, with a view to broader shared objectives relating to supporting student success and climate preparedness and adaptation.
- A Ventilation Technical Advisory Panel meeting took place on Friday, February 11.
- Attendees included select school districts, independent school representatives, EDUC's contracted HVAC expert, Medical Health Officers Dr. Ariella Zbar from Fraser Health and Dr. Michael Schwandt from Vancouver Coastal Health, and EDUC staff.
- The focus for this meeting was to better understand the role filtration and outdoor air supply play in promoting indoor air quality, and to gain insight on the recent science and data on transmission of COVD-19 within schools, with a focus on ventilation as a vector of transmission, including the role HEPA filter units in promoting safe learning environments.
- A list of questions addressed by the medical experts and HVAC specialist can be found in Appendix A.

- A presentation slide from the HVAC Specialist which focuses on the role of filtration and outdoor air supply as it relates to indoor air quality can be found in Appendix B.

Table 1: DETAILED REPORT ON FEDERAL VENTILATION FUNDS

School District	Status and Next Steps
SD 5 Southeast Kootenay	- Classrooms without mechanical ventilation: 0 - Funds used for 91 HEPA filter units that are delivered and will be installed by end of February.
SD 6 Rocky Mountain	- Classrooms without mechanical ventilation: 0 - Funds potentially used towards air handling units and HEPA filter units in common areas
SD 8 Kootenay Lake	- Classrooms without mechanical ventilation: 2 - HEPA filter units were previously installed in 2 classrooms - Funds will used to upgrade existing ventilation systems
SD 10 Arrow Lakes	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 19 Revelstoke	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 20 Kootenay-Columbia	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade existing ventilation systems
SD 22 Vernon	- Classrooms without mechanical ventilation: 0 - Funds potentially used for utility costs and ionization technology
SD 23 Central Okanagan	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs, filters and system controls
SD 27 Cariboo-Chilcotin	- Classrooms without mechanical ventilation: TBC - Funds used towards 38 HEPA filter units and filters - HEPA filters expected to be delivered mid-February and installed shortly after received
SD 28 Quesnel	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will be used for HEPA filter units and replacing rooftop ventilation units
SD 33 Chilliwack	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs and filter upgrades
SD 34 Abbotsford	- Classrooms without mechanical ventilation: 50 - HEPA filters were installed in classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for filters and system calibration
SD35 Langley	- Classrooms without mechanical ventilation: 0 - Funds will be used for systems controls, filters, and duct cleaning
SD 36 Surrey	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade ventilation systems
SD 37 Delta	- Classrooms without mechanical ventilation: 30 (including 16 portables) - HEPA filters were installed in 14 classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for 16 HEPA filter units, system controls and rooftop ventilation units - HEPA filter units already installed
SD 38 Richmond	- Classrooms without mechanical ventilation: 186 - Funds used for 293 HEPA filter units - HEPA filter units already installed

SD 39 Vancouver	- Classrooms without mechanical ventilation: 20 – 30 (all portables) - Funds will be used for 20-30 HEPA filter units and ventilation system upgrades in portables - HEPA filter units to be installed by early March
SD 40 New Westminster	- Classrooms without mechanical ventilation: 64 (including 40 portables) - Funds used for 64 HEPA filter units and remaining funds if any will be used for ventilation upgrades - HEPA filter units already installed
SD 41 Burnaby	- Classrooms without mechanical ventilation: 280 - Funds used for 350 HEPA filter units - HEPA filter units already installed
SD 42 Maple Ridge - Pitt Meadows	- Classrooms without mechanical ventilation: 25 (all portables) - Funds used for 26 HEPA filter units, filters, system controls and utility costs - 10 of the HEPA filter units have been installed with rest to be installed later in February
SD 43 Coquitlam	- Classrooms without mechanical ventilation: 11 classrooms in schools and all portables - Funds used for 235 HEPA filter units and if there are any remaining funds it is for minor ventilation system upgrades - HEPA filter units have arrived and over 100 have been installed with remaining ones to be installed next week
SD 44 North Vancouver	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation upgrades, filters and utility costs
SD 45 West Vancouver	- Classrooms without mechanical ventilation: 44 - Funds will be used for 44 HEPA filters already installed, remaining funds TBC
SD 46 Sunshine Coast	- Classrooms without mechanical ventilation: 0 - Funds to be used for ventilation upgrades
SD 47 Powell River	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase HEPA filter units, 3 units ordered to date
SD 48 Sea to Sky	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation system upgrades and utility costs
SD 49 Central Coast	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will potentially be used for HEPA filter units and ventilation system upgrades
SD 50 Haida Gwaii	- Classrooms without mechanical ventilation: 0 - Funds will be used towards HEPA filter units and ventilation system upgrades - SD has ordered 5 HEPA filters, delivery date TBC
SD 51 Boundary	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase 2 HEPA filter units, filters, ventilation system upgrades and any remaining funds for utility costs
SD 52 Prince Rupert	- Classrooms without mechanical ventilation: 0 - Funds used for 13 HEPA filter units and increased utility costs - 13 HEPA filter units have already been installed
SD 53 Okanagan Similkameen	- Classrooms without mechanical ventilation: 0 - Funds used for utility costs, filters and potentially HEPA filter units
SD 54 Bulkley Valley	- Classrooms without mechanical ventilation: approx. 6 classrooms and 4 portables. Only one is a full-time classroom. - Funds used to purchase 12 HEPA filter units and filters - All HEPA filter units delivered - 3 already installed and rest to be installed in the week of February 14.

SD 57 Prince George	- Classrooms without mechanical ventilation: 0 - Funds used for 120 HEPA filter units and filters - HEPA filter units have been ordered and installation expected in late Feb when units arrive
SD58 Nicola-Similkameen	- Classrooms without mechanical ventilation: 0 - Consulting mechanical engineer to determine how to spend the funds
SD 59 Peace River South	- Classrooms without mechanical ventilation: 4 portables and an annex - Funds will be used to purchase 120 HEPA filter units and filters - Units are expected to be delivered late February and installed as soon as possible.
SD 60 Peace River North	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase MERV-13 filters and remaining funds TBC
SD 61 Greater Victoria	- Classrooms without mechanical ventilation: School district staff are reviewing and TBC - Funds to be used for HEPA filter units in occupied classrooms without mechanical ventilation and ventilation upgrades
SD 62 Sooke	- Classrooms without mechanical ventilation: less than 10 - Funds used for 10 HEPA filter units, filters, and duct cleaning - HEPA filter units have been ordered and installation expected in February when units arrive.
SD 63 Saanich	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs
SD 67 Okanagan Skaha	- Classrooms without mechanical ventilation: 0 - Funds will be used towards upgrading ventilation systems
SD 68 Nanaimo-Ladysmith	- Classrooms without mechanical ventilation: 12 - HEPA filters were previously installed in classrooms without mechanical ventilation - Funds used for heat pumps and filters
SD 69 Qualicum	- Classrooms without mechanical ventilation: 0 - Funds will be used for duct cleaning
SD70 Pacific Rim	- Classrooms without mechanical ventilation: 7 (portables) - Funds used for 7 HEPA filter units, filters, duct cleaning and utility costs - HEPA filter units have been ordered and installation expected in late Feb when units arrive
SD71 Comox Valley	- Classrooms without mechanical ventilation: 0 - Funds used for 150 HEPA filter units and filters - HEPA filter units already installed
SD72 Campbell River	- Classrooms without mechanical ventilation: 22 - Funds used for 63 HEPA filter units and ventilation upgrades - HEPA filter units already installed
SD 73 Kamloops-Thompson	- Classrooms without mechanical ventilation: 0 - Funds will be used for system controls, filters and utility costs
SD74 Gold Trail	- Classrooms without mechanical ventilation: 0 - Funds will be used for 12 HEPA filter units, filters, and ventilation in portables - 12 HEPA filter units to be delivered by end of February.
SD 75 Mission	- Classrooms without mechanical ventilation: 0 - Funds will be used towards purchasing 15-18 HEPA filter units for all portables, ventilation upgrades and purchasing filters - HEPA filter units to be order within the next week, expected to arrive mid-March

SD 78 Fraser Cascade	- Classrooms without mechanical ventilation: 0 - Funds will be used for upgrading ventilation systems
SD 79 Cowichan Valley	- Classrooms without mechanical ventilation: 9 - Funds used for 25 HEPA filter units and ventilation system upgrades - Delivery of HEPA filters TBC
SD 83 North Okanagan-Shuswap	- Classrooms without mechanical ventilation: approx. 6 - Funds will be used for 100 HEPA filter units - All units have been delivered and will be installed by mid-March
SD 84 Vancouver Island West	- Classrooms without mechanical ventilation: 2 - Funds will be used for 2 HEPA filter units and ventilation system upgrades - Units have been ordered and will be installed by end of March
SD 85 Vancouver Island North	- Classrooms without mechanical ventilation: 6 including 1 portable - Funds will be used for 9 HEPA filter units and potentially ventilation system upgrades with remaining funds
SD 91 Nechako Lakes	- Classrooms without mechanical ventilation: 12 - Fund use TBC
SD92 Nisga'a	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters
SD 93 CSF	- Classrooms without mechanical ventilation: 50 - Funds used for 50 HEPA filter units - HEPA filter units have been shipped and installation expected mid February

Table 2: DETAILED REPORT ON SCHOOL DISTRICT VENTILATION REPORTING & BCTF COMMENTS

School District	**BCTF Comments**	**Addressed In SD Reporting (Yes/No)**	**Items Addressed/Not Addressed**
SD 05 – Southeast Kootenay*	- No information for Jaffray Elementary Junior Secondary or Fernie Secondary - Identical statement for all schools regarding engineer's recommendation of not going to MERV 13.	No - EDUC following up with school district	- Reporting doesn't have site-specific information; all schools have identical messaging. - Reporting still missing for Fernie Secondary and Jaffray Elementary Junior Secondary.
SD 06 - Rocky Mountain*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 22 – Vernon*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

SD 23 - Central Okanagan	- Increased outside air circulation in schools during winter months is not possible - Unknown filters in schools	Yes	-Reporting identifies MERV 13 filters in all schools. - Reporting identifies increased supply of outside air supply in all schools. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 28 – Quesnel*	- No specific feedback provided.	N/A	N/A
SD 33 - Chilliwack	- No site-specific information. - Unclear whether MERV-13 are in all schools.	Yes	- Reporting confirms MERV 13 in all schools.
SD 34 – Abbotsford*	No specific feedback provided.	N/A	N/A
SD 36 – Surrey*	- Unknown filters in schools	Yes	- Reporting identifies a mix of MERV 13, 10, and 8 in schools.
SD 37 – Delta*	- Increased outside air circulation in schools during winter months is not possible - Confusing statement for Delta Manor: "Air handling units include MERV 13 filters. Filters are included in unit's ventilators, but they are not MERV 13 (we focussed on increased fresh air ventilation instead of increased filtration)."	No - EDUC following up with school district	- Reporting provides confusing statement regarding Delta Manor has not yet been addressed. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting states school district has MERV 13 filters in gyms and MERV 10 filters in some schools. Other schools have MERV 10 filters throughout, and some have MERV 13 throughout
SD 38 – Richmond*	- No specific feedback provided.	N/A	N/A
SD 43 – Coquitlam*	- "(Fresh air supply) increased to 100% throughout summer season. Scaled it back in Oct 11th week, due to cold weather." Unclear what other mitigations are replacing the fresh air supply.	Yes	- Reporting identifies mitigation strategies to increase outdoor air supply. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 44 – North Vancouver*	- "All ventilation systems have been programmed district-wide to utilize the maximum amount of outdoor air possible. This would mean that most systems are providing 100% outdoor air." Not feasible year-round. Other mitigations unclear.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting identifies schools using MERV 13, some MERV 10.

	- Unknown filters in schools		
SD 48 – Sea to Sky	- "MERV – 13 filters installed in all air-handling units in all schools": Does this mean all schools have MERV 13 filters in place? - "Portable Dyson HEPA Air Scrubbers – to be deployed where required": Since the forms are specific to individual schools it should be listed the schools that have them and the number. - Unknown filters in schools	Yes	- Reporting identifies MERV 13s in all schools, and addresses where HEPA filters are used.
SD 49 – Central Coast*	- Wuikinux Elementary School: The school does not have HVAC system. Wuikinux Nation is responsible for heating system maintenance according to Local Education Agreement (LEA). No information provided including inspection dates. - Shearwater Elementary: "The school does not have HVAC system. Oil furnace is in place for heating". No dates for inspections—they happen daily. "Furnace and heat pump upgrade in progress": More information should be available.	No - EDUC following up with school district	- No update from SD and no further information available on SD website.
SD 51 – Boundary	- Currently using MERV 8 and are working on upgrading to a higher MERV value: This information may need to be updated.	Yes	- Reporting confirms filters in all schools are MERV 13 or in process of being upgraded to MERV 13 from MERV 11.
SD 52 – Prince Rupert*	- Unknown filters in schools	Yes	- Reporting identifies the use of MERV 8 in all schools.
SD 54 Bulkley Valley*	- Increased outside air circulation in schools during winter months is not possible - MERV 8 filters in all but 2 schools	Yes	- Reporting identifies upgrades to MERV 13 filters in renovated areas, with MERV 8 found in remaining spaces. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

SD 57 Prince George*	- Same mitigations in all schools: Providing the maximum amount of outside air to improve ventilation. (Not feasible year-round.)	Yes	- Reporting identifies use of MERV 8 filters in all schools, except Kelly Road Secondary (MERV 13). - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD58 - Nicola-Similkameen*	- Information same for all schools. Were MERV 13's installed in any schools?	Yes	- Reporting identifies that no MERV 13 filters have yet been installed; school district in process of assessing suitability of MERV 13 in schools.
SD61 – Greater Victoria*	- No specific feedback provided.	N/A	N/A
SD62 – Sooke*	- Inspection reports only identify the year and month.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD70 – Pacific Rim*	- Inspections only identified by seasons. - Information is the same for all schools and is not site specific.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD71 – Comox Valley*	- "The majority of HVAC filters are MERV10. Where the HVAC unit is engineered to accept MERV-13 filters they are installed. Approximately five percent of HVAC units in schools can accept this size and grade of filter." General statement for all schools not site-specific. The schools included in the 'approximately' 5% are not identified.	No - EDUC following up with school district	- Reporting pertaining to site-specific ventilation is not provided, and which schools can accommodate MERV 13 filters is not identified.
SD72 – Campbell River	- Combination of MERV-10 and 13. It's the same statement for all schools with the % changing depending on the school. Timelines are unclear: "Direction received to replace MERV-10 filters with MERV-13 as existing stock is used. 25% complete." - "Engineering study required to quantify effectiveness of other technologies that might be feasible for ventilation system": Unclear whether this is in progress.	Yes	- Reporting confirms that all conversions from MERV 10s to MERV 13s is complete. - Reporting suggests that engineering study to assess effectiveness of other technologies for ventilation is not yet underway.

SD81 – Fort Nelson*	- Main mitigation used is windows that open. Not all rooms in all schools have windows that open. Also indicates increase air flow depending on ambient temperature. This is not feasible as a mitigation in Fort Nelson year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD82 – Coast Mountains*	- Increase outside air intake for more fresh air and air exchanges. Extend HVAC running schedule (to exchange air prior to occupancy). This is the only mitigation in all schools. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD83 – North Okanagan-Shuswap*	- "Variable 15% – 100% fresh air supplied to the classrooms based on the CO2 levels. Windows can be opened for more fresh air as needed during the day": Same mitigations for all schools. No site-specific information included. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD85 – Vancouver Island North*	- Unknown filters in schools - "MERV13 Filters installed everywhere they are where compatible with existing equipment" No site specific information. - Missing some inspection dates. - Outside air intake appears to be the only mitigation. - Cheslakee's Elementary: Units have outside air intakes, but some are stuck in manual. Unclear whether this has been repaired.	No - EDUC following up with school district	- No reporting update from SD and no further information available on SD website.
SD91 – Nechako Lakes*	- "There has been up to a 75% increase in the volume of outside air relative to the ASHRAE minimum" Only mitigation.	No - EDUC following up with school district	- No reporting to address further mitigation strategies.

*Due to HVAC infrastructure compatibility issues, not all school districts are able to accommodate MERV 13 filters in all their schools but other mitigation measures such as increased outdoor air supply are being utilized to improve indoor air quality.

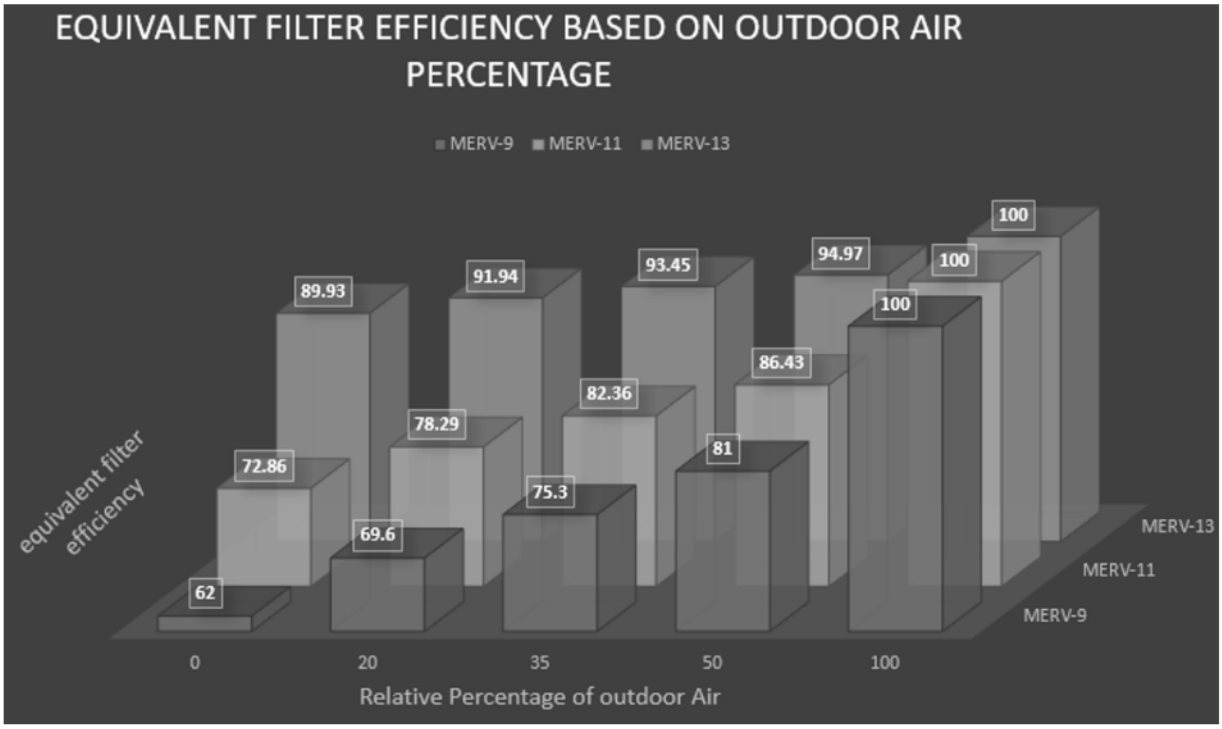
Appendix A: Questions and Answers: Health and HVAC Expert Perspective

1. **What is the general risk of COVID transmission within schools? Are there concerns about ventilation systems in relation to COVID transmission in schools? How does a ventilation system mitigate COVID transmission?**
    - Data suggests relatively low transmission and risk in schools.
        i. While Omicron variant is more transmissible than previous variants, transmission remains low in school settings.
    - Answer to latter aspect of this question is captured in Question 2.
2. **What role does filtration within a ventilation system play in reducing COVID transmission? For rooms without ventilation systems or rooms that are under ventilated but have ventilation systems, do portable HEPA filter units assist in reducing COVID transmission and are there other measures that may be helpful? Are higher grade filters like MERV 13 better than lower grade filters in reducing COVID transmission?**
    - Impact of ventilation on COVID-19 viral transmission is not to be overstated. Some schools may benefit, but biggest impact will be addressing issues in small, unventilated rooms in older buildings. This may have a small 'incremental' improvement in decreasing transmission of COVID-19.
        i. Recommended approach by medical experts is a targeted strategy: identifying problematic rooms/spaces and addressing them.
3. **What role does outdoor air exchange within a ventilation system play in reducing COVID transmission? Do public health use CO2 levels to determine risk of COVID transmission in indoor environments?**
    - Emphasis remains on outdoor air exchange in reducing COVID-19 transmission, though ventilation systems should be looked at holistically including both outdoor air exchange and filtration.
    - Finer filters would have the most benefit to the indoor air quality when outside air is poor (wildfires, heavy pollution, etc.)
4. **Evolving technologies (UV-C light, negative ionizers, etc.) claim to reduce transmission of COVID – any thoughts on this?**
    - Currently, there is not widespread support for emerging technologies (e.g., UV-C light, negative ionizers, etc.) given limited testing and potential adverse impacts.
5. **Do you know of effective ventilation system mitigation strategies that can be implemented in the short-term to reduce COVID transmission? Are there some better long-term solutions to reduce COVID transmission?**
    - The nuance and complexity of the impact of ventilation systems in relation to COVID-19 transmission was emphasized, therefore no universal recommendation is made. Focus on targeted approach reiterated (addressing small, unventilated spaces).
6. **Do you have ventilation recommendations specific to increasing occupant engagement, mental health and wellness, and learning capacity?**
    - While improved ventilation may have marginal benefit for reducing COVID-19 transmission, it is also important to focus on broader long-term benefits of overall air-quality especially in reference to issues beyond COVID-19: climate change; pollution; wildfire smoke.

- Concerns raised about noise of self contained, fan powered, HEPA filtration units which may negatively impact the learning environment.

7. **Are you aware of evidence/documents this panel should consider reviewing when considering the above topics?**
   - Research literature provided by health experts for panel members to review.
     i. EPA - Creating Healthy Indoor Air Quality in Schools
     ii. BCCDC - COVID-19 and indoor air: Risk mitigating measures and future-proofing

Appendix B: Equivalent Filter Efficiency at Removing Virus Size Particles Based on Outdoor Air Percentage



Preliminary Report #4 on Ventilation Activities
As of February 24, 2022

GENERAL OVERVIEW:

Federal Ventilation Funds Update:

- EDUC staff reached out to 57 of the school districts to gain a better understanding of how the federal ventilation funds will be spent.
- Most districts have determined how they are using the funds, while some are still in the process.
- As the table below indicates, a significant proportion of the funds are going towards standalone HEPA filtration units, which should be sufficient to address all occupied classrooms (including portables) in the province without mechanical ventilation systems.
- The 57 school districts surveyed committed to purchasing 1,687 portable HEPA filtration units and over 65% of the units have already been installed.
- Of the 57 school districts surveyed, less than 5% of these classrooms currently don't have mechanical ventilation systems.
- Funds are also being used to purchase MERV filters, update HVAC system controls and cover increased utility cost associated with greater outdoor air circulation in schools which align with HVAC consultant recommendations and eligible use of funds.
- Detailed reporting from school districts on the use of the funds will follow, but it is too early at this point given that many school districts are still determining how to use the funds.
- EDUC Staff in process of reaching out to 3 remaining school districts to determine how federal ventilation funds will be spent.
- See Table 1 for further details on use of federal funds.

School District Ventilation Reporting & BCTF Comments:

- BCTF had comments on school ventilation reporting for 29 school districts and EDUC staff have followed up with all 29 school districts regarding these concerns.
- EDUC staff have reviewed the 700+ school ventilation reports that are on school district websites against comments provided by the BCTF.
- Many school districts have updated their school ventilation reports to address the comments, but 6 are still in the process.
- Detailed information regarding the status of addressing BCTF comments by each school district is included in Table 2.
- EDUC staff are in the process of reviewing school ventilation reports of the 31 remaining school districts over the coming weeks. 10 of these school districts reports were reviewed this week and are included in Table 3.

Ventilation Technical Advisory Panel Update:

- The primary purpose of the Ventilation Technical Advisory Panel is to advise EDUC and school districts on ventilation enhancements relating to public health goals, including mitigation of COVID-19, with a view to broader shared objectives relating to supporting student success and climate preparedness and adaptation.
- Members include select school districts, independent school representatives, EDUC's contracted HVAC expert and Medical Health Officers.
- Three Ventilation Technical Advisory Panel (VTAP) meetings have been held over the past few months and the next one is to be held in the coming weeks.

Preliminary Report #4 on Ventilation Activities
As of February 24, 2022

Table 1: DETAILED REPORT ON FEDERAL VENTILATION FUNDS

School District	Status and Next Steps
SD 5 Southeast Kootenay	- Classrooms without mechanical ventilation: 0 - Funds used for 91 HEPA filter units that are delivered and will be installed by end of February.
SD 6 Rocky Mountain	- Classrooms without mechanical ventilation: 0 - Funds potentially used towards air handling units and HEPA filter units in common areas
SD 8 Kootenay Lake	- Classrooms without mechanical ventilation: 2 - HEPA filter units were previously installed in 2 classrooms - Funds will used to upgrade existing ventilation systems
SD 10 Arrow Lakes	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 19 Revelstoke	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 20 Kootenay-Columbia	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade existing ventilation systems
SD 22 Vernon	- Classrooms without mechanical ventilation: 0 - Funds potentially used for utility costs and ionization technology
SD 23 Central Okanagan	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs, filters and system controls
SD 27 Cariboo-Chilcotin	- Classrooms without mechanical ventilation: TBC - Funds used towards installing 38 HEPA filter units and filters - HEPA filters units already installed
SD 28 Quesnel	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will be used for HEPA filter units and replacing rooftop ventilation units
SD 33 Chilliwack	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs and filter upgrades
SD 34 Abbotsford	- Classrooms without mechanical ventilation: 50 - HEPA filters were installed in classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for filters and system calibration
SD35 Langley	- Classrooms without mechanical ventilation: 0 - Funds will be used for systems controls, filters, and duct cleaning
SD 36 Surrey	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade ventilation systems
SD 37 Delta	- Classrooms without mechanical ventilation: 30 (including 16 portables) - HEPA filters were installed in 14 classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for 16 HEPA filter units, system controls and rooftop ventilation units - HEPA filter units already installed
SD 38 Richmond	- Classrooms without mechanical ventilation: 186 - Funds used for 293 HEPA filter units - HEPA filter units already installed

SD 39 Vancouver	- Classrooms without mechanical ventilation: 20 – 30 (all portables) - Funds will be used for 20-30 HEPA filter units and ventilation system upgrades in portables - HEPA filter units to be installed by early March
SD 40 New Westminster	- Classrooms without mechanical ventilation: 64 (including 40 portables) - Funds used for 64 HEPA filter units and remaining funds if any will be used for ventilation upgrades - HEPA filter units already installed
SD 41 Burnaby	- Classrooms without mechanical ventilation: 280 - Funds used for 350 HEPA filter units - HEPA filter units already installed
SD 42 Maple Ridge - Pitt Meadows	- Classrooms without mechanical ventilation: 25 (all portables) - Funds used for 26 HEPA filter units, filters, system controls and utility costs - HEPA filter units already installed
SD 43 Coquitlam	- Classrooms without mechanical ventilation: 11 classrooms in schools and all portables - Funds used for 235 HEPA filter units and if there are any remaining funds it is for minor ventilation system upgrades - HEPA filter units already installed
SD 44 North Vancouver	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation upgrades, filters and utility costs
SD 45 West Vancouver	- Classrooms without mechanical ventilation: 44 - Funds will be used for 44 HEPA filters already installed, remaining funds TBC
SD 46 Sunshine Coast	- Classrooms without mechanical ventilation: 0 - Funds to be used for ventilation upgrades
SD 47 Powell River	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase HEPA filter units, 3 units ordered to date
SD 48 Sea to Sky	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation system upgrades and utility costs
SD 49 Central Coast	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will potentially be used for HEPA filter units and ventilation system upgrades
SD 50 Haida Gwaii	- Classrooms without mechanical ventilation: 0 - Funds will be used towards HEPA filter units and ventilation system upgrades - SD has ordered 5 HEPA filters, delivery date TBC
SD 51 Boundary	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase 2 HEPA filter units, filters, ventilation system upgrades and any remaining funds for utility costs
SD 52 Prince Rupert	- Classrooms without mechanical ventilation: 0 - Funds used for 13 HEPA filter units and increased utility costs - 13 HEPA filter units have already been installed
SD 53 Okanagan Similkameen	- Classrooms without mechanical ventilation: 0 - Funds used for utility costs, filters and potentially HEPA filter units
SD 54 Bulkley Valley	- Classrooms without mechanical ventilation: approx. 6 classrooms and 4 portables. Only one is a full-time classroom. - Funds used to purchase 12 HEPA filter units and filters - All HEPA filter units already installed
SD 57 Prince George	- Classrooms without mechanical ventilation: 0 - Funds used for 120 HEPA filter units and filters

	- HEPA filter units have been ordered and installation expected in late Feb when units arrive
SD58 Nicola-Similkameen	- Classrooms without mechanical ventilation: 0 - Consulting mechanical engineer to determine how to spend the funds
SD 59 Peace River South	- Classrooms without mechanical ventilation: 4 portables and an annex - Funds will be used to purchase 120 HEPA filter units and filters - Units are expected to be delivered late February and installed as soon as possible.
SD 60 Peace River North	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase MERV-13 filters and remaining funds TBC
SD 61 Greater Victoria	- Classrooms without mechanical ventilation: School district staff are reviewing and TBC - Funds to be used for HEPA filter units in occupied classrooms without mechanical ventilation and ventilation upgrades
SD 62 Sooke	- Classrooms without mechanical ventilation: less than 10 - Funds used for 10 HEPA filter units, filters, and duct cleaning - HEPA filter units have been ordered and installation expected in late February when units arrive
SD 63 Saanich	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs
SD 64 – Gulf Islands	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs - Previously purchased 6 HEPA filter units which are operating in spaces without optimal ventilation
SD 67 Okanagan Skaha	- Classrooms without mechanical ventilation: 0 - Funds will be used towards upgrading ventilation systems
SD 68 Nanaimo-Ladysmith	- Classrooms without mechanical ventilation: 12 - HEPA filters were previously installed in classrooms without mechanical ventilation - Funds used for heat pumps and filters
SD 69 Qualicum	- Classrooms without mechanical ventilation: 0 - Funds will be used for duct cleaning
SD70 Pacific Rim	- Classrooms without mechanical ventilation: 7 (portables) - Funds used for 7 HEPA filter units, filters, duct cleaning and utility costs - HEPA filter units have been ordered and installation expected in late Feb when units arrive
SD71 Comox Valley	- Classrooms without mechanical ventilation: 0 - Funds used for 150 HEPA filter units and filters - HEPA filter units already installed
SD72 Campbell River	- Classrooms without mechanical ventilation: 22 - Funds used for 63 HEPA filter units and ventilation upgrades - HEPA filter units already installed
SD 73 Kamloops-Thompson	- Classrooms without mechanical ventilation: 0 - Funds will be used for system controls, filters and utility costs
SD74 Gold Trail	- Classrooms without mechanical ventilation: 0 - Funds will be used for 12 HEPA filter units, filters, and ventilation in portables - 12 HEPA filter units to be delivered by end of February
SD 75 Mission	- Classrooms without mechanical ventilation: 0

	- Funds will be used towards purchasing 15-18 HEPA filter units for all portables, ventilation upgrades and purchasing filters - HEPA filter units expected to arrive mid-March
SD 78 Fraser Cascade	- Classrooms without mechanical ventilation: 0 - Funds will be used for upgrading ventilation systems
SD 79 Cowichan Valley	- Classrooms without mechanical ventilation: 9 - Funds used for 25 HEPA filter units and ventilation system upgrades - Delivery of HEPA filters TBC
SD 83 North Okanagan-Shuswap	- Classrooms without mechanical ventilation: approx. 6 - Funds will be used for 100 HEPA filter units - All units have been delivered and will be installed by mid-March
SD 84 Vancouver Island West	- Classrooms without mechanical ventilation: 2 - Funds will be used for 2 HEPA filter units and ventilation system upgrades - Units have been ordered and will be installed by end of March
SD 85 Vancouver Island North	- Classrooms without mechanical ventilation: 6 including 1 portable - Funds will be used for 9 HEPA filter units and potentially ventilation system upgrades with remaining funds
SD 91 Nechako Lakes	- Classrooms without mechanical ventilation: 12 - Fund use TBC
SD92 Nisga'a	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters
SD 93 CSF	- Classrooms without mechanical ventilation: 50 - Funds used for 50 HEPA filter units - HEPA filter units to be installed over the next week

Table 2: DETAILED REPORT ON SCHOOL DISTRICT VENTILATION REPORTING & BCTF COMMENTS

School District	**BCTF Comments**	**Addressed In SD Reporting (Yes/No)**	**Items Addressed/Not Addressed**
SD 05 – Southeast Kootenay*	- No information for Jaffray Elementary Junior Secondary or Fernie Secondary - Identical statement for all schools regarding engineer's recommendation of not going to MERV 13.	No - EDUC following up with school district	- Reporting doesn't have site-specific information; all schools have identical messaging. - Reporting still missing for Fernie Secondary and Jaffray Elementary Junior Secondary.
SD 06 - Rocky Mountain*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 22 – Vernon*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased

			outdoor air circulation within facilities continues despite cold temperatures.
SD 23 - Central Okanagan	- Increased outside air circulation in schools during winter months is not possible - Unknown filters in schools	Yes	-Reporting identifies MERV 13 filters in all schools. - Reporting identifies increased supply of outside air supply in all schools. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 28 – Quesnel*	- No specific feedback provided.	N/A	N/A
SD 33 - Chilliwack	- No site-specific information. - Unclear whether MERV-13 are in all schools.	Yes	- Reporting confirms MERV 13 in all schools.
SD 34 – Abbotsford*	No specific feedback provided.	N/A	N/A
SD 36 – Surrey*	- Unknown filters in schools	Yes	- Reporting identifies a mix of MERV 13, 10, and 8 in schools.
SD 37 – Delta*	- Increased outside air circulation in schools during winter months is not possible - Confusing statement for Delta Manor: "Air handling units include MERV 13 filters. Filters are included in unit's ventilators, but they are not MERV 13 (we focussed on increased fresh air ventilation instead of increased filtration)."	No - EDUC following up with school district	- Reporting provides confusing statement regarding Delta Manor has not yet been addressed. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting states school district has MERV 13 filters in gyms and MERV 10 filters in some schools. Other schools have MERV 10 filters throughout, and some have MERV 13 throughout
SD 38 – Richmond*	- No specific feedback provided.	N/A	N/A
SD 43 – Coquitlam*	- "(Fresh air supply) increased to 100% throughout summer season. Scaled it back in Oct 11th week, due to cold weather." Unclear what other mitigations are replacing the fresh air supply.	Yes	- Reporting identifies mitigation strategies to increase outdoor air supply. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 44 – North Vancouver*	- "All ventilation systems have been programmed district-wide to utilize the maximum amount of outdoor air possible. This would mean that most systems are providing 100% outdoor	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

	air." Not feasible year-round. Other mitigations unclear. - Unknown filters in schools		- Reporting identifies schools using MERV 13, some MERV 10.
SD 48 – Sea to Sky	- "MERV – 13 filters installed in all air-handling units in all schools": Does this mean all schools have MERV 13 filters in place? - "Portable Dyson HEPA Air Scrubbers – to be deployed where required": Since the forms are specific to individual schools it should be listed the schools that have them and the number. - Unknown filters in schools	Yes	- Reporting identifies MERV 13s in all schools, and addresses where HEPA filters are used.
SD 49 – Central Coast*	- Wuikinux Elementary School: The school does not have HVAC system. Wuikinux Nation is responsible for heating system maintenance according to Local Education Agreement (LEA). No information provided including inspection dates. - Shearwater Elementary: "The school does not have HVAC system. Oil furnace is in place for heating". No dates for inspections—they happen daily. "Furnace and heat pump upgrade in progress": More information should be available.	No - EDUC following up with school district	- No update from SD and no further information available on SD website.
SD 51 – Boundary	- Currently using MERV 8 and are working on upgrading to a higher MERV value: This information may need to be updated.	Yes	- Reporting confirms filters in all schools are MERV 13 or in process of being upgraded to MERV 13 from MERV 11.
SD 52 – Prince Rupert*	- Unknown filters in schools	Yes	- Reporting identifies the use of MERV 8 in all schools.
SD 54 Bulkley Valley*	- Increased outside air circulation in schools during winter months is not possible - MERV 8 filters in all but 2 schools	Yes	- Reporting identifies upgrades to MERV 13 filters in renovated areas, with MERV 8 found in remaining spaces. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

SD 57 Prince George*	- Same mitigations in all schools: Providing the maximum amount of outside air to improve ventilation. (Not feasible year-round.)	Yes	- Reporting identifies use of MERV 8 filters in all schools, except Kelly Road Secondary (MERV 13). - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD58 - Nicola-Similkameen*	- Information same for all schools. Were MERV 13's installed in any schools?	Yes	- Reporting identifies that no MERV 13 filters have yet been installed; school district in process of assessing suitability of MERV 13 in schools.
SD61 – Greater Victoria*	- No specific feedback provided.	N/A	N/A
SD62 – Sooke*	- Inspection reports only identify the year and month.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD70 – Pacific Rim*	- Inspections only identified by seasons. - Information is the same for all schools and is not site specific.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD71 – Comox Valley*	- "The majority of HVAC filters are MERV10. Where the HVAC unit is engineered to accept MERV-13 filters they are installed. Approximately five percent of HVAC units in schools can accept this size and grade of filter." General statement for all schools not site-specific. The schools included in the 'approximately' 5% are not identified.	No - EDUC following up with school district	- Reporting pertaining to site-specific ventilation is not provided, and which schools can accommodate MERV 13 filters is not identified.
SD72 – Campbell River	- Combination of MERV-10 and 13. It's the same statement for all schools with the % changing depending on the school. Timelines are unclear: "Direction received to replace MERV-10 filters with MERV-13 as existing stock is used. 25% complete." - "Engineering study required to quantify effectiveness of other technologies that might be feasible for ventilation system": Unclear whether this is in progress.	Yes	- Reporting confirms that all conversions from MERV 10s to MERV 13s is complete. - Reporting suggests that engineering study to assess effectiveness of other technologies for ventilation is not yet underway.

SD81 – Fort Nelson*	- Main mitigation used is windows that open. Not all rooms in all schools have windows that open. Also indicates increase air flow depending on ambient temperature. This is not feasible as a mitigation in Fort Nelson year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD82 – Coast Mountains*	- Increase outside air intake for more fresh air and air exchanges. Extend HVAC running schedule (to exchange air prior to occupancy). This is the only mitigation in all schools. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD83 – North Okanagan-Shuswap*	- "Variable 15% – 100% fresh air supplied to the classrooms based on the CO2 levels. Windows can be opened for more fresh air as needed during the day": Same mitigations for all schools. No site-specific information included. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD85 – Vancouver Island North*	- Unknown filters in schools - "MERV13 Filters installed everywhere they are where compatible with existing equipment" No site specific information. - Missing some inspection dates. - Outside air intake appears to be the only mitigation. - Cheslakee's Elementary: Units have outside air intakes, but some are stuck in manual. Unclear whether this has been repaired.	No - EDUC following up with school district	- No reporting update from SD and no further information available on SD website.
SD91 – Nechako Lakes*	- "There has been up to a 75% increase in the volume of outside air relative to the ASHRAE minimum" Only mitigation.	No - EDUC following up with school district	- No reporting to address further mitigation strategies.

*Due to HVAC infrastructure compatibility issues, not all school districts are able to accommodate MERV 13 filters in all their schools but other mitigation measures such as increased outdoor air supply are being utilized to improve indoor air quality.

Table 3: REPORT ON SCHOOL DISTRICT VENTILATION REPORTING

School District	**Meets Reporting Requirements? (Yes/No)**	**Information Outstanding**
SD08 - Kootenay Lake	Yes	N/A
SD19 - Revelstoke	Yes	N/A
SD20 - Kootenay-Columbia	Yes	N/A
SD35 - Langley	Yes	N/A
SD39 - Vancouver	Yes	N/A
SD45 - West Vancouver	Yes	N/A
SD46 - Sunshine Coast	Yes	N/A
SD47 - Powell River	Yes	N/A
SD50 - Haida Gwaii	Yes	N/A
SD53 - Okanagan-Similkameen	Yes	N/A

Preliminary Report #5 on Ventilation Activities
As of March 3, 2022

GENERAL OVERVIEW:

Federal Ventilation Funds Update:

- EDUC staff reached out to 59 of the school districts to gain a better understanding of how the federal ventilation funds will be spent.
- Most districts have determined how they are using the funds, while some are still in the process.
- As the table below indicates, a significant proportion of the funds are going towards standalone HEPA filtration units, which should be sufficient to address all occupied classrooms (including portables) in the province without mechanical ventilation systems.
- The 59 school districts surveyed committed to purchasing 1,767 portable HEPA filtration units and over 75% of the units have already been installed.
- Of the 59 school districts surveyed, less than 5% of these classrooms currently don't have mechanical ventilation systems.
- Funds are also being used to purchase MERV filters, update HVAC system controls and cover increased utility cost associated with greater outdoor air circulation in schools which align with HVAC consultant recommendations and eligible use of funds.
- Detailed reporting from school districts on the use of the funds will follow, but it is too early at this point given that many school districts are still determining how to use the funds.
- EDUC Staff in process of reaching out to the 1 remaining school district to determine how federal ventilation funds will be spent.
- See Table 1 for further details on use of federal funds.

School District Ventilation Reporting & BCTF Comments:

- BCTF had comments on school ventilation reporting for 29 school districts and EDUC staff have followed up with all 29 school districts regarding these concerns.
- EDUC staff have reviewed the 1000+ school ventilation reports that are on school district websites against comments provided by the BCTF.
- Many school districts have updated their school ventilation reports to address the comments, but 6 are still in the process.
- Detailed information regarding the status of addressing BCTF comments by each school district is included in Table 2.
- EDUC staff are in the process of reviewing school ventilation reports of the 31 remaining school districts over the coming weeks. Over the past two weeks an additional 20 (10 this week) of these school districts reports were reviewed and are included in Table 3.

Ventilation Technical Advisory Panel Update:

- The primary purpose of the Ventilation Technical Advisory Panel is to advise EDUC and school districts on ventilation enhancements relating to public health goals, including mitigation of COVID-19, with a view to broader shared objectives relating to supporting student success and climate preparedness and adaptation.
- Members include select school districts, independent school representatives, EDUC's contracted HVAC expert and Medical Health Officers.
- Three Ventilation Technical Advisory Panel (VTAP) meetings have been held over the past few months and the next one is to be held in the coming weeks.

Preliminary Report #5 on Ventilation Activities
As of March 3, 2022

Table 1: DETAILED REPORT ON FEDERAL VENTILATION FUNDS

School District	Status and Next Steps
SD 5 Southeast Kootenay	- Classrooms without mechanical ventilation: 0 - Funds used for 91 HEPA filter units - HEPA filter units already installed
SD 6 Rocky Mountain	- Classrooms without mechanical ventilation: 0 - Funds potentially used towards air handling units and HEPA filter units in common areas
SD 8 Kootenay Lake	- Classrooms without mechanical ventilation: 2 - HEPA filter units were previously installed in 2 classrooms - Funds will used to upgrade existing ventilation systems
SD 10 Arrow Lakes	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 19 Revelstoke	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 20 Kootenay-Columbia	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade existing ventilation systems
SD 22 Vernon	- Classrooms without mechanical ventilation: 0 - Funds potentially used for utility costs and ionization technology
SD 23 Central Okanagan	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs, filters and system controls
SD 27 Cariboo-Chilcotin	- Classrooms without mechanical ventilation: TBC - Funds used towards installing 38 HEPA filter units and filters - HEPA filter units already installed
SD 28 Quesnel	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will be used for HEPA filter units and replacing rooftop ventilation units
SD 33 Chilliwack	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs and filter upgrades
SD 34 Abbotsford	- Classrooms without mechanical ventilation: 50 - HEPA filters were installed in classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for filters and system calibration
SD35 Langley	- Classrooms without mechanical ventilation: 0 - Funds will be used for systems controls, filters, and duct cleaning
SD 36 Surrey	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade ventilation systems
SD 37 Delta	- Classrooms without mechanical ventilation: 30 (including 16 portables) - HEPA filters were installed in 14 classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for 16 HEPA filter units, system controls and rooftop ventilation units - HEPA filter units already installed
SD 38 Richmond	- Classrooms without mechanical ventilation: 186 - Funds used for 293 HEPA filter units - HEPA filter units already installed

SD 39 Vancouver	- Classrooms without mechanical ventilation: 20 – 30 (all portables) - Funds will be used for 20-30 HEPA filter units and ventilation system upgrades in portables - HEPA filter units to be installed by early March
SD 40 New Westminster	- Classrooms without mechanical ventilation: 64 (including 40 portables) - Funds used for 64 HEPA filter units and remaining funds if any will be used for ventilation upgrades - HEPA filter units already installed
SD 41 Burnaby	- Classrooms without mechanical ventilation: 280 - Funds used for 350 HEPA filter units - HEPA filter units already installed
SD 42 Maple Ridge - Pitt Meadows	- Classrooms without mechanical ventilation: 25 (all portables) - Funds used for 26 HEPA filter units, filters, system controls and utility costs - HEPA filter units already installed
SD 43 Coquitlam	- Classrooms without mechanical ventilation: 11 classrooms in schools and all portables - Funds used for 235 HEPA filter units and if there are any remaining funds it is for minor ventilation system upgrades - HEPA filter units already installed
SD 44 North Vancouver	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation upgrades, filters and utility costs
SD 45 West Vancouver	- Classrooms without mechanical ventilation: 44 - Funds will be used for 44 HEPA filters already installed, remaining funds TBC
SD 46 Sunshine Coast	- Classrooms without mechanical ventilation: 0 - Funds to be used for ventilation upgrades
SD 47 Powell River	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase HEPA filter units, 3 units ordered to date
SD 48 Sea to Sky	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation system upgrades and utility costs
SD 49 Central Coast	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will potentially be used for HEPA filter units and ventilation system upgrades
SD 50 Haida Gwaii	- Classrooms without mechanical ventilation: 0 - Funds will be used towards HEPA filter units and ventilation system upgrades - SD has ordered 5 HEPA filters, delivery date TBC
SD 51 Boundary	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase 2 HEPA filter units, filters, ventilation system upgrades and any remaining funds for utility costs
SD 52 Prince Rupert	- Classrooms without mechanical ventilation: 0 - Funds used for 13 HEPA filter units and increased utility costs - 13 HEPA filter units have already been installed
SD 53 Okanagan Similkameen	- Classrooms without mechanical ventilation: 0 - Funds used for utility costs, filters and potentially HEPA filter units
SD 54 Bulkley Valley	- Classrooms without mechanical ventilation: approx. 6 classrooms and 4 portables. Only one is a full-time classroom. - Funds used to purchase 12 HEPA filter units and filters - All HEPA filter units already installed
SD 57 Prince George	- Classrooms without mechanical ventilation: 0 - Funds used for 120 HEPA filter units and filters

	- HEPA filter units already installed
SD58 Nicola-Similkameen	- Classrooms without mechanical ventilation: 0 - Consulting mechanical engineer to determine how to spend the funds
SD 59 Peace River South	- Classrooms without mechanical ventilation: 4 portables and an annex - Funds will be used to purchase 120 HEPA filter units and filters - Units are delivered and will be installed as soon as possible.
SD 60 Peace River North	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase MERV-13 filters and remaining funds TBC
SD 61 Greater Victoria	- Classrooms without mechanical ventilation: School district staff are reviewing and TBC - Funds to be used for HEPA filter units in occupied classrooms without mechanical ventilation and ventilation upgrades
SD 62 Sooke	- Classrooms without mechanical ventilation: less than 10 - Funds used for 10 HEPA filter units, filters, and duct cleaning - HEPA filter units already installed
SD 63 Saanich	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs
SD 64 – Gulf Islands	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs - Previously purchased 6 HEPA filter units which are operating in spaces without optimal ventilation
SD 67 Okanagan Skaha	- Classrooms without mechanical ventilation: 0 - Funds will be used towards upgrading ventilation systems
SD 68 Nanaimo-Ladysmith	- Classrooms without mechanical ventilation: 12 - HEPA filters were previously installed in classrooms without mechanical ventilation - Funds used for heat pumps and filters
SD 69 Qualicum	- Classrooms without mechanical ventilation: 0 - Funds will be used for duct cleaning
SD70 Pacific Rim	- Classrooms without mechanical ventilation: 7 (portables) - Funds used for 7 HEPA filter units, filters, duct cleaning and utility costs - HEPA filter units already installed
SD71 Comox Valley	- Classrooms without mechanical ventilation: 0 - Funds used for 150 HEPA filter units and filters - HEPA filter units already installed
SD72 Campbell River	- Classrooms without mechanical ventilation: 22 - Funds used for 63 HEPA filter units and ventilation upgrades - HEPA filter units already installed
SD 73 Kamloops-Thompson	- Classrooms without mechanical ventilation: 0 - Funds will be used for system controls, filters and utility costs
SD74 Gold Trail	- Classrooms without mechanical ventilation: 0 - Funds will be used for 12 HEPA filter units, filters, and ventilation in portables - 12 HEPA filter units already installed
SD 75 Mission	- Classrooms without mechanical ventilation: 0 - Funds will be used towards purchasing 15-18 HEPA filter units for all portables, ventilation upgrades and purchasing filters - HEPA filter units expected to arrive mid-March

SD 78 Fraser Cascade	- Classrooms without mechanical ventilation: 0 - Funds will be used for upgrading ventilation systems
SD 79 Cowichan Valley	- Classrooms without mechanical ventilation: 9 - Funds used for 25 HEPA filter units and ventilation system upgrades - Delivery of HEPA filters TBC
SD 82 Coast Mountains	- Classrooms without mechanical ventilation: 68 - Funds used for 80 HEPA filter units - 68 HEPA filter units already installed and 12 to be installed in coming weeks
SD 83 North Okanagan-Shuswap	- Classrooms without mechanical ventilation: approx. 6 - Funds will be used for 100 HEPA filter units - All units have been delivered and will be installed by mid-March
SD 84 Vancouver Island West	- Classrooms without mechanical ventilation: 2 - Funds will be used for 2 HEPA filter units and ventilation system upgrades - Units have been ordered and will be installed by end of March
SD 85 Vancouver Island North	- Classrooms without mechanical ventilation: 6 including 1 portable - Funds will be used for 9 HEPA filter units and potentially ventilation system upgrades with remaining funds
SD87 - Stikine	- Classrooms without mechanical ventilation: 0 - Funds will likely be used for filters, ventilation system upgrades, duct cleaning and utility costs
SD 91 Nechako Lakes	- Classrooms without mechanical ventilation: 12 - Fund use TBC
SD92 Nisga'a	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters
SD 93 CSF	- Classrooms without mechanical ventilation: 50 - Funds used for 50 HEPA filter units - HEPA filter units to be installed over the next week

Table 2: DETAILED REPORT ON SCHOOL DISTRICT VENTILATION REPORTING & BCTF COMMENTS

School District	**BCTF Comments**	**Addressed In SD Reporting (Yes/No)**	**Items Addressed/Not Addressed**
SD 05 – Southeast Kootenay*	- No information for Jaffray Elementary Junior Secondary or Fernie Secondary - Identical statement for all schools regarding engineer's recommendation of not going to MERV 13.	No - EDUC following up with school district	- Reporting doesn't have site-specific information; all schools have identical messaging. - Reporting still missing for Fernie Secondary and Jaffray Elementary Junior Secondary.
SD 06 - Rocky Mountain*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

SD 22 – Vernon*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 23 - Central Okanagan	- Increased outside air circulation in schools during winter months is not possible - Unknown filters in schools	Yes	-Reporting identifies MERV 13 filters in all schools. - Reporting identifies increased supply of outside air supply in all schools. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 28 – Quesnel*	- No specific feedback provided.	N/A	N/A
SD 33 - Chilliwack	- No site-specific information. - Unclear whether MERV-13 are in all schools.	Yes	- Reporting confirms MERV 13 in all schools.
SD 34 – Abbotsford*	No specific feedback provided.	N/A	N/A
SD 36 – Surrey*	- Unknown filters in schools	Yes	- Reporting identifies a mix of MERV 13, 10, and 8 in schools.
SD 37 – Delta*	- Increased outside air circulation in schools during winter months is not possible - Confusing statement for Delta Manor: "Air handling units include MERV 13 filters. Filters are included in unit's ventilators, but they are not MERV 13 (we focussed on increased fresh air ventilation instead of increased filtration)."	No - EDUC following up with school district	- Reporting provides confusing statement regarding Delta Manor has not yet been addressed. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting states school district has MERV 13 filters in gyms and MERV 10 filters in some schools. Other schools have MERV 10 filters throughout, and some have MERV 13 throughout
SD 38 – Richmond*	- No specific feedback provided.	N/A	N/A
SD 43 – Coquitlam*	- "(Fresh air supply) increased to 100% throughout summer season. Scaled it back in Oct 11th week, due to cold weather." Unclear what other mitigations are replacing the fresh air supply.	Yes	- Reporting identifies mitigation strategies to increase outdoor air supply. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 44 – North Vancouver*	- "All ventilation systems have been programmed district-wide to utilize the maximum amount of outdoor	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased

	air possible. This would mean that most systems are providing 100% outdoor air." Not feasible year-round. Other mitigations unclear. - Unknown filters in schools		outdoor air circulation within facilities continues despite cold temperatures. - Reporting identifies schools using MERV 13, some MERV 10.
SD 48 – Sea to Sky	- "MERV – 13 filters installed in all air-handling units in all schools": Does this mean all schools have MERV 13 filters in place? - "Portable Dyson HEPA Air Scrubbers – to be deployed where required": Since the forms are specific to individual schools it should be listed the schools that have them and the number. - Unknown filters in schools	Yes	- Reporting identifies MERV 13s in all schools, and addresses where HEPA filters are used.
SD 49 – Central Coast*	- Wuikinux Elementary School: The school does not have HVAC system. Wuikinux Nation is responsible for heating system maintenance according to Local Education Agreement (LEA). No information provided including inspection dates. - Shearwater Elementary: "The school does not have HVAC system. Oil furnace is in place for heating". No dates for inspections—they happen daily. "Furnace and heat pump upgrade in progress": More information should be available.	No - EDUC following up with school district	- No update from SD and no further information available on SD website.
SD 51 – Boundary	- Currently using MERV 8 and are working on upgrading to a higher MERV value: This information may need to be updated.	Yes	- Reporting confirms filters in all schools are MERV 13 or in process of being upgraded to MERV 13 from MERV 11.
SD 52 – Prince Rupert*	- Unknown filters in schools	Yes	- Reporting identifies the use of MERV 8 in all schools.

SD 54 Bulkley Valley*	- Increased outside air circulation in schools during winter months is not possible - MERV 8 filters in all but 2 schools	Yes	- Reporting identifies upgrades to MERV 13 filters in renovated areas, with MERV 8 found in remaining spaces. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 57 Prince George*	- Same mitigations in all schools: Providing the maximum amount of outside air to improve ventilation. (Not feasible year-round.)	Yes	- Reporting identifies use of MERV 8 filters in all schools, except Kelly Road Secondary (MERV 13). - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD58 - Nicola-Similkameen*	- Information same for all schools. Were MERV 13's installed in any schools?	Yes	- Reporting identifies that no MERV 13 filters have yet been installed; school district in process of assessing suitability of MERV 13 in schools.
SD61 – Greater Victoria*	- No specific feedback provided.	N/A	N/A
SD62 – Sooke*	- Inspection reports only identify the year and month.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD70 – Pacific Rim*	- Inspections only identified by seasons. - Information is the same for all schools and is not site specific.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD71 – Comox Valley*	- "The majority of HVAC filters are MERV10. Where the HVAC unit is engineered to accept MERV-13 filters they are installed. Approximately five percent of HVAC units in schools can accept this size and grade of filter." General statement for all schools not site-specific. The schools included in the 'approximately' 5% are not identified.	No - EDUC following up with school district	- Reporting pertaining to site-specific ventilation is not provided, and which schools can accommodate MERV 13 filters is not identified.
SD72 – Campbell River	- Combination of MERV-10 and 13. It's the same statement for all	Yes	- Reporting confirms that all conversions from MERV 10s to MERV 13s is complete.

	schools with the % changing depending on the school. Timelines are unclear: "Direction received to replace MERV-10 filters with MERV-13 as existing stock is used. 25% complete." - "Engineering study required to quantify effectiveness of other technologies that might be feasible for ventilation system": Unclear whether this is in progress.		- Reporting suggests that engineering study to assess effectiveness of other technologies for ventilation is not yet underway.
SD81 – Fort Nelson*	- Main mitigation used is windows that open. Not all rooms in all schools have windows that open. Also indicates increase air flow depending on ambient temperature. This is not feasible as a mitigation in Fort Nelson year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD82 – Coast Mountains*	- Increase outside air intake for more fresh air and air exchanges. Extend HVAC running schedule (to exchange air prior to occupancy). This is the only mitigation in all schools. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD83 – North Okanagan-Shuswap*	- "Variable 15% – 100% fresh air supplied to the classrooms based on the CO2 levels. Windows can be opened for more fresh air as needed during the day": Same mitigations for all schools. No site-specific information included. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD85 – Vancouver Island North*	- Unknown filters in schools - "MERV13 Filters installed everywhere they are where compatible with existing equipment" No site specific information. - Missing some inspection dates. - Outside air intake appears to be the only mitigation. - Cheslakee's Elementary: Units have outside air intakes, but some are stuck in manual. Unclear whether this has been repaired.	No - EDUC following up with school district	- No reporting update from SD and no further information available on SD website.

SD91 – Nechako Lakes*	- "There has been up to a 75% increase in the volume of outside air relative to the ASHRAE minimum" Only mitigation.	No - EDUC following up with school district	- No reporting to address further mitigation strategies.

*Due to HVAC infrastructure compatibility issues, not all school districts are able to accommodate MERV 13 filters in all their schools but other mitigation measures such as increased outdoor air supply are being utilized to improve indoor air quality.

Table 3: REPORT ON SCHOOL DISTRICT VENTILATION REPORTING

School District	**Meets Reporting Requirements? (Yes/No)**	**Information Outstanding**
SD08 - Kootenay Lake	Yes	N/A
SD10 - Arrow Lakes	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD19 - Revelstoke	Yes	N/A
SD20 - Kootenay-Columbia	Yes	N/A
SD27 - Cariboo-Chilcotin	Yes	N/A
SD35 - Langley	Yes	N/A
SD39 - Vancouver	Yes	N/A
SD40 - New Westminster	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD41 - Burnaby	Yes	N/A
SD42 - Maple Ridge-Pitt Meadows	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD45 - West Vancouver	Yes	N/A
SD46 - Sunshine Coast	Yes	N/A
SD47 - Powell River	Yes	N/A
SD50 - Haida Gwaii	Yes	N/A
SD53 - Okanagan-Similkameen	Yes	N/A
SD59 – Peace River South	Yes	N/A
SD60 – Peace River North	Yes	N/A

SD63 - Saanich	Yes	N/A
SD64 – Gulf Islands	Yes	N/A
SD67 – Okanagan-Skaha	Yes	N/A

Preliminary Report #6 on Ventilation Activities
As of March 10, 2022

GENERAL OVERVIEW:

Federal Ventilation Funds Update:

- EDUC staff reached out to all 60 school districts to gain a better understanding of how the federal ventilation funds will be spent.
- Most districts have determined how they are using the funds, while some are still in the process.
- As the table below indicates, a significant proportion of the funds are going towards standalone HEPA filtration units, which should be sufficient to address all occupied classrooms (including portables) in the province without mechanical ventilation systems.
- The 60 school districts surveyed committed to purchasing 1,767 portable HEPA filtration units and over 80% of the units have already been installed.
- Of 60 school districts, less than 5% of these classrooms currently don't have mechanical ventilation systems.
- Funds are also being used to purchase MERV filters, update HVAC system controls and cover increased utility cost associated with greater outdoor air circulation in schools which align with HVAC consultant recommendations and eligible use of funds.
- Detailed reporting from school districts on the use of the funds will follow, but it is too early at this point given that many school districts are still determining how to use the funds.
- See Table 1 for further details on use of federal funds.

School District Ventilation Reporting & BCTF Comments:

- BCTF had comments on school ventilation reporting for 29 school districts and EDUC staff have followed up with all 29 school districts regarding these concerns.
- EDUC staff have reviewed the 1400+ school ventilation reports that are on school district websites against comments provided by the BCTF and general requirements.
- Many school districts have updated their school ventilation reports to address the BCTF comments, but 6 are still in the process.
- Detailed information regarding the status of addressing BCTF comments by each school district is included in Table 2.
- EDUC staff have reviewed school ventilation reports of the 31 remaining school districts. Over the past 3 weeks, all 31 (11 this week) school districts' reports were reviewed and are included in Table 3. Minor issues were identified with 9 of these reports which are in the process of being addressed.

Ventilation Technical Advisory Panel Update:

- The primary purpose of the Ventilation Technical Advisory Panel is to advise EDUC and school districts on ventilation enhancements relating to public health goals, including mitigation of COVID-19, with a view to broader shared objectives relating to supporting student success and climate preparedness and adaptation.
- Members include select school districts, independent school representatives, EDUC's contracted HVAC expert and Medical Health Officers.
- Three Ventilation Technical Advisory Panel (VTAP) meetings have been held over the past few months and the next one is to be held in the coming weeks.
- EDUC is in the process of scheduling the next VTAP Meeting for the first week of April, with the exact date yet to be determined.

Preliminary Report #6 on Ventilation Activities
As of March 10, 2022

Table 1: DETAILED REPORT ON FEDERAL VENTILATION FUNDS

School District	Status and Next Steps
SD 5 Southeast Kootenay	- Classrooms without mechanical ventilation: 0 - Funds used for 91 HEPA filter units - HEPA filter units already installed
SD 6 Rocky Mountain	- Classrooms without mechanical ventilation: 0 - Funds potentially used towards air handling units and HEPA filter units in common areas
SD 8 Kootenay Lake	- Classrooms without mechanical ventilation: 2 - HEPA filter units were previously installed in 2 classrooms - Funds will used to upgrade existing ventilation systems
SD 10 Arrow Lakes	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 19 Revelstoke	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 20 Kootenay-Columbia	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade existing ventilation systems
SD 22 Vernon	- Classrooms without mechanical ventilation: 0 - Funds potentially used for utility costs and ionization technology
SD 23 Central Okanagan	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs, filters and system controls
SD 27 Cariboo-Chilcotin	- Classrooms without mechanical ventilation: TBC - Funds used towards installing 38 HEPA filter units and filters - HEPA filter units already installed
SD 28 Quesnel	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will be used for HEPA filter units and replacing rooftop ventilation units
SD 33 Chilliwack	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs and filter upgrades
SD 34 Abbotsford	- Classrooms without mechanical ventilation: 50 - HEPA filters were installed in classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for filters and system calibration
SD35 Langley	- Classrooms without mechanical ventilation: 0 - Funds will be used for systems controls, filters, and duct cleaning
SD 36 Surrey	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade ventilation systems
SD 37 Delta	- Classrooms without mechanical ventilation: 30 (including 16 portables) - HEPA filters were installed in 14 classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for 16 HEPA filter units, system controls and rooftop ventilation units - HEPA filter units already installed
SD 38 Richmond	- Classrooms without mechanical ventilation: 186 - Funds used for 293 HEPA filter units - HEPA filter units already installed

SD 39 Vancouver	- Classrooms without mechanical ventilation: 20 – 30 (all portables) - Funds will be used for 20-30 HEPA filter units and ventilation system upgrades in portables - HEPA filter units already installed
SD 40 New Westminster	- Classrooms without mechanical ventilation: 64 (including 40 portables) - Funds used for 64 HEPA filter units and remaining funds if any will be used for ventilation upgrades - HEPA filter units already installed
SD 41 Burnaby	- Classrooms without mechanical ventilation: 280 - Funds used for 350 HEPA filter units - HEPA filter units already installed
SD 42 Maple Ridge - Pitt Meadows	- Classrooms without mechanical ventilation: 25 (all portables) - Funds used for 26 HEPA filter units, filters, system controls and utility costs - HEPA filter units already installed
SD 43 Coquitlam	- Classrooms without mechanical ventilation: 11 classrooms in schools and all portables - Funds used for 235 HEPA filter units and if there are any remaining funds it is for minor ventilation system upgrades - HEPA filter units already installed
SD 44 North Vancouver	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation upgrades, filters and utility costs
SD 45 West Vancouver	- Classrooms without mechanical ventilation: 44 - Funds will be used for 44 HEPA filters already installed, remaining funds TBC
SD 46 Sunshine Coast	- Classrooms without mechanical ventilation: 0 - Funds to be used for ventilation upgrades
SD 47 Powell River	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase HEPA filter units, 3 units ordered to date
SD 48 Sea to Sky	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation system upgrades and utility costs
SD 49 Central Coast	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will potentially be used for HEPA filter units and ventilation system upgrades
SD 50 Haida Gwaii	- Classrooms without mechanical ventilation: 0 - Funds will be used towards HEPA filter units and ventilation system upgrades - SD has ordered 5 HEPA filters, delivery date TBC
SD 51 Boundary	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase 2 HEPA filter units, filters, ventilation system upgrades and any remaining funds for utility costs
SD 52 Prince Rupert	- Classrooms without mechanical ventilation: 0 - Funds used for 13 HEPA filter units and increased utility costs - 13 HEPA filter units have already been installed
SD 53 Okanagan Similkameen	- Classrooms without mechanical ventilation: 0 - Funds used for utility costs, filters and potentially HEPA filter units
SD 54 Bulkley Valley	- Classrooms without mechanical ventilation: approx. 6 classrooms and 4 portables. Only one is a full-time classroom. - Funds used to purchase 12 HEPA filter units and filters - All HEPA filter units already installed
SD 57 Prince George	- Classrooms without mechanical ventilation: 0 - Funds used for 120 HEPA filter units and filters

	- HEPA filter units already installed
SD58 Nicola-Similkameen	- Classrooms without mechanical ventilation: 0 - Consulting mechanical engineer to determine how to spend the funds
SD 59 Peace River South	- Classrooms without mechanical ventilation: 4 portables and an annex - Funds will be used to purchase 120 HEPA filter units and filters - Units are delivered and will be installed as soon as possible.
SD 60 Peace River North	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase MERV-13 filters and remaining funds TBC
SD 61 Greater Victoria	- Classrooms without mechanical ventilation: School district staff are reviewing and TBC - Funds to be used for HEPA filter units in occupied classrooms without mechanical ventilation and ventilation upgrades
SD 62 Sooke	- Classrooms without mechanical ventilation: less than 10 - Funds used for 10 HEPA filter units, filters, and duct cleaning - HEPA filter units already installed
SD 63 Saanich	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs
SD 64 – Gulf Islands	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs - Previously purchased 6 HEPA filter units which are operating in spaces without optimal ventilation
SD 67 Okanagan Skaha	- Classrooms without mechanical ventilation: 0 - Funds will be used towards upgrading ventilation systems
SD 68 Nanaimo-Ladysmith	- Classrooms without mechanical ventilation: 12 - HEPA filters were previously installed in classrooms without mechanical ventilation - Funds used for heat pumps and filters
SD 69 Qualicum	- Classrooms without mechanical ventilation: 0 - Funds will be used for duct cleaning
SD70 Pacific Rim	- Classrooms without mechanical ventilation: 7 (portables) - Funds used for 7 HEPA filter units, filters, duct cleaning and utility costs - HEPA filter units already installed
SD71 Comox Valley	- Classrooms without mechanical ventilation: 0 - Funds used for 150 HEPA filter units and filters - HEPA filter units already installed
SD72 Campbell River	- Classrooms without mechanical ventilation: 22 - Funds used for 63 HEPA filter units and ventilation upgrades - HEPA filter units already installed
SD 73 Kamloops-Thompson	- Classrooms without mechanical ventilation: 0 - Funds will be used for system controls, filters and utility costs
SD74 Gold Trail	- Classrooms without mechanical ventilation: 0 - Funds will be used for 12 HEPA filter units, filters, and ventilation in portables - 12 HEPA filter units already installed
SD 75 Mission	- Classrooms without mechanical ventilation: 0 - Funds will be used towards purchasing 15-18 HEPA filter units for all portables, ventilation upgrades and purchasing filters - HEPA filter units expected to arrive mid-March

SD 78 Fraser Cascade	- Classrooms without mechanical ventilation: 0 - Funds will be used for upgrading ventilation systems
SD 79 Cowichan Valley	- Classrooms without mechanical ventilation: 9 - Funds used for 25 HEPA filter units and ventilation system upgrades - Delivery of HEPA filters TBC
SD81 Fort Nelson	- Classrooms without mechanical ventilation: 0 - Funds will be used for upgrading ventilation systems
SD 82 Coast Mountains	- Classrooms without mechanical ventilation: 68 - Funds used for 80 HEPA filter units - 80 HEPA filter units already installed
SD 83 North Okanagan-Shuswap	- Classrooms without mechanical ventilation: approx. 6 - Funds used for 100 HEPA filter units - 100 HEPA filter units already installed
SD 84 Vancouver Island West	- Classrooms without mechanical ventilation: 2 - Funds will be used for 2 HEPA filter units and ventilation system upgrades - Units have been ordered and will be installed by end of March
SD 85 Vancouver Island North	- Classrooms without mechanical ventilation: 6 including 1 portable - Funds will be used for 9 HEPA filter units and potentially ventilation system upgrades with remaining funds
SD87 - Stikine	- Classrooms without mechanical ventilation: 0 - Funds will likely be used for filters, ventilation system upgrades, duct cleaning and utility costs
SD 91 Nechako Lakes	- Classrooms without mechanical ventilation: 12 - Fund use TBC
SD92 Nisga'a	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters
SD 93 CSF	- Classrooms without mechanical ventilation: 50 - Funds used for 50 HEPA filter units - HEPA filter units to be installed over the next couple weeks

Table 2: DETAILED REPORT ON SCHOOL DISTRICT VENTILATION REPORTING & BCTF COMMENTS

School District	**BCTF Comments**	**Addressed In SD Reporting (Yes/No)**	**Items Addressed/Not Addressed**
SD 05 – Southeast Kootenay*	- No information for Jaffray Elementary Junior Secondary or Fernie Secondary - Identical statement for all schools regarding engineer's recommendation of not going to MERV 13.	No - EDUC following up with school district	- Reporting doesn't have site-specific information; all schools have identical messaging. - Reporting still missing for Fernie Secondary and Jaffray Elementary Junior Secondary.
SD 06 - Rocky Mountain*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased

			outdoor air circulation within facilities continues despite cold temperatures.
SD 22 – Vernon*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 23 - Central Okanagan	- Increased outside air circulation in schools during winter months is not possible - Unknown filters in schools	Yes	-Reporting identifies MERV 13 filters in all schools. - Reporting identifies increased supply of outside air supply in all schools. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 28 – Quesnel*	- No specific feedback provided.	N/A	N/A
SD 33 - Chilliwack	- No site-specific information. - Unclear whether MERV-13 are in all schools.	Yes	- Reporting confirms MERV 13 in all schools.
SD 34 – Abbotsford*	- No specific feedback provided.	N/A	N/A
SD 36 – Surrey*	- Unknown filters in schools	Yes	- Reporting identifies a mix of MERV 13, 10, and 8 in schools.
SD 37 – Delta*	- Increased outside air circulation in schools during winter months is not possible - Confusing statement for Delta Manor: "Air handling units include MERV 13 filters. Filters are included in unit's ventilators, but they are not MERV 13 (we focussed on increased fresh air ventilation instead of increased filtration)."	No - EDUC following up with school district	- Reporting provides confusing statement regarding Delta Manor has not yet been addressed. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting states school district has MERV 13 filters in gyms and MERV 10 filters in some schools. Other schools have MERV 10 filters throughout, and some have MERV 13 throughout
SD 38 – Richmond*	- No specific feedback provided.	N/A	N/A
SD 43 – Coquitlam*	- "(Fresh air supply) increased to 100% throughout summer season. Scaled it back in Oct 11th week, due to cold weather." Unclear what other mitigations are replacing the fresh air supply.	Yes	- Reporting identifies mitigation strategies to increase outdoor air supply. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

SD 44 – North Vancouver*	- "All ventilation systems have been programmed district-wide to utilize the maximum amount of outdoor air possible. This would mean that most systems are providing 100% outdoor air." Not feasible year-round. Other mitigations unclear. - Unknown filters in schools	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting identifies schools using MERV 13, some MERV 10.
SD 48 – Sea to Sky	- "MERV – 13 filters installed in all air-handling units in all schools": Does this mean all schools have MERV 13 filters in place? - "Portable Dyson HEPA Air Scrubbers – to be deployed where required": Since the forms are specific to individual schools it should be listed the schools that have them and the number. - Unknown filters in schools	Yes	- Reporting identifies MERV 13s in all schools, and addresses where HEPA filters are used.
SD 49 – Central Coast*	- Wuikinux Elementary School: The school does not have HVAC system. Wuikinux Nation is responsible for heating system maintenance according to Local Education Agreement (LEA). No information provided including inspection dates. - Shearwater Elementary: "The school does not have HVAC system. Oil furnace is in place for heating". No dates for inspections—they happen daily. "Furnace and heat pump upgrade in progress": More information should be available.	No - EDUC following up with school district	- No update from SD and no further information available on SD website.
SD 51 – Boundary	- Currently using MERV 8 and are working on upgrading to a higher MERV value: This information may need to be updated.	Yes	- Reporting confirms filters in all schools are MERV 13 or in process of being upgraded to MERV 13 from MERV 11.
SD 52 – Prince Rupert*	- Unknown filters in schools	Yes	- Reporting identifies the use of MERV 8 in all schools.

SD 54 Bulkley Valley*	- Increased outside air circulation in schools during winter months is not possible - MERV 8 filters in all but 2 schools	Yes	- Reporting identifies upgrades to MERV 13 filters in renovated areas, with MERV 8 found in remaining spaces. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 57 Prince George*	- Same mitigations in all schools: Providing the maximum amount of outside air to improve ventilation. (Not feasible year-round.)	Yes	- Reporting identifies use of MERV 8 filters in all schools, except Kelly Road Secondary (MERV 13). - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD58 - Nicola-Similkameen*	- Information same for all schools. - Were MERV 13's installed in any schools?	Yes	- Reporting identifies that no MERV 13 filters have yet been installed; school district in process of assessing suitability of MERV 13 in schools.
SD61 – Greater Victoria*	- No specific feedback provided.	N/A	N/A
SD62 – Sooke*	- Inspection reports only identify the year and month.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD70 – Pacific Rim*	- Inspections only identified by seasons. - Information is the same for all schools and is not site specific.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD71 – Comox Valley*	- "The majority of HVAC filters are MERV10. Where the HVAC unit is engineered to accept MERV-13 filters they are installed. Approximately five percent of HVAC units in schools can accept this size and grade of filter." General statement for all schools not site-specific. The schools included in the 'approximately' 5% are not identified.	No - EDUC following up with school district	- Reporting pertaining to site-specific ventilation is not provided, and which schools can accommodate MERV 13 filters is not identified.
SD72 – Campbell River	- Combination of MERV-10 and 13. It's the same statement for all	Yes	- Reporting confirms that all conversions from MERV 10s to MERV 13s is complete.

	schools with the % changing depending on the school. Timelines are unclear: "Direction received to replace MERV-10 filters with MERV-13 as existing stock is used. 25% complete." - "Engineering study required to quantify effectiveness of other technologies that might be feasible for ventilation system": Unclear whether this is in progress.		- Reporting suggests that engineering study to assess effectiveness of other technologies for ventilation is not yet underway.
SD81 – Fort Nelson*	- Main mitigation used is windows that open. Not all rooms in all schools have windows that open. Also indicates increase air flow depending on ambient temperature. This is not feasible as a mitigation in Fort Nelson year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD82 – Coast Mountains*	- Increase outside air intake for more fresh air and air exchanges. Extend HVAC running schedule (to exchange air prior to occupancy). This is the only mitigation in all schools. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD83 – North Okanagan-Shuswap*	- "Variable 15% – 100% fresh air supplied to the classrooms based on the CO2 levels. Windows can be opened for more fresh air as needed during the day": Same mitigations for all schools. No site-specific information included. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD85 – Vancouver Island North*	- Unknown filters in schools - "MERV13 Filters installed everywhere they are where compatible with existing equipment" No site specific information. - Missing some inspection dates. - Outside air intake appears to be the only mitigation. - Cheslakee's Elementary: Units have outside air intakes, but some are stuck in manual. Unclear whether this has been repaired.	No - EDUC following up with school district	- No reporting update from SD and no further information available on SD website.

SD91 – Nechako Lakes*	- "There has been up to a 75% increase in the volume of outside air relative to the ASHRAE minimum" Only mitigation.	No - EDUC following up with school district	- No reporting to address further mitigation strategies.

*Due to HVAC infrastructure compatibility issues, not all school districts are able to accommodate MERV 13 filters in all their schools but other mitigation measures such as increased outdoor air supply are being utilized to improve indoor air quality.

Table 3: REPORT ON SCHOOL DISTRICT VENTILATION REPORTING

School District	**Meets Reporting Requirements? (Yes/No)**	**Information Outstanding**
SD08 - Kootenay Lake	Yes	N/A
SD10 - Arrow Lakes	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD19 - Revelstoke	Yes	N/A
SD20 - Kootenay-Columbia	Yes	N/A
SD27 - Cariboo-Chilcotin	Yes	N/A
SD35 - Langley	Yes	N/A
SD39 - Vancouver	Yes	N/A
SD40 - New Westminster	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD41 - Burnaby	Yes	N/A
SD42 - Maple Ridge-Pitt Meadows	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD45 - West Vancouver	Yes	N/A
SD46 - Sunshine Coast	Yes	N/A
SD47 - Powell River	Yes	N/A
SD50 - Haida Gwaii	Yes	N/A
SD53 - Okanagan-Similkameen	Yes	N/A
SD59 – Peace River South	Yes	N/A
SD60 – Peace River North	Yes	N/A

SD63 - Saanich	Yes	N/A
SD64 – Gulf Islands	Yes	N/A
SD67 – Okanagan-Skaha	Yes	N/A
SD68 – Nanaimo-Ladysmith	Yes	N/A
SD69 – Qualicum	Yes	N/A
SD73 – Kamloops-Thompson	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD74 – Gold Trail	Yes	N/A
SD75 – Mission	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD78 – Fraser-Cascade	No - EDUC following up with school district	Reporting does not identify type of filters in some schools.
SD79 – Cowichan Valley	Yes	N/A
SD84 – Vancouver Island West	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD87 - Stikine	No - EDUC following up with school district	Reporting does not provide detail regarding fresh air ventilation.
SD92 – Nisga'a	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD93 – Conseil Scolaire Francophone	Yes	N/A

VENTILATION TECHNICAL ADVISORY PANEL

TERMS OF REFERENCE – FINAL

Updated - April 4, 2022

BRITISH COLUMBIA | Ministry of Education

Background

In the context of the COVID-19 pandemic, the Ministry of Education has been working with school districts to identify opportunities to enhance school ventilation systems in public schools as part of overall strategies to promote health and safety in schools.

A Ventilation Technical Advisory Panel (the Advisory Panel) is being established to take stock of the information that has been collected to date, share information on best practices and provide guidance on additional mitigations that may be utilized in different contexts, as appropriate.

Purpose

The primary purpose of the Advisory Panel is to advise the Ministry and school districts on ventilation enhancements relating to public health goals, including COVID-19, with a view to broader shared objectives relating to supporting student success and climate preparedness and adaptation, among other priorities.

The Advisory Panel will share advice and recommendations on ventilation systems, strategies, and best practices with BCASBO members, through the BCASBO Executive. Recommendations will be in alignment with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Reopening of Schools and Universities Guidelines to enhance indoor air quality and address the risk of virus transmission. The panel will consider K-12 Health and Safety guidelines, a range of emerging practices and technologies, current mechanical systems employed by the sector and budget constraints.

Responsibilities

The Advisory Panel will provide the following:

1. Ventilation and air circulation best practices:
    a) Additional guidance on how to effectively operate ventilation systems to reduce the risk of viral transmission.
    b) Recommendations on cost-effective equipment and/or materials to support ventilation and air circulation best practices.
    c) Advice on staff training and development to support ventilation recommendations.
    d) Identification of key performance indicators to evaluate effective ventilation strategies that will promote a safe and healthy environment for learning.

2. Ongoing advice to districts on opportunities or priorities for value-added equipment or product procurements.

Advisory Panel deliberations will be guided by ASHRAE Reopening of Schools and Universities Guidelines. Discussions may result in additional sources of

best practices.

Advisory Panel Operations

The Ministry of Education will provide a Co-chair and assist with coordinating meetings, developing meeting agendas, and documenting decisions.

BCASBO is to nominate a Secretary Treasurer as Advisory Panel Co-chair.

Representation

The Advisory Panel will include representation from the Ministry, the sector along with industry technical experts. The Ministry will provide technical expertise to the Advisory Panel in the form of a contracted mechanical engineer with expertise in institutional mechanical ventilation systems.

Five representatives from the Ministry of Education:

- Francois Bertrand, Executive Director, Capital Management
- Damien Crowell, A/Director, Capital Management
- Ravnit Aujla, Regional Director, Capital Management
- Megan Graham, Planning Analyst, Capital Management
- Aimee King, Administrative Coordinator

One representative from BCASBO:

- Patti Dundas, Past President and Assistant Secretary-Treasurer, SD36

One representative from EFMA:

- Chuck Morris, President and Director of Facility Services, SD61

One representative from FISA:

- Shawn Chisholm, Executive Director, Federation of Independent Schools

One representative from the School Safety Association of BC:

- Colette O'Reilly, Director, SD39

Four additional representatives from the sector:

- Steve Hopkins, Secretary-Treasurer, SD47
- Bob Beukers, Manager of Electrical & Mechanical, SD34
- Josh Currie, Assistant Director of Operations, SD23
- Matt Foley, Energy Manager, SD41

One technical expert:

- Stephen McNicholls, SMcN Consulting Inc.

Ad Hoc Members:

- WorkSafeBC Representative, TBD

- Public Health Representative, Dr. Ariellla Zbar, Fraser Health
- Public Health Representative, Dr. Michael Schwandt, Coastal Health
- Grant Sheppard, Deputy Inspector of Independent Schools, Ministry of Education
- Tym Berger, Principal, Abbotsford Christian Middle School

Timelines

The Advisory Panel is expected to meet bi-weekly at first, switching to monthly as appropriate. A decision will be made by April 2022 on whether to extend the Advisory Panel timeline further, and the duration of any extension.

Deliverables

Deliverables will include:

- Identify features of effective ventilation systems and practices, within a COVID mitigation context.
- Guidance on cost-effective mitigations that may be applied in different contexts, to reduce the risk of viral transmission.
- Recommendations on ongoing investments to promote health and safety, with consideration for student success and climate preparedness and adaptation.

Communication

Throughout their work, Advisory Panel representatives may canvas organization members and other K-12 and health sector contacts to identify best practices that should be considered in their Advisory Panel discussions. Advisory Panel members will provide updates to their organizations, as needed.

Ventilation Technical Advisory Panel Meeting #4 (April 5, 2022)

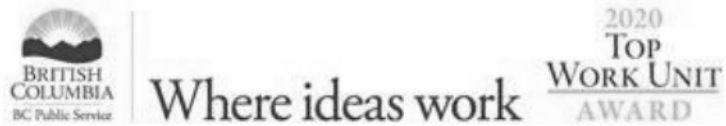
From:	Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To:	Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Patti Dundas <dundas_p@surreyschools.ca>, Chuck Morris <cmorris@sd61.bc.ca>, Collette O'Reilly <coreilly@vsb.bc.ca>, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>, Bob Beukers <Bob.Beukers@abbyschools.ca>, josh.currie@sd23.bc.ca, Stephen McNicholls <stephen@smcn.ca>, Graham, Megan 1 EDUC:EX <Megan.Graham@gov.bc.ca>, King, Aimee EDUC:EX <Aimee.King@gov.bc.ca>, Shawn Chisholm <shawn@fisabc.ca>, matt.foley@burnabyschools.ca, tberger@abbotsfordchistian.com
Cc:	Sheppard, Grant EDUC:EX <Grant.Sheppard@gov.bc.ca>
Sent:	April 4, 2022 9:29:35 AM PDT
Attachments:	HVAC Technical Advisory Panel Terms of Reference - FINAL.pdf, Best Practices Guidelines Ventilation in BC Schools.docx, image001.jpg, 2.0 Minutes for Meeting #03 - February 11, 2022.docx, 1.0 VTAP Meeting Agenda - April 5, 2022.docx

Hello all,

Attached is a draft agenda for the Ventilation Technical Advisory Panel Meeting #4 (April 5, 2022) along with a high-level overview of a Best Practices Guidelines for Ventilation in BC School document that we would like to discuss in detail at the meeting. Also, I've included the meeting minutes from the February 11, 2022 and an updated Technical Advisory Panel Terms of Reference (only change was addition of few additional folks under the representation section). Please contact me if you have any suggestions regarding the agenda or any comments/questions. Thanks,

Damien

Damien Crowell | A/Director | Minor Capital Programs & Finance Unit | Ministry of Education
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca



Ventilation Technical Advisory Panel Agenda

Meeting #04
4/5/2022
1:00pm –2:00pm
Location: Zoom Video Conference Call

Members:	Francois Bertrand, Damien Crowell, Ravnit Aujla, Megan Graham, Aimee King, Patti Dundas, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls, Grant Sheppard, Shawn Chisholm, Matt Foley, Tym Berger
Guests:	N/A
Regrets:	N/A

TIME	TOPIC		LEAD
1:00 – 1:05pm	**1.0 Meeting Agenda & Introductions**	Information	Francois Bertrand
1:05 – 1:30pm	**2.0 Best Practices Document Review**	Information	Damien Crowell
1:30 – 1:40pm	**3.0 Ventilation Minor Capital Projects**	Information	Damien Crowell
1:40 – 1:55pm	**4.0 Roundtable and/or Questions**	Information	All
1:55 – 2:00pm	**5.0 Wrap up/Items for Future Meetings**	Information	Francois Bertrand

Next Meeting: TBD

Draft Ventilation Technical Advisory Panel Meeting #4 (April 5, 2022) Meeting Minutes

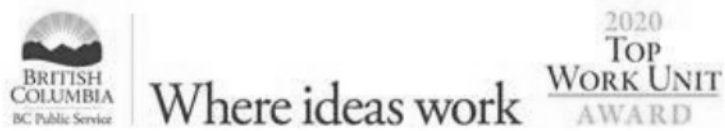
From:	Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To:	Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Patti Dundas <dundas_p@surreyschools.ca>, Chuck Morris <cmorris@sd61.bc.ca>, Collette O'Reilly <coreilly@vsb.bc.ca>, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>, Bob Beukers <Bob.Beukers@abbyschools.ca>, josh.currie@sd23.bc.ca, Stephen McNicholls <stephen@smcn.ca>, Graham, Megan 1 EDUC:EX <Megan.Graham@gov.bc.ca>, King, Aimee EDUC:EX <Aimee.King@gov.bc.ca>, Shawn Chisholm <shawn@fisabc.ca>, matt.foley@burnabyschools.ca, tberger@abbotsfordchristian.com
Cc:	Sheppard, Grant EDUC:EX <Grant.Sheppard@gov.bc.ca>
Sent:	April 8, 2022 2:50:42 PM PDT
Attachments:	image001.jpg, Minutes for Meeting #04 - April 5 2022.docx

Hello all,

Attached are draft meeting minutes for the Ventilation Technical Advisory Panel Meeting #4 (April 5, 2022). Please contact me if you have any comments/questions. Thanks,

Damien

Damien Crowell | A/Director | Minor Capital Programs & Finance Unit | Ministry of Education
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca



CONFIDENTIAL

Ventilation Technical Advisory Panel
Minutes – Meeting #04

Date: Tuesday – April 5, 2022
Time: 1:00 to 2:00pm
Location: Video Conference Call
Members: Francois Bertrand, Damien Crowell, Ravnit Aujla, Megan Graham, Aimee King, Patti Dundas, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls, Shawn Chisholm, Tym Berger, Matt Foley

Guests: N/A

Regrets N/A

Agenda Item	Discussion/Action items
1. Meeting Agenda & Introductions	• Agenda was circulated in advance of the meeting and no concerns were raised. • Matt Foley from SD41 recently became a panel member. • Duration of holding VTAP meetings raised; formal discussion suggested as agenda item for next meeting.
2. Best Practices Document Review	• The Ministry developed five high-level themes for a future Best Practices Guideline for Ventilation in BC Schools. • The themes included identifying key drivers for HVAC improvements, prioritizing HVAC projects, maintaining existing HVAC systems, identifying role of HEPA filters and providing general resources. • It is anticipated that the Best Practices Guideline for Ventilation in BC Schools can be completed for end of May. **Action Item:** • VTAP members were requested to provide feedback on the themes related to the guidelines by April 11 (Monday).

3. Ventilation Minor Capital Projects	• The Ministry summarized funding provided for HVAC projects in recent years through the School Enhancement Program, Carbon Neutral Capital Program, Annual Facilities Grant and other government funding sources. • There has been an increase in the funding going towards HVAC projects in recent years as school districts are identifying them as high priority projects on capital plan submissions. **Action Item:** • Ministry to post 2022/23 SEP and CNCP HVAC projects on website: https://www2.gov.bc.ca/gov/content/education-training/k-12/administration/capital/resources-archive
4. Roundtable and/or Questions	• Rather than focus on just filtration (MERV 13), HVAC specialist reiterated that HVAC systems need to be viewed holistically (outdoor air supply, filtration, etc.) • HVAC specialist identified digital controls as an important aspect of new and upgraded HVAC systems. • Issues raised by school districts regarding prioritizing ventilation projects when applying for funding (e.g., determining whether to ventilate classrooms vs. entire schools).

5. Wrap-up/Items for Future Meetings	• Meeting #05, TBD
	• Items for future meetings:
	  ○ Discussion on how long to continue VTAP meetings going forward
	  ○ Review of next iteration of Best Practices Guideline for Ventilation in BC Schools.
	  ○ Time: TBD
	• Location: Video Conference Call

6. Adjournment	• Meeting adjourned at 1:46pm.

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF EDUCATION

CONTRACT AMENDMENT # 1

Contract Number: C22-7368

This AGREEMENT dated for reference the 11th day of April, 2022

BETWEEN: **HER MAJESTY THE QUEEN IN RIGHT OF THE PROVINCE OF BRITISH COLUMBIA represented by the Minister of Education and Child Care**
(herein called the "Province")

OF THE FIRST PART

AND:

STEPHEN MCNICHOLLS CONSULTING INC. (SMCN CONSULTING INC.)
(herein called the "Contractor" or "Recipient")

OF THE SECOND PART

WITNESS THAT WHEREAS:

A. The parties hereto entered in an Agreement dated for reference the 14th day of December, 2021, a copy of which is attached hereto as Appendix "1" (hereinafter called the "Agreement"),

B. **AND WHEREAS** the parties have agreed to amend the Agreement.

NOW THEREFORE in consideration of the covenants and agreements herein contained, the parties agree as follows:

(1) That Schedule 'A', Part 1 – Term, shall be amended to read as follows:

1. The term of this Agreement commences on December 17, 2021 and ends on July 17, 2022.

(2) That, in all other respects, the terms and conditions of the Agreement remain unchanged.

The parties hereto have executed this Agreement on the day and year as set out above.

SIGNED AND DELIVERED by the Contractor or Recipient or by an Authorized Representative:	**SIGNED AND DELIVERED** on behalf of the Province by an authorized representative of the Province.
Stephen McNicholls, P.Eng.	Francois Bertrand, Executive Director
(Print Name)	**(Print Name)**
	
(Signature)	**(Signature)**

Report #12 on Ventilation Activities
As of April 28, 2022

GENERAL OVERVIEW:

Federal Ventilation Funds Update:

- EDUC staff reached out to all 60 school districts to gain a better understanding of how the federal ventilation funds will be spent.
- Most districts have determined how they are using the funds, while some are still in the process.
- As the table below indicates, a significant proportion of the funds are going towards standalone HEPA filtration units, which should be sufficient to address all occupied classrooms (including portables) in the province without mechanical ventilation systems.
- The 60 school districts surveyed committed to purchasing 1,767 portable HEPA filtration units and over 95% of the units have already been installed.
- Of 60 school districts, less than 5% of these classrooms currently don't have mechanical ventilation systems.
- Funds are also being used to purchase MERV filters, update HVAC system controls and cover increased utility cost associated with greater outdoor air circulation in schools which align with HVAC consultant recommendations and eligible use of funds.
- Detailed reporting from school districts on the use of the funds will follow, but it is too early at this point given that some school districts are still determining how to use the funds.
- See Table 1 for further details on use of federal funds.

School District Ventilation Reporting & BCTF Comments:

- BCTF had comments on school ventilation reporting for 29 school districts and EDUC staff have followed up with all 29 school districts regarding these concerns.
- EDUC staff have reviewed the 1400+ school ventilation reports that are on school district websites against comments provided by the BCTF and general requirements.
- Many school districts have updated their school ventilation reports to address the BCTF comments, but 3 are still in the process.
- Detailed information regarding the status of addressing BCTF comments by each school district is included in Table 2.
- EDUC staff have reviewed school ventilation reports of the 31 remaining school districts. All 31 school districts' reports were reviewed and are included in Table 3. Minor issues were identified with 5 of these reports which are in the process of being addressed.
- EDUC staff have reached out to all school districts with outstanding ventilation reporting issues and requested updates to these online reports.

Ventilation Technical Advisory Panel Update:

- The primary purpose of the Ventilation Technical Advisory Panel is to advise EDUC and school districts on ventilation enhancements relating to public health goals, including mitigation of COVID-19, with a view to broader shared objectives relating to supporting student success and climate preparedness and adaptation.
- Members include select school districts, independent school representatives, EDUC's contracted HVAC expert and Medical Health Officers.
- Four Ventilation Technical Advisory Panel (VTAP) meetings have been held over the past five months.
- The next VTAP meeting is planned for the third week of May, with exact date to be determined.

Report #12 on Ventilation Activities
As of April 28, 2022

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School District	Status and Next Steps
SD 5 Southeast Kootenay	- Classrooms without mechanical ventilation: 0 - Funds used for 91 HEPA filter units - HEPA filter units already installed
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SD 8 Kootenay Lake	- Classrooms without mechanical ventilation: 2 - HEPA filter units were previously installed in 2 classrooms - Funds will used to upgrade existing ventilation systems
SD 10 Arrow Lakes	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 19 Revelstoke	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 20 Kootenay-Columbia	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade existing ventilation systems
SD 22 Vernon	- Classrooms without mechanical ventilation: 0 - Funds potentially used for utility costs and ionization technology
SD 23 Central Okanagan	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs, filters and system controls
SD 27 Cariboo-Chilcotin	- Classrooms without mechanical ventilation: TBC - Funds used towards installing 38 HEPA filter units and filters - HEPA filter units already installed
SD 28 Quesnel	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will be used for HEPA filter units and replacing rooftop ventilation units
SD 33 Chilliwack	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs and filter upgrades
SD 34 Abbotsford	- Classrooms without mechanical ventilation: 50 - HEPA filters were installed in classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for filters and system calibration
SD35 Langley	- Classrooms without mechanical ventilation: 0 - Funds will be used for systems controls, filters, and duct cleaning
SD 36 Surrey	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade ventilation systems
SD 37 Delta	- Classrooms without mechanical ventilation: 30 (including 16 portables) - HEPA filters were installed in 14 classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for 16 HEPA filter units, system controls and rooftop ventilation units - HEPA filter units already installed
SD 38 Richmond	- Classrooms without mechanical ventilation: 186 - Funds used for 293 HEPA filter units - HEPA filter units already installed

SD 39 Vancouver	- Classrooms without mechanical ventilation: 20 – 30 (all portables) - Funds will be used for 20-30 HEPA filter units and ventilation system upgrades in portables - HEPA filter units already installed
SD 40 New Westminster	- Classrooms without mechanical ventilation: 64 (including 40 portables) - Funds used for 64 HEPA filter units and remaining funds if any will be used for ventilation upgrades - HEPA filter units already installed
SD 41 Burnaby	- Classrooms without mechanical ventilation: 280 - Funds used for 350 HEPA filter units - HEPA filter units already installed
SD 42 Maple Ridge - Pitt Meadows	- Classrooms without mechanical ventilation: 25 (all portables) - Funds used for 26 HEPA filter units, filters, system controls and utility costs - HEPA filter units already installed
SD 43 Coquitlam	- Classrooms without mechanical ventilation: 11 classrooms in schools and all portables - Funds used for 235 HEPA filter units and if there are any remaining funds it is for minor ventilation system upgrades - HEPA filter units already installed
SD 44 North Vancouver	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation upgrades, filters and utility costs
SD 45 West Vancouver	- Classrooms without mechanical ventilation: 44 - Funds will be used for 44 HEPA filters already installed, remaining funds TBC
SD 46 Sunshine Coast	- Classrooms without mechanical ventilation: 0 - Funds to be used for ventilation upgrades
SD 47 Powell River	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase HEPA filter units, 3 units installed to date
SD 48 Sea to Sky	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation system upgrades and utility costs
SD 49 Central Coast	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will potentially be used for HEPA filter units and ventilation system upgrades
SD 50 Haida Gwaii	- Classrooms without mechanical ventilation: 0 - Funds will be used towards HEPA filter units and ventilation system upgrades - SD has ordered 5 HEPA filters and they are installed
SD 51 Boundary	- Classrooms without mechanical ventilation: 0 - Funds will be used for 2 HEPA filter units, filters, ventilation system upgrades and any remaining funds for utility costs - HEPA filter units already installed
SD 52 Prince Rupert	- Classrooms without mechanical ventilation: 0 - Funds used for 13 HEPA filter units and increased utility costs - 13 HEPA filter units have already been installed
SD 53 Okanagan Similkameen	- Classrooms without mechanical ventilation: 0 - Funds used for utility costs, filters and potentially HEPA filter units
SD 54 Bulkley Valley	- Classrooms without mechanical ventilation: approx. 6 classrooms and 4 portables. Only one is a full-time classroom. - Funds used to purchase 12 HEPA filter units and filters - All HEPA filter units already installed

SD 57 Prince George	- Classrooms without mechanical ventilation: 0 - Funds used for 120 HEPA filter units and filters - HEPA filter units already installed
SD58 Nicola-Similkameen	- Classrooms without mechanical ventilation: 0 - Consulting mechanical engineer to determine how to spend the funds
SD 59 Peace River South	- Classrooms without mechanical ventilation: 4 portables and an annex - Funds used to purchase 120 HEPA filter units and filters - Units are delivered and installed.
SD 60 Peace River North	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase MERV-13 filters and remaining funds TBC
SD 61 Greater Victoria	- Classrooms without mechanical ventilation: School district staff are reviewing and TBC - Funds to be used for HEPA filter units in occupied classrooms without mechanical ventilation and ventilation upgrades
SD 62 Sooke	- Classrooms without mechanical ventilation: less than 10 - Funds used for 10 HEPA filter units, filters, and duct cleaning - HEPA filter units already installed
SD 63 Saanich	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs
SD 64 – Gulf Islands	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs - Previously purchased 6 HEPA filter units which are operating in spaces without optimal ventilation
SD 67 Okanagan Skaha	- Classrooms without mechanical ventilation: 0 - Funds will be used towards upgrading ventilation systems
SD 68 Nanaimo-Ladysmith	- Classrooms without mechanical ventilation: 12 - HEPA filters were previously installed in classrooms without mechanical ventilation - Funds used for heat pumps and filters
SD 69 Qualicum	- Classrooms without mechanical ventilation: 0 - Funds will be used for duct cleaning
SD70 Pacific Rim	- Classrooms without mechanical ventilation: 7 (portables) - Funds used for 7 HEPA filter units, filters, duct cleaning and utility costs - HEPA filter units already installed
SD71 Comox Valley	- Classrooms without mechanical ventilation: 0 - Funds used for 150 HEPA filter units and filters - HEPA filter units already installed
SD72 Campbell River	- Classrooms without mechanical ventilation: 22 - Funds used for 63 HEPA filter units and ventilation upgrades - HEPA filter units already installed
SD 73 Kamloops-Thompson	- Classrooms without mechanical ventilation: 0 - Funds will be used for system controls, filters and utility costs
SD74 Gold Trail	- Classrooms without mechanical ventilation: 0 - Funds will be used for 12 HEPA filter units, filters, and ventilation in portables - 12 HEPA filter units already installed
SD 75 Mission	- Classrooms without mechanical ventilation: 0 - Funds used towards purchasing 15-18 HEPA filter units for all portables, ventilation upgrades and purchasing filters

	- HEPA filter units already installed
SD 78 Fraser Cascade	- Classrooms without mechanical ventilation: 0 - Funds will be used for upgrading ventilation systems
SD 79 Cowichan Valley	- Classrooms without mechanical ventilation: 9 - Funds used for 25 HEPA filter units and ventilation system upgrades - Units are installed
SD81 Fort Nelson	- Classrooms without mechanical ventilation: 0 - Funds will be used for upgrading ventilation systems
SD 82 Coast Mountains	- Classrooms without mechanical ventilation: 68 - Funds used for 80 HEPA filter units - 80 HEPA filter units already installed
SD 83 North Okanagan-Shuswap	- Classrooms without mechanical ventilation: approx. 6 - Funds used for 100 HEPA filter units - 100 HEPA filter units already installed
SD 84 Vancouver Island West	- Classrooms without mechanical ventilation: 2 - Funds used for 2 HEPA filter units and ventilation system upgrades - Units are installed
SD 85 Vancouver Island North	- Classrooms without mechanical ventilation: 6 including 1 portable - Funds will be used for 9 HEPA filter units and potentially ventilation system upgrades with remaining funds
SD87 - Stikine	- Classrooms without mechanical ventilation: 0 - Funds will likely be used for filters, ventilation system upgrades, duct cleaning and utility costs
SD 91 Nechako Lakes	- Classrooms without mechanical ventilation: 12 - Fund use TBC
SD92 Nisga'a	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters
SD 93 CSF	- Classrooms without mechanical ventilation: 50 - Funds used for 50 HEPA filter units - HEPA filter units already installed

Table 2: DETAILED REPORT ON SCHOOL DISTRICT VENTILATION REPORTING & BCTF COMMENTS

School District	**BCTF Comments**	**Addressed In SD Reporting (Yes/No)**	**Items Addressed/Not Addressed**
SD 05 – Southeast Kootenay*	- No information for Jaffray Elementary Junior Secondary or Fernie Secondary - Identical statement for all schools regarding engineer's recommendation of not going to MERV 13.	No - EDUC following up with school district	- Reporting doesn't have site-specific information; all schools have identical messaging. - Reporting still missing for Fernie Secondary and Jaffray Elementary Junior Secondary.

SD 06 - Rocky Mountain*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 22 – Vernon*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 23 - Central Okanagan	- Increased outside air circulation in schools during winter months is not possible - Unknown filters in schools	Yes	-Reporting identifies MERV 13 filters in all schools. - Reporting identifies increased supply of outside air supply in all schools. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 28 – Quesnel*	- No specific feedback provided.	N/A	N/A
SD 33 - Chilliwack	- No site-specific information. - Unclear whether MERV-13 are in all schools.	Yes	- Reporting confirms MERV 13 in all schools.
SD 34 – Abbotsford*	- No specific feedback provided.	N/A	N/A
SD 36 – Surrey*	- Unknown filters in schools	Yes	- Reporting identifies a mix of MERV 13, 10, and 8 in schools.
SD 37 – Delta*	- Increased outside air circulation in schools during winter months is not possible - Confusing statement for Delta Manor: “Air handling units include MERV 13 filters. Filters are included in unit’s ventilators, but they are not MERV 13 (we focussed on increased fresh air ventilation instead of increased filtration).”	Yes	- Reporting provides confusing statement regarding Delta Manor has not yet been addressed. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting states school district has MERV 13 filters in gyms and MERV 10 filters in some schools. Other schools have MERV 10 filters throughout, and some have MERV 13 throughout
SD 38 – Richmond*	- No specific feedback provided.	N/A	N/A
SD 43 – Coquitlam*	- “(Fresh air supply) increased to 100% throughout summer season. Scaled it back in Oct 11th week, due to cold weather.” Unclear what	Yes	- Reporting identifies mitigation strategies to increase outdoor air supply. EDUC staff spoke with the Facilities Director and increased

	other mitigations are replacing the fresh air supply.		outdoor air circulation within facilities continues despite cold temperatures.
SD 44 – North Vancouver*	- "All ventilation systems have been programmed district-wide to utilize the maximum amount of outdoor air possible. This would mean that most systems are providing 100% outdoor air." Not feasible year-round. Other mitigations unclear. - Unknown filters in schools	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting identifies schools using MERV 13, some MERV 10.
SD 48 – Sea to Sky	- "MERV – 13 filters installed in all air-handling units in all schools": Does this mean all schools have MERV 13 filters in place? - "Portable Dyson HEPA Air Scrubbers – to be deployed where required": Since the forms are specific to individual schools it should be listed the schools that have them and the number. - Unknown filters in schools	Yes	- Reporting identifies MERV 13s in all schools, and addresses where HEPA filters are used.
SD 49 – Central Coast*	- Wuikinux Elementary School: The school does not have HVAC system. Wuikinux Nation is responsible for heating system maintenance according to Local Education Agreement (LEA). No information provided including inspection dates. - Shearwater Elementary: "The school does not have HVAC system. Oil furnace is in place for heating". No dates for inspections—they happen daily. "Furnace and heat pump upgrade in progress": More information should be available.	No - EDUC following up with school district	- No update from SD and no further information available on SD website.
SD 51 – Boundary	- Currently using MERV 8 and are working on upgrading to a higher MERV value: This information may need to be updated.	Yes	- Reporting confirms filters in all schools are MERV 13 or in process of being upgraded to MERV 13 from MERV 11.
SD 52 – Prince Rupert*	- Unknown filters in schools	Yes	- Reporting identifies the use of MERV 8 in all schools.

SD 54 Bulkley Valley*	- Increased outside air circulation in schools during winter months is not possible - MERV 8 filters in all but 2 schools	Yes	- Reporting identifies upgrades to MERV 13 filters in renovated areas, with MERV 8 found in remaining spaces. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 57 Prince George*	- Same mitigations in all schools: Providing the maximum amount of outside air to improve ventilation. (Not feasible year-round.)	Yes	- Reporting identifies use of MERV 8 filters in all schools, except Kelly Road Secondary (MERV 13). - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD58 - Nicola-Similkameen*	- Information same for all schools. - Were MERV 13's installed in any schools?	Yes	- Reporting identifies that no MERV 13 filters have yet been installed; school district in process of assessing suitability of MERV 13 in schools.
SD61 – Greater Victoria*	- No specific feedback provided.	N/A	N/A
SD62 – Sooke*	- Inspection reports only identify the year and month.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD70 – Pacific Rim*	- Inspections only identified by seasons. - Information is the same for all schools and is not site specific.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD71 – Comox Valley*	- "The majority of HVAC filters are MERV10. Where the HVAC unit is engineered to accept MERV-13 filters they are installed. Approximately five percent of HVAC units in schools can accept this size and grade of filter." General statement for all schools not site-specific. The schools included in the 'approximately' 5% are not identified.	No - EDUC following up with school district	- Reporting pertaining to site-specific ventilation is not provided, and which schools can accommodate MERV 13 filters is not identified.
SD72 – Campbell River	- Combination of MERV-10 and 13. It's the same statement for all	Yes	- Reporting confirms that all conversions from MERV 10s to MERV 13s is complete.

	schools with the % changing depending on the school. Timelines are unclear: "Direction received to replace MERV-10 filters with MERV-13 as existing stock is used. 25% complete." - "Engineering study required to quantify effectiveness of other technologies that might be feasible for ventilation system": Unclear whether this is in progress.		- Reporting suggests that engineering study to assess effectiveness of other technologies for ventilation is not yet underway.
SD81 – Fort Nelson*	- Main mitigation used is windows that open. Not all rooms in all schools have windows that open. Also indicates increase air flow depending on ambient temperature. This is not feasible as a mitigation in Fort Nelson year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD82 – Coast Mountains*	- Increase outside air intake for more fresh air and air exchanges. Extend HVAC running schedule (to exchange air prior to occupancy). This is the only mitigation in all schools. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD83 – North Okanagan-Shuswap*	- "Variable 15% – 100% fresh air supplied to the classrooms based on the CO2 levels. Windows can be opened for more fresh air as needed during the day": Same mitigations for all schools. No site-specific information included. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD85 – Vancouver Island North*	- Unknown filters in schools - "MERV13 Filters installed everywhere they are where compatible with existing equipment" No site specific information. - Missing some inspection dates. - Outside air intake appears to be the only mitigation. - Cheslakee's Elementary: Units have outside air intakes, but some are stuck in manual. Unclear whether this has been repaired.	Yes	- Reporting identifies use of site specific MERV filters in all schools. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

SD91 – Nechako Lakes*	- "There has been up to a 75% increase in the volume of outside air relative to the ASHRAE minimum" Only mitigation.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

*Due to HVAC infrastructure compatibility issues, not all school districts are able to accommodate MERV 13 filters in all their schools but other mitigation measures such as increased outdoor air supply are being utilized to improve indoor air quality.

Table 3: REPORT ON SCHOOL DISTRICT VENTILATION REPORTING

School District	**Meets Reporting Requirements? (Yes/No)**	**Information Outstanding**
SD08 - Kootenay Lake	Yes	N/A
SD10 - Arrow Lakes	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD19 - Revelstoke	Yes	N/A
SD20 - Kootenay-Columbia	Yes	N/A
SD27 - Cariboo-Chilcotin	Yes	N/A
SD35 - Langley	Yes	N/A
SD39 - Vancouver	Yes	N/A
SD40 - New Westminster	Yes	N/A
SD41 - Burnaby	Yes	N/A
SD42 - Maple Ridge-Pitt Meadows	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD45 - West Vancouver	Yes	N/A
SD46 - Sunshine Coast	Yes	N/A
SD47 - Powell River	Yes	N/A
SD50 - Haida Gwaii	Yes	N/A
SD53 - Okanagan-Similkameen	Yes	N/A
SD59 – Peace River South	Yes	N/A
SD60 – Peace River North	Yes	N/A
SD63 - Saanich	Yes	N/A

SD64 – Gulf Islands	Yes	N/A
SD67 – Okanagan-Skaha	Yes	N/A
SD68 – Nanaimo-Ladysmith	Yes	N/A
SD69 – Qualicum	Yes	N/A
SD73 – Kamloops-Thompson	Yes	N/A
SD74 – Gold Trail	Yes	N/A
SD75 – Mission	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD78 – Fraser-Cascade	Yes	N/A
SD79 – Cowichan Valley	Yes	N/A
SD84 – Vancouver Island West	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD87 - Stikine	Yes	N/A
SD92 – Nisga'a	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD93 – Conseil Scolaire Francophone	Yes	N/A

Report #13 on Ventilation Activities
As of May 5, 2022

GENERAL OVERVIEW:

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- Most districts have determined how they are using the funds, while some are still in the process.
- As the table below indicates, a significant proportion of the funds are going towards standalone HEPA filtration units, which should be sufficient to address all occupied classrooms (including portables) in the province without mechanical ventilation systems.
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SD 79 Cowichan Valley	- Classrooms without mechanical ventilation: 9 - Funds used for 25 HEPA filter units and ventilation system upgrades - Units are installed
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SD 82 Coast Mountains	- Classrooms without mechanical ventilation: 68 - Funds used for 80 HEPA filter units - 80 HEPA filter units already installed
SD 83 North Okanagan-Shuswap	- Classrooms without mechanical ventilation: approx. 6 - Funds used for 100 HEPA filter units - 100 HEPA filter units already installed
SD 84 Vancouver Island West	- Classrooms without mechanical ventilation: 2 - Funds used for 2 HEPA filter units and ventilation system upgrades - Units are installed
SD 85 Vancouver Island North	- Classrooms without mechanical ventilation: 6 including 1 portable - Funds will be used for 9 HEPA filter units and potentially ventilation system upgrades with remaining funds
SD87 - Stikine	- Classrooms without mechanical ventilation: 0 - Funds will likely be used for filters, ventilation system upgrades, duct cleaning and utility costs
SD 91 Nechako Lakes	- Classrooms without mechanical ventilation: 12 - Fund use TBC
SD92 Nisga'a	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters
SD 93 CSF	- Classrooms without mechanical ventilation: 50 - Funds used for 50 HEPA filter units - HEPA filter units already installed

Table 2: DETAILED REPORT ON SCHOOL DISTRICT VENTILATION REPORTING & BCTF COMMENTS

School District	**BCTF Comments**	**Addressed In SD Reporting (Yes/No)**	**Items Addressed/Not Addressed**
SD 05 – Southeast Kootenay*	- No information for Jaffray Elementary Junior Secondary or Fernie Secondary - Identical statement for all schools regarding engineer's recommendation of not going to MERV 13.	No - EDUC following up with school district	- Reporting doesn't have site-specific information; all schools have identical messaging. - Reporting still missing for Fernie Secondary and Jaffray Elementary Junior Secondary.

SD 06 - Rocky Mountain*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 22 – Vernon*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 23 - Central Okanagan	- Increased outside air circulation in schools during winter months is not possible - Unknown filters in schools	Yes	-Reporting identifies MERV 13 filters in all schools. - Reporting identifies increased supply of outside air supply in all schools. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 28 – Quesnel*	- No specific feedback provided.	N/A	N/A
SD 33 - Chilliwack	- No site-specific information. - Unclear whether MERV-13 are in all schools.	Yes	- Reporting confirms MERV 13 in all schools.
SD 34 – Abbotsford*	- No specific feedback provided.	N/A	N/A
SD 36 – Surrey*	- Unknown filters in schools	Yes	- Reporting identifies a mix of MERV 13, 10, and 8 in schools.
SD 37 – Delta*	- Increased outside air circulation in schools during winter months is not possible - Confusing statement for Delta Manor: “Air handling units include MERV 13 filters. Filters are included in unit’s ventilators, but they are not MERV 13 (we focussed on increased fresh air ventilation instead of increased filtration).”	Yes	- Reporting addressed confusing statement regarding Delta Manor. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting states school district has MERV 13 filters in gyms and MERV 10 filters in some schools. Other schools have MERV 10 filters throughout, and some have MERV 13 throughout
SD 38 – Richmond*	- No specific feedback provided.	N/A	N/A
SD 43 – Coquitlam*	- “(Fresh air supply) increased to 100% throughout summer season. Scaled it back in Oct 11th week, due to cold weather.” Unclear what	Yes	- Reporting identifies mitigation strategies to increase outdoor air supply. EDUC staff spoke with the Facilities Director and increased

	other mitigations are replacing the fresh air supply.		outdoor air circulation within facilities continues despite cold temperatures.
SD 44 – North Vancouver*	- "All ventilation systems have been programmed district-wide to utilize the maximum amount of outdoor air possible. This would mean that most systems are providing 100% outdoor air." Not feasible year-round. Other mitigations unclear. - Unknown filters in schools	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting identifies schools using MERV 13, some MERV 10.
SD 48 – Sea to Sky	- "MERV – 13 filters installed in all air-handling units in all schools": Does this mean all schools have MERV 13 filters in place? - "Portable Dyson HEPA Air Scrubbers – to be deployed where required": Since the forms are specific to individual schools it should be listed the schools that have them and the number. - Unknown filters in schools	Yes	- Reporting identifies MERV 13s in all schools, and addresses where HEPA filters are used.
SD 49 – Central Coast*	- Wuikinux Elementary School: The school does not have HVAC system. Wuikinux Nation is responsible for heating system maintenance according to Local Education Agreement (LEA). No information provided including inspection dates. - Shearwater Elementary: "The school does not have HVAC system. Oil furnace is in place for heating". No dates for inspections—they happen daily. "Furnace and heat pump upgrade in progress": More information should be available.	No - EDUC following up with school district	- No update from SD and no further information available on SD website.
SD 51 – Boundary	- Currently using MERV 8 and are working on upgrading to a higher MERV value: This information may need to be updated.	Yes	- Reporting confirms filters in all schools are MERV 13 or in process of being upgraded to MERV 13 from MERV 11.
SD 52 – Prince Rupert*	- Unknown filters in schools	Yes	- Reporting identifies the use of MERV 8 in all schools.

SD 54 Bulkley Valley*	- Increased outside air circulation in schools during winter months is not possible - MERV 8 filters in all but 2 schools	Yes	- Reporting identifies upgrades to MERV 13 filters in renovated areas, with MERV 8 found in remaining spaces. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 57 Prince George*	- Same mitigations in all schools: Providing the maximum amount of outside air to improve ventilation. (Not feasible year-round.)	Yes	- Reporting identifies use of MERV 8 filters in all schools, except Kelly Road Secondary (MERV 13). - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD58 - Nicola-Similkameen*	- Information same for all schools. - Were MERV 13's installed in any schools?	Yes	- Reporting identifies that no MERV 13 filters have yet been installed; school district in process of assessing suitability of MERV 13 in schools.
SD61 – Greater Victoria*	- No specific feedback provided.	N/A	N/A
SD62 – Sooke*	- Inspection reports only identify the year and month.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD70 – Pacific Rim*	- Inspections only identified by seasons. - Information is the same for all schools and is not site specific.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD71 – Comox Valley*	- "The majority of HVAC filters are MERV10. Where the HVAC unit is engineered to accept MERV-13 filters they are installed. Approximately five percent of HVAC units in schools can accept this size and grade of filter." General statement for all schools not site-specific. The schools included in the 'approximately' 5% are not identified.	Yes	- Reporting identifies use of specific filters in all schools.
SD72 – Campbell River	- Combination of MERV-10 and 13. It's the same statement for all	Yes	- Reporting confirms that all conversions from MERV 10s to MERV 13s is complete.

	schools with the % changing depending on the school. Timelines are unclear: "Direction received to replace MERV-10 filters with MERV-13 as existing stock is used. 25% complete." - "Engineering study required to quantify effectiveness of other technologies that might be feasible for ventilation system": Unclear whether this is in progress.		- Reporting suggests that engineering study to assess effectiveness of other technologies for ventilation is not yet underway.
SD81 – Fort Nelson*	- Main mitigation used is windows that open. Not all rooms in all schools have windows that open. Also indicates increase air flow depending on ambient temperature. This is not feasible as a mitigation in Fort Nelson year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD82 – Coast Mountains*	- Increase outside air intake for more fresh air and air exchanges. Extend HVAC running schedule (to exchange air prior to occupancy). This is the only mitigation in all schools. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD83 – North Okanagan-Shuswap*	- "Variable 15% – 100% fresh air supplied to the classrooms based on the CO2 levels. Windows can be opened for more fresh air as needed during the day": Same mitigations for all schools. No site-specific information included. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD85 – Vancouver Island North*	- Unknown filters in schools - "MERV13 Filters installed everywhere they are where compatible with existing equipment" No site specific information. - Missing some inspection dates. - Outside air intake appears to be the only mitigation. - Cheslakee's Elementary: Units have outside air intakes, but some are stuck in manual. Unclear whether this has been repaired.	Yes	- Reporting identifies use of site specific MERV filters in all schools. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

SD91 – Nechako Lakes*	- "There has been up to a 75% increase in the volume of outside air relative to the ASHRAE minimum" Only mitigation.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

*Due to HVAC infrastructure compatibility issues, not all school districts are able to accommodate MERV 13 filters in all their schools but other mitigation measures such as increased outdoor air supply are being utilized to improve indoor air quality.

Table 3: REPORT ON SCHOOL DISTRICT VENTILATION REPORTING

School District	**Meets Reporting Requirements? (Yes/No)**	**Information Outstanding**
SD08 - Kootenay Lake	Yes	N/A
SD10 - Arrow Lakes	Yes	N/A
SD19 - Revelstoke	Yes	N/A
SD20 - Kootenay-Columbia	Yes	N/A
SD27 - Cariboo-Chilcotin	Yes	N/A
SD35 - Langley	Yes	N/A
SD39 - Vancouver	Yes	N/A
SD40 - New Westminster	Yes	N/A
SD41 - Burnaby	Yes	N/A
SD42 - Maple Ridge-Pitt Meadows	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD45 - West Vancouver	Yes	N/A
SD46 - Sunshine Coast	Yes	N/A
SD47 - Powell River	Yes	N/A
SD50 - Haida Gwaii	Yes	N/A
SD53 - Okanagan-Similkameen	Yes	N/A
SD59 – Peace River South	Yes	N/A
SD60 – Peace River North	Yes	N/A
SD63 - Saanich	Yes	N/A

SD64 – Gulf Islands	Yes	N/A
SD67 – Okanagan-Skaha	Yes	N/A
SD68 – Nanaimo-Ladysmith	Yes	N/A
SD69 – Qualicum	Yes	N/A
SD73 – Kamloops-Thompson	Yes	N/A
SD74 – Gold Trail	Yes	N/A
SD75 – Mission	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD78 – Fraser-Cascade	Yes	N/A
SD79 – Cowichan Valley	Yes	N/A
SD84 – Vancouver Island West	Yes	N/A
SD87 - Stikine	Yes	N/A
SD92 – Nisga'a	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD93 – Conseil Scolaire Francophone	Yes	N/A

Report #14 on Ventilation Activities
As of May 12, 2022

GENERAL OVERVIEW:

Federal Ventilation Funds Update:

- EDUC staff reached out to all 60 school districts to gain a better understanding of how the federal ventilation funds will be spent.
- Most districts have determined how they are using the funds, while some are still in the process.
- As the table below indicates, a significant proportion of the funds are going towards standalone HEPA filtration units, which should be sufficient to address all occupied classrooms (including portables) in the province without mechanical ventilation systems.
- The 60 school districts surveyed committed to purchasing 1,767 portable HEPA filtration units and over 95% of the units have already been installed.
- Of 60 school districts, less than 5% of these classrooms currently don't have mechanical ventilation systems.
- Funds are also being used to purchase MERV filters, update HVAC system controls and cover increased utility cost associated with greater outdoor air circulation in schools which align with HVAC consultant recommendations and eligible use of funds.
- Detailed reporting from school districts on the use of the funds will follow, but it is too early at this point given that some school districts are still determining how to use the funds.
- See Table 1 for further details on use of federal funds.

School District Ventilation Reporting & BCTF Comments:

- BCTF had comments on school ventilation reporting for 29 school districts and EDUC staff have followed up with all 29 school districts regarding these concerns.
- EDUC staff have reviewed the 1400+ school ventilation reports that are on school district websites against comments provided by the BCTF and general requirements.
- Many school districts have updated their school ventilation reports to address the BCTF comments, but 2 are still in the process.
- Detailed information regarding the status of addressing BCTF comments by each school district is included in Table 2.
- EDUC staff have reviewed school ventilation reports of the 31 remaining school districts. All 31 school districts' reports were reviewed and are included in Table 3. Minor issues were identified with 3 of these reports which are in the process of being addressed.
- EDUC staff have reached out to all school districts with outstanding ventilation reporting issues and requested updates to these online reports.

Ventilation Technical Advisory Panel Update:

- The primary purpose of the Ventilation Technical Advisory Panel is to advise EDUC and school districts on ventilation enhancements relating to public health goals, including mitigation of COVID-19, with a view to broader shared objectives relating to supporting student success and climate preparedness and adaptation.
- Members include select school districts, independent school representatives, EDUC's contracted HVAC expert and Medical Health Officers.
- Four Ventilation Technical Advisory Panel (VTAP) meetings have been held over the past five months.
- The next VTAP meeting is planned for May 18, 2022 from 1:00-2:00pm.

Report #14 on Ventilation Activities
As of May 12, 2022

Table 1: DETAILED REPORT ON FEDERAL VENTILATION FUNDS

School District	Status and Next Steps
SD 5 Southeast Kootenay	- Classrooms without mechanical ventilation: 0 - Funds used for 91 HEPA filter units - HEPA filter units already installed
SD 6 Rocky Mountain	- Classrooms without mechanical ventilation: 0 - Funds potentially used towards air handling units and HEPA filter units in common areas
SD 8 Kootenay Lake	- Classrooms without mechanical ventilation: 2 - HEPA filter units were previously installed in 2 classrooms - Funds will used to upgrade existing ventilation systems
SD 10 Arrow Lakes	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 19 Revelstoke	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase filters
SD 20 Kootenay-Columbia	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade existing ventilation systems
SD 22 Vernon	- Classrooms without mechanical ventilation: 0 - Funds potentially used for utility costs and ionization technology
SD 23 Central Okanagan	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs, filters and system controls
SD 27 Cariboo-Chilcotin	- Classrooms without mechanical ventilation: TBC - Funds used towards installing 38 HEPA filter units and filters - HEPA filter units already installed
SD 28 Quesnel	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will be used for HEPA filter units and replacing rooftop ventilation units
SD 33 Chilliwack	- Classrooms without mechanical ventilation: 0 - Funds will be used for utility costs and filter upgrades
SD 34 Abbotsford	- Classrooms without mechanical ventilation: 50 - HEPA filters were installed in classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for filters and system calibration
SD35 Langley	- Classrooms without mechanical ventilation: 0 - Funds will be used for systems controls, filters, and duct cleaning
SD 36 Surrey	- Classrooms without mechanical ventilation: 0 - Funds will be used to upgrade ventilation systems
SD 37 Delta	- Classrooms without mechanical ventilation: 30 (including 16 portables) - HEPA filters were installed in 14 classrooms without mechanical ventilation using previous installment of federal funding - Funds will be used for 16 HEPA filter units, system controls and rooftop ventilation units - HEPA filter units already installed
SD 38 Richmond	- Classrooms without mechanical ventilation: 186 - Funds used for 293 HEPA filter units - HEPA filter units already installed

SD 39 Vancouver	- Classrooms without mechanical ventilation: 20 – 30 (all portables) - Funds will be used for 20-30 HEPA filter units and ventilation system upgrades in portables - HEPA filter units already installed
SD 40 New Westminster	- Classrooms without mechanical ventilation: 64 (including 40 portables) - Funds used for 64 HEPA filter units and remaining funds if any will be used for ventilation upgrades - HEPA filter units already installed
SD 41 Burnaby	- Classrooms without mechanical ventilation: 280 - Funds used for 350 HEPA filter units - HEPA filter units already installed
SD 42 Maple Ridge - Pitt Meadows	- Classrooms without mechanical ventilation: 25 (all portables) - Funds used for 26 HEPA filter units, filters, system controls and utility costs - HEPA filter units already installed
SD 43 Coquitlam	- Classrooms without mechanical ventilation: 11 classrooms in schools and all portables - Funds used for 235 HEPA filter units and if there are any remaining funds it is for minor ventilation system upgrades - HEPA filter units already installed
SD 44 North Vancouver	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation upgrades, filters and utility costs
SD 45 West Vancouver	- Classrooms without mechanical ventilation: 44 - Funds will be used for 44 HEPA filters already installed, remaining funds TBC
SD 46 Sunshine Coast	- Classrooms without mechanical ventilation: 0 - Funds to be used for ventilation upgrades
SD 47 Powell River	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase HEPA filter units, 3 units installed to date
SD 48 Sea to Sky	- Classrooms without mechanical ventilation: 0 - Funds will potentially be used for ventilation system upgrades and utility costs
SD 49 Central Coast	- Classrooms without mechanical ventilation: less than 10 but TBC - Funds will potentially be used for HEPA filter units and ventilation system upgrades
SD 50 Haida Gwaii	- Classrooms without mechanical ventilation: 0 - Funds will be used towards HEPA filter units and ventilation system upgrades - SD has ordered 5 HEPA filters and they are installed
SD 51 Boundary	- Classrooms without mechanical ventilation: 0 - Funds will be used for 2 HEPA filter units, filters, ventilation system upgrades and any remaining funds for utility costs - HEPA filter units already installed
SD 52 Prince Rupert	- Classrooms without mechanical ventilation: 0 - Funds used for 13 HEPA filter units and increased utility costs - 13 HEPA filter units have already been installed
SD 53 Okanagan Similkameen	- Classrooms without mechanical ventilation: 0 - Funds used for utility costs, filters and potentially HEPA filter units
SD 54 Bulkley Valley	- Classrooms without mechanical ventilation: approx. 6 classrooms and 4 portables. Only one is a full-time classroom. - Funds used to purchase 12 HEPA filter units and filters - All HEPA filter units already installed

SD 57 Prince George	- Classrooms without mechanical ventilation: 0 - Funds used for 120 HEPA filter units and filters - HEPA filter units already installed
SD58 Nicola-Similkameen	- Classrooms without mechanical ventilation: 0 - Consulting mechanical engineer to determine how to spend the funds
SD 59 Peace River South	- Classrooms without mechanical ventilation: 4 portables and an annex - Funds used to purchase 120 HEPA filter units and filters - Units are delivered and installed.
SD 60 Peace River North	- Classrooms without mechanical ventilation: 0 - Funds will be used to purchase MERV-13 filters and remaining funds TBC
SD 61 Greater Victoria	- Classrooms without mechanical ventilation: School district staff are reviewing and TBC - Funds to be used for HEPA filter units in occupied classrooms without mechanical ventilation and ventilation upgrades
SD 62 Sooke	- Classrooms without mechanical ventilation: less than 10 - Funds used for 10 HEPA filter units, filters, and duct cleaning - HEPA filter units already installed
SD 63 Saanich	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs
SD 64 – Gulf Islands	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters and utility costs - Previously purchased 6 HEPA filter units which are operating in spaces without optimal ventilation
SD 67 Okanagan Skaha	- Classrooms without mechanical ventilation: 0 - Funds will be used towards upgrading ventilation systems
SD 68 Nanaimo-Ladysmith	- Classrooms without mechanical ventilation: 12 - HEPA filters were previously installed in classrooms without mechanical ventilation - Funds used for heat pumps and filters
SD 69 Qualicum	- Classrooms without mechanical ventilation: 0 - Funds will be used for duct cleaning
SD70 Pacific Rim	- Classrooms without mechanical ventilation: 7 (portables) - Funds used for 7 HEPA filter units, filters, duct cleaning and utility costs - HEPA filter units already installed
SD71 Comox Valley	- Classrooms without mechanical ventilation: 0 - Funds used for 150 HEPA filter units and filters - HEPA filter units already installed
SD72 Campbell River	- Classrooms without mechanical ventilation: 22 - Funds used for 63 HEPA filter units and ventilation upgrades - HEPA filter units already installed
SD 73 Kamloops-Thompson	- Classrooms without mechanical ventilation: 0 - Funds will be used for system controls, filters and utility costs
SD74 Gold Trail	- Classrooms without mechanical ventilation: 0 - Funds will be used for 12 HEPA filter units, filters, and ventilation in portables - 12 HEPA filter units already installed
SD 75 Mission	- Classrooms without mechanical ventilation: 0 - Funds used towards purchasing 15-18 HEPA filter units for all portables, ventilation upgrades and purchasing filters

	- HEPA filter units already installed
SD 78 Fraser Cascade	- Classrooms without mechanical ventilation: 0 - Funds will be used for upgrading ventilation systems
SD 79 Cowichan Valley	- Classrooms without mechanical ventilation: 9 - Funds used for 25 HEPA filter units and ventilation system upgrades - Units are installed
SD81 Fort Nelson	- Classrooms without mechanical ventilation: 0 - Funds will be used for upgrading ventilation systems
SD 82 Coast Mountains	- Classrooms without mechanical ventilation: 68 - Funds used for 80 HEPA filter units - 80 HEPA filter units already installed
SD 83 North Okanagan-Shuswap	- Classrooms without mechanical ventilation: approx. 6 - Funds used for 100 HEPA filter units - 100 HEPA filter units already installed
SD 84 Vancouver Island West	- Classrooms without mechanical ventilation: 2 - Funds used for 2 HEPA filter units and ventilation system upgrades - Units are installed
SD 85 Vancouver Island North	- Classrooms without mechanical ventilation: 6 including 1 portable - Funds will be used for 9 HEPA filter units and potentially ventilation system upgrades with remaining funds
SD87 - Stikine	- Classrooms without mechanical ventilation: 0 - Funds will likely be used for filters, ventilation system upgrades, duct cleaning and utility costs
SD 91 Nechako Lakes	- Classrooms without mechanical ventilation: 12 - Fund use TBC
SD92 Nisga'a	- Classrooms without mechanical ventilation: 0 - Funds will be used for filters
SD 93 CSF	- Classrooms without mechanical ventilation: 50 - Funds used for 50 HEPA filter units - HEPA filter units already installed

Table 2: DETAILED REPORT ON SCHOOL DISTRICT VENTILATION REPORTING & BCTF COMMENTS

School District	**BCTF Comments**	**Addressed In SD Reporting (Yes/No)**	**Items Addressed/Not Addressed**
SD 05 – Southeast Kootenay*	- No information for Jaffray Elementary Junior Secondary or Fernie Secondary - Identical statement for all schools regarding engineer's recommendation of not going to MERV 13.	No - EDUC following up with school district	- Reporting doesn't have site-specific information; all schools have identical messaging. - Reporting still missing for Fernie Secondary and Jaffray Elementary Junior Secondary.

SD 06 - Rocky Mountain*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 22 – Vernon*	- Increased outside air circulation in schools during winter months is not possible	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 23 - Central Okanagan	- Increased outside air circulation in schools during winter months is not possible - Unknown filters in schools	Yes	-Reporting identifies MERV 13 filters in all schools. - Reporting identifies increased supply of outside air supply in all schools. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 28 – Quesnel*	- No specific feedback provided.	N/A	N/A
SD 33 - Chilliwack	- No site-specific information. - Unclear whether MERV-13 are in all schools.	Yes	- Reporting confirms MERV 13 in all schools.
SD 34 – Abbotsford*	- No specific feedback provided.	N/A	N/A
SD 36 – Surrey*	- Unknown filters in schools	Yes	- Reporting identifies a mix of MERV 13, 10, and 8 in schools.
SD 37 – Delta*	- Increased outside air circulation in schools during winter months is not possible - Confusing statement for Delta Manor: “Air handling units include MERV 13 filters. Filters are included in unit’s ventilators, but they are not MERV 13 (we focussed on increased fresh air ventilation instead of increased filtration).”	Yes	- Reporting addressed confusing statement regarding Delta Manor. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting states school district has MERV 13 filters in gyms and MERV 10 filters in some schools. Other schools have MERV 10 filters throughout, and some have MERV 13 throughout
SD 38 – Richmond*	- No specific feedback provided.	N/A	N/A
SD 43 – Coquitlam*	- “(Fresh air supply) increased to 100% throughout summer season. Scaled it back in Oct 11th week, due to cold weather.” Unclear what	Yes	- Reporting identifies mitigation strategies to increase outdoor air supply. EDUC staff spoke with the Facilities Director and increased

	other mitigations are replacing the fresh air supply.		outdoor air circulation within facilities continues despite cold temperatures.
SD 44 – North Vancouver*	- "All ventilation systems have been programmed district-wide to utilize the maximum amount of outdoor air possible. This would mean that most systems are providing 100% outdoor air." Not feasible year-round. Other mitigations unclear. - Unknown filters in schools	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures. - Reporting identifies schools using MERV 13, some MERV 10.
SD 48 – Sea to Sky	- "MERV – 13 filters installed in all air-handling units in all schools": Does this mean all schools have MERV 13 filters in place? - "Portable Dyson HEPA Air Scrubbers – to be deployed where required": Since the forms are specific to individual schools it should be listed the schools that have them and the number. - Unknown filters in schools	Yes	- Reporting identifies MERV 13s in all schools, and addresses where HEPA filters are used.
SD 49 – Central Coast*	- Wuikinux Elementary School: The school does not have HVAC system. Wuikinux Nation is responsible for heating system maintenance according to Local Education Agreement (LEA). No information provided including inspection dates. - Shearwater Elementary: "The school does not have HVAC system. Oil furnace is in place for heating". No dates for inspections—they happen daily. "Furnace and heat pump upgrade in progress": More information should be available.	No - EDUC following up with school district	- No update from SD and no further information available on SD website.
SD 51 – Boundary	- Currently using MERV 8 and are working on upgrading to a higher MERV value: This information may need to be updated.	Yes	- Reporting confirms filters in all schools are MERV 13 or in process of being upgraded to MERV 13 from MERV 11.
SD 52 – Prince Rupert*	- Unknown filters in schools	Yes	- Reporting identifies the use of MERV 8 in all schools.

SD 54 Bulkley Valley*	- Increased outside air circulation in schools during winter months is not possible - MERV 8 filters in all but 2 schools	Yes	- Reporting identifies upgrades to MERV 13 filters in renovated areas, with MERV 8 found in remaining spaces. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD 57 Prince George*	- Same mitigations in all schools: Providing the maximum amount of outside air to improve ventilation. (Not feasible year-round.)	Yes	- Reporting identifies use of MERV 8 filters in all schools, except Kelly Road Secondary (MERV 13). - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD58 - Nicola-Similkameen*	- Information same for all schools. - Were MERV 13's installed in any schools?	Yes	- Reporting identifies that no MERV 13 filters have yet been installed; school district in process of assessing suitability of MERV 13 in schools.
SD61 – Greater Victoria*	- No specific feedback provided.	N/A	N/A
SD62 – Sooke*	- Inspection reports only identify the year and month.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD70 – Pacific Rim*	- Inspections only identified by seasons. - Information is the same for all schools and is not site specific.	Yes	- Reporting identifies frequency at which filters are inspected and changed.
SD71 – Comox Valley*	- "The majority of HVAC filters are MERV10. Where the HVAC unit is engineered to accept MERV-13 filters they are installed. Approximately five percent of HVAC units in schools can accept this size and grade of filter." General statement for all schools not site-specific. The schools included in the 'approximately' 5% are not identified.	Yes	- Reporting identifies use of specific filters in all schools.
SD72 – Campbell River	- Combination of MERV-10 and 13. It's the same statement for all	Yes	- Reporting confirms that all conversions from MERV 10s to MERV 13s is complete.

	schools with the % changing depending on the school. Timelines are unclear: "Direction received to replace MERV-10 filters with MERV-13 as existing stock is used. 25% complete." - "Engineering study required to quantify effectiveness of other technologies that might be feasible for ventilation system": Unclear whether this is in progress.		- Reporting suggests that engineering study to assess effectiveness of other technologies for ventilation is not yet underway.
SD81 – Fort Nelson*	- Main mitigation used is windows that open. Not all rooms in all schools have windows that open. Also indicates increase air flow depending on ambient temperature. This is not feasible as a mitigation in Fort Nelson year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD82 – Coast Mountains*	- Increase outside air intake for more fresh air and air exchanges. Extend HVAC running schedule (to exchange air prior to occupancy). This is the only mitigation in all schools. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD83 – North Okanagan-Shuswap*	- "Variable 15% – 100% fresh air supplied to the classrooms based on the CO2 levels. Windows can be opened for more fresh air as needed during the day": Same mitigations for all schools. No site-specific information included. Not feasible year-round.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.
SD85 – Vancouver Island North*	- Unknown filters in schools - "MERV13 Filters installed everywhere they are where compatible with existing equipment" No site specific information. - Missing some inspection dates. - Outside air intake appears to be the only mitigation. - Cheslakee's Elementary: Units have outside air intakes, but some are stuck in manual. Unclear whether this has been repaired.	Yes	- Reporting identifies use of site specific MERV filters in all schools. - Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

SD91 – Nechako Lakes*	- "There has been up to a 75% increase in the volume of outside air relative to the ASHRAE minimum" Only mitigation.	Yes	- Reporting identifies increased supply of outside air. EDUC staff spoke with the Facilities Director and increased outdoor air circulation within facilities continues despite cold temperatures.

*Due to HVAC infrastructure compatibility issues, not all school districts are able to accommodate MERV 13 filters in all their schools but other mitigation measures such as increased outdoor air supply are being utilized to improve indoor air quality.

Table 3: REPORT ON SCHOOL DISTRICT VENTILATION REPORTING

School District	**Meets Reporting Requirements? (Yes/No)**	**Information Outstanding**
SD08 - Kootenay Lake	Yes	N/A
SD10 - Arrow Lakes	Yes	N/A
SD19 - Revelstoke	Yes	N/A
SD20 - Kootenay-Columbia	Yes	N/A
SD27 - Cariboo-Chilcotin	Yes	N/A
SD35 - Langley	Yes	N/A
SD39 - Vancouver	Yes	N/A
SD40 - New Westminster	Yes	N/A
SD41 - Burnaby	Yes	N/A
SD42 - Maple Ridge-Pitt Meadows	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD45 - West Vancouver	Yes	N/A
SD46 - Sunshine Coast	Yes	N/A
SD47 - Powell River	Yes	N/A
SD50 - Haida Gwaii	Yes	N/A
SD53 - Okanagan-Similkameen	Yes	N/A
SD59 – Peace River South	Yes	N/A
SD60 – Peace River North	Yes	N/A
SD63 - Saanich	Yes	N/A

SD64 – Gulf Islands	Yes	N/A
SD67 – Okanagan-Skaha	Yes	N/A
SD68 – Nanaimo-Ladysmith	Yes	N/A
SD69 – Qualicum	Yes	N/A
SD73 – Kamloops-Thompson	Yes	N/A
SD74 – Gold Trail	Yes	N/A
SD75 – Mission	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD78 – Fraser-Cascade	Yes	N/A
SD79 – Cowichan Valley	Yes	N/A
SD84 – Vancouver Island West	Yes	N/A
SD87 - Stikine	Yes	N/A
SD92 – Nisga'a	No - EDUC following up with school district	Reporting does not specify filter change frequency.
SD93 – Conseil Scolaire Francophone	Yes	N/A

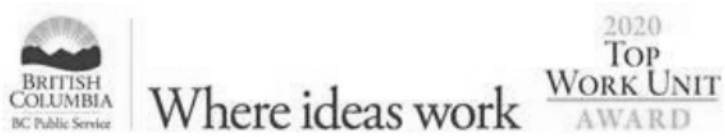
Best Practices Guidelines Ventilation in BC Schools

From:	Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To:	Stephen McNicholls <stephen@smcn.ca>
Cc:	Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Graham, Megan 1 EDUC:EX <Megan.Graham@gov.bc.ca>
Sent:	April 25, 2022 8:21:30 AM PDT
Attachments:	Best Practices Guidelines Ventilation in BC Schools.docx, image001.jpg

Hi Stephen,[s.22] If you send over a draft copy of the Best Practices Guidelines Ventilation in BC Schools sections that your team is working on or draft presentation for ASBO, please copy Ravnit and Megan (both cc'd on this email). Feel free to reach out if you have any questions. Thanks again for your help on this.

Damien

Damien Crowell | A/Director | Minor Capital Programs & Finance Unit | Ministry of Education
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca



Best Practice Guidelines: Ventilation in BC Schools

Since the beginning of the pandemic, a significant focus has been placed on improving ventilation in schools across the province. These efforts have assisted with mitigating COVID transmission, while improving air quality in support of student success.

To support ongoing improvements to ventilation in schools, the Ministry proposes to engage the Ventilation Technical Advisory Panel (VTAP) and its contracted HVAC advisor in collating a report outlining shared principles, best practices and guidelines for approaching ventilation improvements moving forward. The report will supplement requirements and standards, and be used to inform ongoing investments in ventilation systems moving forward.

1) Determining key drivers for HVAC improvements

   Beyond mitigating the spread of COVID-19, identify key drivers for ventilation improvement, such as extreme weather events and pollution. For example, schools at risk for poor air quality due to wildfire smoke or schools susceptible to heat waves may have different ventilation and filtration needs, and a targeted flexible approach may be required.

2) Prioritizing HVAC upgrades based on existing ventilation and filtration

   The collective knowledge of VTAP will assist with developing guidance on prioritizing HVAC upgrades based on existing ventilation and filtration systems in schools. Factors to be considered may include spaces and/or schools with limited or no ventilation, as well as existing outdoor air supply, filtration systems, size of room, and function of room (e.g., gym, music room, etc.).

3) Proper Maintenance of existing HVAC systems

   There are elements of HVAC systems that need to be regularly maintained to ensure the system is functioning properly and that may extend life of equipment. These may include duct cleaning, damper settings, etc.

4) Contextualizing the role of HEPA filters

   Continue to emphasize viewing HVAC systems holistically, considering both outdoor air intake as well as filtration. HEPA filters are considered as supplemental to the overall HVAC system and may be best suited for certain circumstances that can be better defined.

5) Providing resources to school districts

   Continue to strive to provide ventilation and filtration resources to school districts. Some current best practices and standards are provided below.

   ASHRAE Guidance for Re-Opening of Schools
   Government of Ontario: School Ventilation
   Public Health Ontario: Heating, Ventilation and Air Conditioning (HVAC) Systems in Buildings and COVID-19

Ventilation Technical Advisory Panel Meeting #5 (May 18, 2022)

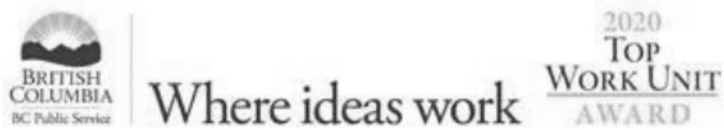
From:	Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To:	Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Chuck Morris <cmorris@sd61.bc.ca>, Collette O'Reilly <coreilly@vsb.bc.ca>, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>, Bob Beukers <Bob.Beukers@abbyschools.ca>, Stephen McNicholls <stephen@smcn.ca>, Graham, Megan 1 EDUC:EX <Megan.Graham@gov.bc.ca>, Shawn Chisholm <shawn@fisabc.ca>, matt.foley@burnabyschools.ca, tberger@abbotsfordchistian.com
Cc:	Sheppard, Grant EDUC:EX <Grant.Sheppard@gov.bc.ca>, Patti Dundas <dundas_p@surreyschools.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, josh.currie@sd23.bc.ca, King, Aimee EDUC:EX <Aimee.King@gov.bc.ca>
Sent:	May 17, 2022 9:48:00 AM PDT
Attachments:	2.0 Draft Detailed -Best Practices Guidelines Ventilation in BC Schools.docx, 1.0 VTAP Meeting Agenda - May 18, 2022.docx, image001.jpg, Minutes for Meeting #04 - April 5 2022.docx

Hello all,

Attached is a draft agenda for the Ventilation Technical Advisory Panel Meeting #5 (May 18, 2022) along with an initial draft of a detailed Best Practices Guidelines for Ventilation in BC School document that we would like to discuss in detail at the meeting. Also, I've included the meeting minutes from the April 5, 2022. Please contact me if you have any suggestions regarding the agenda or any comments/questions. Thanks,

Damien

Damien Crowell | A/Director | Minor Capital Programs & Finance Unit | Ministry of Education
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca



Prioritizing HVAC Upgrades Based on Existing Ventilation and Filtration Capacities

VENTILATION

When planning for HVAC upgrades with a particular focus on ventilation improvements, school districts should prioritize capital requests based on analysis of the type and condition of existing systems.

Age of any type of system and/or equipment will obviously be a factor supporting need for renewal, but consideration should be given to the potential to repair and/or re-commissioning systems that do provide ventilation, with higher priority for capital requests reserved for spaces and/or schools with no ventilation.

Existing Ventilation System Categories

1) Systems with capacity to provide 6-8 air changes per hour (AC/hr) and equipped with digital controls.

The optimal category for pandemic operation, with ability to provide greater amounts of outdoor air than code requirement, as well as digitally programmed operation that does not compromise occupant comfort or risk damage to heating equipment during colder weather

2) Systems with capacity to provide 6-8 AC/hr, but without digital controls

3) Systems with capacity to provide 6-8 AC/hr, but with non-functional outdoor air dampers, or dampers controlled in an “either/or” manner in parallel with heating valves, as with some older unit ventilators.

4) Systems with overall capacity to provide 6-8 AC/hr, but with permanently restricted OUTDOOR AIR paths, as with many furnaces provided for classrooms and portables.

Depending on system/equipment condition, categories 2, 3 and 4 can potentially be made equivalent to Category 1 with investments in controls, damper operability, or increased size of outdoor air ducts and louvres.

5) Systems with capacity to provide 3-4 AC/hr, which therefore cannot provide enhanced OUTDOOR air ventilation.

a) *Common in older schools*
b) *Also typical for schools that qualify for full cooling, where make-up units deliver outdoor air to modular heat pumps or fan coil units*

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c) *Also in newer schools, where providing code minimum outdoor air was done strategically to minimize energy use*

Category 5(a) systems likely include re-circulation of some room air, and are likely to be valid, high priority requests.

Category 5(b) systems may also be valid upgrade candidates. When upgrades are carried out it is recommended to increase the airflow capacity of the make-up air unit(s), along with appropriate amounts of pre-heating and/or pre-cooling capacity. This will allow replacement of the make-up equipment and the modular indoor units to be independent phases of the renewal.

Category 5(c) systems designed for newer schools will be equipped with newer equipment, not in need of urgent renewal based on age or condition. These often include HRVs, which although typically not providing any more outdoor air than code minimum, do not re-circulate room air. These systems were designed to minimize energy use and are NOT viewed as wrongly designed. However, considering the current pandemic, and potential for future events of concern, consideration of increasing outdoor air capacity in future is recommended.

6) No Ventilation. Classrooms with heating but no mechanical ventilation. Typically, with operable windows for ventilation

Category 6 systems should be considered as the highest urgency. An upgrade of the heating plant will also likely be required as part of such an HVAC upgrade, since no capacity for heating of ventilation air would have been included in the original design.

Design for Climate Resiliency

In all cases of replacement ventilation systems, consideration of equipment with capacity to deliver more outdoor air than code minimum is recommended. All motor driven fan (and pump) equipment is available with variable speed motors, so amounts of outdoor air can be dialled back during non-emergency times, in the interest of energy savings.

In cases where schools currently provide heating, but not cooling, with ventilation as the delivery medium, consider future provision of at least partial cooling. Include for pipe and duct insulation with vapour barriers, and condensate drain pans in air handling units.

The provision of separate heating and cooling pipe loops, with cooling lines installed in future can be considered, but 2-pipe switchover systems are also an alternative where partial cooling is considered sufficient.

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Heating and cooling pumps and pipes should be considered for enhanced outdoor air capacity, with the caveat the pumps be provided with variable speed motors that can be dialled back during non-emergency operation, to minimize energy use.

FILTRATION

Standard Filter Capacity

Ventilation equipment not compatible with installation of MERV-13 (or higher) filters should also be considered for renewal, to provide improved indoor air quality during times of pandemic emergency, wildfire smoke occurrences and allergy seasons. The ability to easily switch between MERV-13 and filters with lesser MERV rating is optimal, to allow reduced fan energy opportunities during periods of non-emergency operation.

Filter efficiency should not be viewed in isolation of outdoor air delivery. The efficiency of the filter is deemed to relative to re-circulated air, whereas outdoor air assumed to be virus free, unless drawn from an exterior space where people may congregate. The differences in efficiency between different MERV-rated filter is therefore mitigated, the more outdoor air is mixed with re-circulated air.

At the point where 100-percent outdoor air is introduced to an air handling unit, the filter efficiency is effectively a non-factor. Which supports the conclusion that enhanced rates of outdoor air should be used while we are in pandemic mode, within the boundaries of occupant comfort and the risk of damage due to freezing of heating pipes.

HEPA Filter Application

HEPA filter units have an application for rooms that do not have ventilation systems. HVAC systems should be viewed holistically, however, with consideration of the combined benefit of filtration and introduction of outdoor air.

Self-contained HEPA units have limitations on the rate they can recirculate air, due to fan noise constraints, and should be considered as supplemental to HVAC systems.

ENERGY PLANTS

In all cases where requested HVAC upgrades include new heating/cooling plant equipment, consideration of equipment with capacity to support delivery of more outdoor air higher than code minimum is recommended. All motor driven fan

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(and pump) equipment, as well as heating and cooling equipment, is available with options for variable speed operation.

Operation of system components can therefore be dialled back during non-emergency times, in the interest of energy savings.

CONTROLS

For HVAC upgrades where digital controls are currently not installed, include for such in planning for renewed or replacement systems. Correctly commissioned and operating controls are a necessity to ensure HVAC equipment operates correctly, depending on building occupancy status, outdoor temperature, and indoor ventilation requirements.

Future HVAC infrastructure may have enhanced heating/cooling plant, ventilation fan and heat transfer medium pump capacities, which can be dialed back during non-emergency times. Ensuring these do not consume any more energy than necessary will be paramount to efficient building operation and carbon emissions.

Many systems also will, at least in the short term, not be equipped with enhanced capacity. Nevertheless, these can currently deliver enhanced quantities of outdoor air during non-peak heating or cooling weather. Properly commissioned and operating controls can support increased outdoor air rates during shoulder seasons, without compromising the thermal comfort of building occupants, or risking freezing of heating systems as outdoor temperatures drop to a level where increased outdoor air cannot be supported.

Programmable controls system should be provided with simple ‘toggles’ to allow building operators a straightforward method to switch between ‘normal’ and ‘emergency’ modes. Emergency mode should also have sub-categories, whereby enhanced outdoor air delivery can be put into operation during an emergency such as the current SARS-CoV-2 pandemic, but minimal outdoor air is introduced during wildfire smoke and/or allergy seasons.

ENERGY USE

It goes without saying that in spite of consideration for enhanced capacity of future HVAC systems, minimization of energy utilization and carbon emissions must remain paramount to planning of renewed or replacement infrastructure.

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Design of all HVAC systems is to be from the perspective of higher capacity equipment but intended to operate only as necessary to maintain thermal comfort and required ventilation.

Maintenance Requirements for School HVAC Systems/ /Equipment

VERIFICATION OF OUTDOOR AIR DELIVERY

Delivery of at least minimum ASHRAE recommended amount of outdoor air is the target of a correctly functioning ventilation system. Air handling units are typically equipped with dampers intended to modulate introduction of outdoor air, typically connected to the school's digital control system.

Whether dampers are correctly functioning is important to verify. The controls system will be programmed to modulate da pers, typically based on readings from building carbon dioxide (CO2) levels and, with less sophisticated controls based on outdoor temperature.

Dampers and their associated control mechanisms do go out of calibration, however, or experience component failures. What the controls system indicates on a display screen cannot be assumed to be true at the damper location. Linkages break, slip or become disconnected. Or become seized due to lack of maintenance.

Periodically, damper operation should be verified by physically witnessing dampers respond to control signals. Under normal circumstances this is recommended to occur every three years, but when emergency situations such as the current pandemic occur, a district wide damper review should be performed.

Pilot projects conducted at two School Districts in January-February of 2022 identified a failure rate of 10-percent of outdoor dampers.

VERIFICATION OF OVERALL CONTROLS FUNCTIONALITY

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As an extension of the above, it is recommended a review of all controls programming, and re-commissioning as required, also be performed every three years during normal (non-emergency) conditions.

This exercise will identify energy saving opportunities such as HVAC equipment operating outside school occupancy schedules, incorrect temperature setpoints, elevated heating plant water temperature setpoints and variable speed motors running at higher speed than necessary.

DUCT CLEANING

It is recommended that school districts have a rotational schedule of duct cleaning for all facilities, with a maximum period of three years.

FILTER CHANGES

It is recommended that school districts replace or clean filters every three months. In cases where electro-statically charged filters are used to increase MERV-rating, the charge will deteriorate over time. Changing filters on a quarter-annual basis will mitigate this issue well.

Post-pandemic, if the use of lower than MERV-13 filters is accepted again in the interest of fan energy reductions, quarter-annual replacement will allow consideration of using MERV-13 filters on a seasonal basis, during wildfire smoke and/or allergy seasons. It is recommended for school districts to maintain supplies of MERV-13 filters in the future for such occurrences, even if a decision is reached to operate with lower MERV ratings once pandemic measures are no longer required.

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CONFIDENTIAL

Ventilation Technical Advisory Panel
Minutes – Meeting #05

Date: Tuesday – May 18, 2022
Time: 1:00 to 2:00pm
Location: Video Conference Call
Members: Francois Bertrand, Damien Crowell, Ravnit Aujla, Megan Graham, Aimee King, Patti Dundas, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls, Shawn Chisholm, Tym Berger, Matt Foley

Guests: N/A

Regrets Damien Crowell; Patti Dundas; Ravnit Aujla; Grant Sheppard; Josh Currie; Aimee King, Chuck Morris, Shawn Chisholm

Agenda Item	Discussion/Action items
1. Meeting Agenda & Introductions	• Agenda was circulated in advance of the meeting and no concerns were raised.
2. Best Practices Document Review	• HVAC specialist reviewed Best Practices Document with major points being 1) planning for future upgrades and 2) maintenance items • Point raised to discuss finding compromise between minimum requirements and gold-standard for ventilation for feasibility across SDs. • Emphasis on holistic ventilation, e.g., fresh air ventilation as well as filtration, reiterated. • Feedback regarding maintenance includes concern regarding cost to accommodate ventilation standards (e.g., duct-cleaning, etc.) as well as messaging and perception of downgrading MERV filters going forward. **Action Item:** • Contextualize numbers by adding information about minimum vs. ideal standards; the role of fresh air, etc., in Best Practices document. • Different language regarding lower grade filters that avoids reiterating MERV 13 as only possible solution.
3. Roundtable and/or Questions	Points of discussion are noted above.

4. Wrap-up/Items for Future Meetings	• Meeting #06, TBD • Items for future meetings: • Location: Video Conference Call
5. Adjournment	• Meeting adjourned at 2:00pm.



Ventilation -BCASBO AGM & Conference 2022

Ministry of Education & Child Care – May 26, 2022

Presented by:

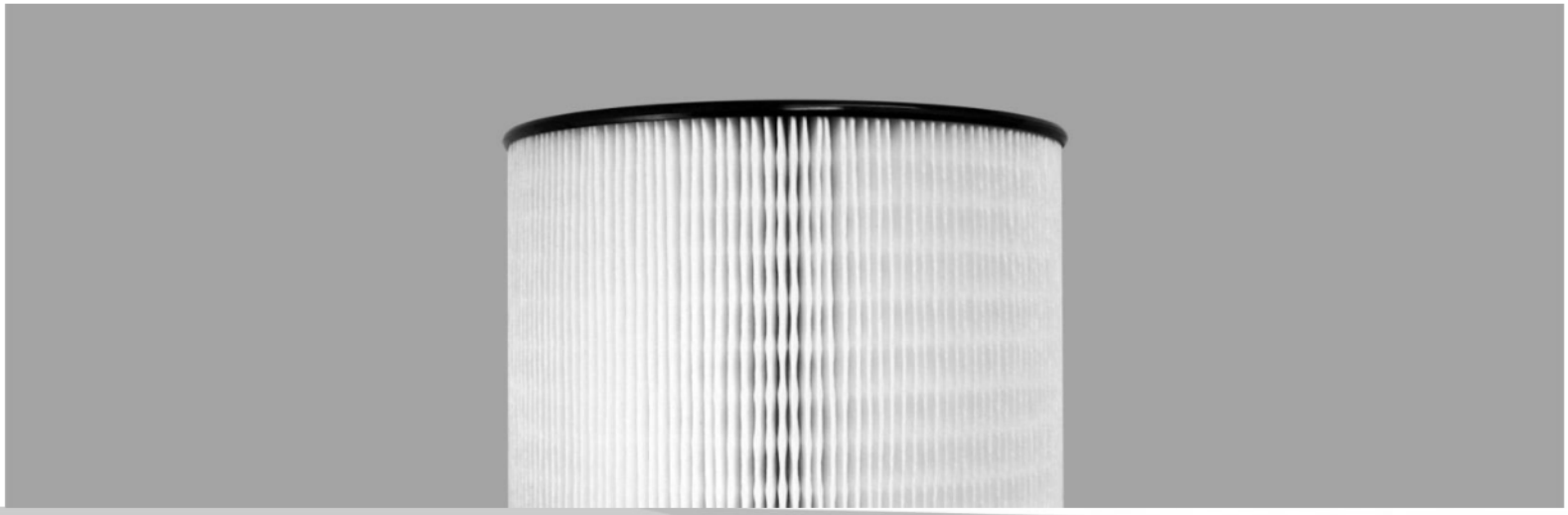
BRITISH COLUMBIA | Ministry of Education and Child Care

Damien Crowell – A/Director, Capital Programs & Finance Unit, Capital Management Branch
Stephen McNicholls – President, Mechanical Engineer, SMcN Consulting

Agenda

Ventilation Initiative Update

1. HVAC Funding to Date
2. School District Reporting
3. Ventilation Technical Advisory Panel (VTAP)
4. Output from VTAP (Stephen McNicholls)



Ventilation Funding Update

Ventilation Funds:

- To date, $166.5 million has been spent on HVAC projects since pandemic started
- Largely based on school districts priorities identified in capital plans
- Additional federal funds to roll-out shortly – ECC will send a reporting template out to keep track of how funds were spent in coming months
- Lots of great investment in ventilation projects recently but there are many other needs out there to maintain existing facilities: roofs, etc.

Ventilation Funding Update

Provincial and Federal Investment in BC Public Schools HVAC Systems

	Program Budget	FY20/21	FY21/22	FY22/23	Total
Routine capital	School Enhancement Program	$17.6M	$32.4M	$33.5M	$83.5M
	Carbon Neutral Capital Program	$4.2M	$12.1M	$14.9M	$31.2M
	Annual Facility Grant	$11.3M	$23.8M	*TBD	$35.1M
COVID funding	Federal Safe Return to School Fund ($242.2M – 2 phases of funding) in 20/21	$13.1M (excluding third phase of funding subject to federal and provincial appropriation valued at $11.9M)			$13.1M
COVID funding	Provincial School Restart Fund in 21/22	$3.6M			$3.6M
TOTAL ESTIMATED INVESTMENT					**$166.5M**

Ventilation Reporting

School Ventilation Reporting:

- Reports on ventilation systems for all schools in the province are available on school district websites
- Stakeholders reached out to Ministry with comments that were mainly focused on: Filters and Outdoor Air Supply
- Vast majority of school districts have addressed these comments
- Reports should be updated on a regular basis to inform stakeholders including public.
- Ministry staff reached out to follow-up on outstanding information in these reports

THANK YOU FOR ALL YOUR EFFORTS ON THIS!

Ventilation Technical Advisory Panel

Ventilation Technical Advisory Panel

- Purpose: To advise the Ministry and school districts on ventilation enhancements relating to COVID-19 and other shared objectives relating to supporting student success and climate preparedness and adaptation
- Members include SD staff, Indy School staff, HVAC expert (SMcN), ECC staff and Medical Health Officers
- Five meetings over past six months

Key Info to Date:

- Ventilation systems need to be viewed holistically – both air supply and filtration
- Goal: knowledge sharing and guidance document

MINISTRY OF EDUCATION

VENTILATION TECHNICAL ADVISORY PANEL

Presentation To:

BRITISH COLUMBIA ASSOCIATION OF SCHOOL BOARD OFFICIALS (BC ASBO)

BRITISH COLUMBIA | Ministry of Education

Penticton, BC

May 26, 2022

BC ASBO

BC ASSOCIATION OF SCHOOL BUSINESS OFFICIALS
Education is our Business

REFERENCES

American Society of Heating, Refrigeration & Air-Conditioning Engineers (ASHRAE)

- **ANSI/ASHRAE STANDARD 62.1 "VENTILATION FOR ACCEPTABLE INDOOR AIR QUALITY"**

- **BUILDING READINESS (2020)**

https://www.ashrae.org/technical-resources/building-readiness

- **FILTRATION & DISINFECTON (2020)**

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

- **ASHRAE EPIDEMIC TASK FORCE (2022)**

Understanding and Applying ASHRAE Core Recommendations for Mitigating Aerosol Infection Risk

https://attendee.gotowebinar.com/recording/4538704157456640268

TOPICS

Response to the Pandemic

- Ventilation Systems Assessment
- Types of Ventilation Systems – Adaptability to Enhanced Ventilation Performance
- Filtration
- Other Air Cleaning Strategies

MAINTENANCE

- Commissioning / Verification of Outdoor Air Delivery
- Adapting MERV-13 Filters to Existing Equipment
- Duct Cleaning

PRIORITIZING FUTURE HVAC UPGRADES / PLANNING FOR CLIMATE RESILICENCY

- Enhanced Ventilation Capacity
- Filtration Strategy
- Energy Strategies

Response to the Pandemic

Ventilation Systems Assessment

Building Readiness Team

The Building Readiness Team should include licensed and certified professionals and companies that can perform the analysis, testing, design, construction, control programming, balancing, commissioning, maintenance and operation services required to make the adjustments to achieve performance in accordance with ASHRAE recommendations.

- Commissioning Provider (CxP)
- Test and Balance Company (TAB)
- Building Automation Systems (BAS)
- Engineer
- Owner's Facilities Staff

Building Evaluation and Adjustment

- HVAC Systems Analysis
- Current Ventilation Operations / Is Enhanced Ventilation Possible
- Pre and Post Occupancy Flushing
- Increased Filtration
- Air cleaning devices (UV light and other newer technologies)
- Commissioning and Verification of Controls Programming
- Commissioning and Verification of Actual Outdoor Air Delivery

Ventilation Strategies

Increased Ventilation above Code Level

Increasing outdoor air above code is a Pandemic mitigation strategy that should be considered. There is potential that building operators could increase **outdoor air ventilation,** which will reduce air recirculated back from the space.

It is important that HVAC systems are evaluated by one or more of a qualified TAB firm, Cx provider or design professional, to confirm that the modifications for pandemic safety do not create unintended consequences. Confirm that systems are operated in a manner that maintains comfortable space conditions. Warmer climates could struggle to keep spaces below acceptable temperature and humidity, and in colder climates above acceptable space temperature.

Increase minimum outdoor air damper position. Add a controls programming toggle to allow 'Normal' or 'Enhanced' modes

- Consider a minimum mixed air temperature that eliminates the possibility of freezing and/or low temperature trips, as well as ability to maintain occupant comfort
- Disable motion sensor control from DDC logic and allow fans to run continuously during school hours, with dampers open to minimum position or greater
- Change CO2 setpoint to operate with outdoor air damper at new minimum position, either by:
  - Revise carbon dioxide (CO2) setpoint from 1000 PPM to 800 PPM, which is recommended by ASHRAE, or
  - A pre-determined outdoor air minimum position., which is climate dependent (see above), or
  - Allow CO2 control logic to open outdoor air dampers to 100% open or a maximum value that will not let mixed air temperature at the heating coil drop below 4°C.

Pre-Occupancy and Post-Occupancy Flushes

- Change schedule hours and COVID minimum damper position to achieve building pre and post occupancy flushes.
    - For 2 hours before occupancy, (recommended by ASHRAE), and
    - Consider also flushing for 1 hour after occupancy

Evaluate your Controls System

It is crucial for the owner to understand the type of BAS in the building. HVAC controls range from simple single zone thermostats controlling a single HVAC unit to complex BAS that integrate the controls for large buildings and even multiple buildings within school districts,

Optimally a digital (computerized) control system has been provided, which allows complex operational sequences to be programmed, which can optimize space conditions and energy use. These are typically also accessible via web-based platforms, allowing remote access to information and site conditions.

However, there are still many legacy systems in use, which use electric and pneumatic controls, and time clocks. These do not have digital communications interfaces, which do not provide building operators any insight into how their buildings are performing, without being physically in the building.

Case Study – District Wide Ventilation Audit

METHODOLOGY

In general, ventilation equipment at each site was reviewed from the following perspectives:

Suitability of filtration – Current ASHRAE best practice guidelines recommend that recirculated air from occupied spaces be provided filtration equivalent to MERV 13 performance, at a minimum. MERV (Minimum Efficiency Reporting Value) is a measure of filtration effectiveness and ranges from 1 to 16.

ASHRAE recommendations also state the following: “Outdoor air is considered free of viral particles unless drawn from an area where people may congregate. HVAC filters that only filter outdoor air do not need to be upgraded… If you have pre-filters and filters, you do not need to upgrade both filters. That would be likely to cause unacceptable pressure drop increases.” With that considered, fresh-air-only equipment, such as a makeup air unit serving an array of fan coil units or modular heat pumps, do not recirculate potentially contaminated air. The filter in such equipment is intended only to act as a pre-filter for the system and therefore should not require filtration additional to what is supplied by the manufacturer.

At each facility reviewed, filters in all central air handling units, as well as a sample of terminal units throughout the buildings, were inspected; and observations such as MERV rating, air-tightness, and filter cleanliness were recorded. In buildings with many terminal units, a portion of filters were sampled; with multiple samples taken from each distinct area of the building to provide a representative sample for the entire building. Observations regarding equipment filtration are summarized in the attached appendices.

Case Study – District Wide Ventilation Audit Cont.

Operation of outdoor air control dampers (mixing dampers) – On ventilation equipment equipped with actuating outdoor air (mixing) dampers, the function of these dampers was observed directly at the equipment location, while it was being operated remotely via digital controls systems. The test procedure consisted of commanding the full range of motion of each damper, before commanding them back to automatic operation. Observations regarding mixing damper operation are summarized in the attached appendices.

General observations - In addition to the two items above, general observations are made regarding other factors which may impact ventilation effectiveness. These included the following:

- Ability of recirculated air to bypass filter
- Operation of equipment supply fan
- Overall system air balance (relief/return air path and room pressurization)

Case Study – District Wide Ventilation Audit Cont.

SUMMARY OF FINDINGS

- Significant proactive effort from the School District has occurred, to implement the recommendations and best practices published by ASHRAE.

- Throughout most of the district, work to improve the existing ventilation systems had already been completed or was in the process of being completed.

- At the time of this review, the following was observed:

  - **Filtration** – Of the different filter classifications observed throughout the school district, the majority of filters on recirculating systems are MERV 13 (or electrostatically-charged MERV 13-equivalent filters). The remainder of filters noted on these systems are either MERV 8, or non-MERV rated washable foam filters.

  - In many cases, the recirculating equipment with filtration not meeting MERV 13 equivalency appears to be in the process of being retrofitted with MERV13 filters. In other cases, it was clear that the configuration of existing equipment created limitations (such as inadequate space to modify the existing filter rack), making a successful retrofit more difficult.

Case Study – District Wide Ventilation Audit Cont.

- In some circumstances fresh-air-only equipment is outfitted with MERV 13 filters. In this scenario air is coming directly from outdoors, and therefore does not pose any realistic risk of carrying viral contaminants. In these limited circumstances, the manufacturer-recommended filter should be used to reduce system pressure loss, increase ventilation, and reduce unnecessary operating and maintenance costs.

Overall, 8% of filter ratings were either insufficient, compared to ASHRAE (under-filtration) or unnecessarily high (over-filtration) for 100% outdoor air systems.

- A number of retrofitted MERV 13 filters did not form a sufficient seal in the airstream; allowing airflow to bypass the filter.

Outdoor air (mixing) dampers - 14% of equipment outdoor air dampers are deemed “inoperable”, either due to poor communication with the building’s DDC system, or a faulty linkage to the actuator.

- Often, these dampers are locked in the “fully-closed” position, allowing no fresh air into the associated spaces, or they are locked in a “partially” or “fully-open” position, which could result in unnecessary energy usage.

Non-functional equipment – In one observed instance the supply fan in a rooftop unit serving the gymnasium would not operate. Other occurrences, such as loose belts and improperly balanced motors, are also noted. Although the immediate effect on ventilation is unclear, steps should be taken to prevent future failure of equipment.

Case Study – District Wide Ventilation Audit Cont.

BUILDING CONTROLS

- 75-percent of the schools are equipped with DDC systems with capability to monitor space CO2 concentrations.
- 25-percent are equipped with DDC systems but do not have the ability to monitor space CO2 concentrations.
- Of the sites with CO2 monitoring, 45-percent have terminal ventilation units with modulating mixing dampers.
- Ventilation systems at the other 55-percent of sites, although likely meeting ASHRAE fresh air requirements, are only able to modulate fresh air intake by increasing or decreasing the fan speed at the central air handler. This allows for building-wide CO2 control but does not allow for demand control on a classroom-by-classroom basis. However, upon review of trend log data, these systems are generally able to keep CO2 concentrations in occupied spaces well within acceptable limits. No ability for enhanced ventilation.
- For the remaining sites without CO2 sensors (5 sites), there is currently no realistic way to verify the amount of fresh air entering a given space. These sites have been identified as being suitable for a potential upgrade to allow CO2 monitoring in occupied spaces.

HOLISTIC VIEW OF VENTILATION SYSTEMS

The pandemic has focused perception of ventilation systems primarily on effectiveness to dilute the concentration of viral particles.

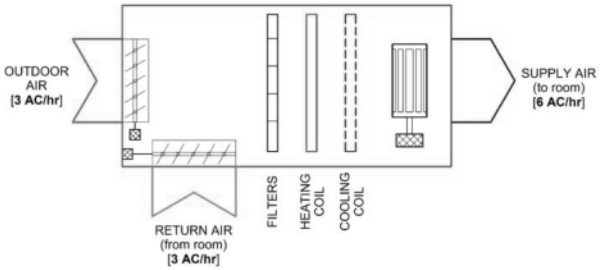
There are other factors however, as to what an effective ventilation system operates:

- Ventilation Effectiveness
- Thermal Comfort
- Energy Use
- Sound Level



MIXING SYSTEM
(WITH AIR CONDITIONING CAPACITY)

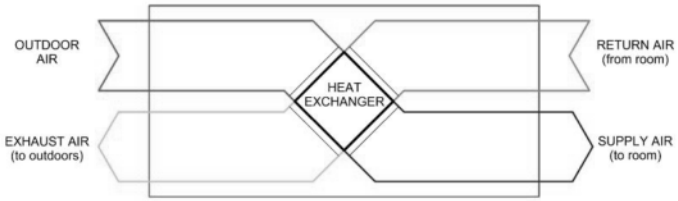
AIR SUPPLIED TO THE ROOM PROVIDES VENTILATION AND THERMAL COMFORT



Mixing type AHU

NON-MIXING SYSTEM
(HEAT RECOVERY)

AIR SUPPLIED TO THE ROOM PROVIDES VENTILATION

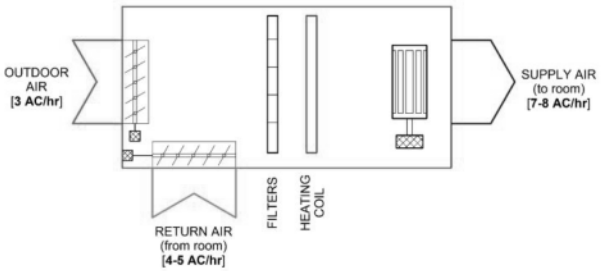


Heat recovery AHU

Typically around 3-4 AC/hr

MIXING SYSTEM
(NO AC - SIZED FOR FREE COOLING)

AIR SUPPLIED TO THE ROOM PROVIDES VENTILATION AND THERMAL COMFORT



Mixing type AHU

NON-MIXING SYSTEM

EQUIPMENT PROVIDES SEPARATE HEATING/COOLING



Convector



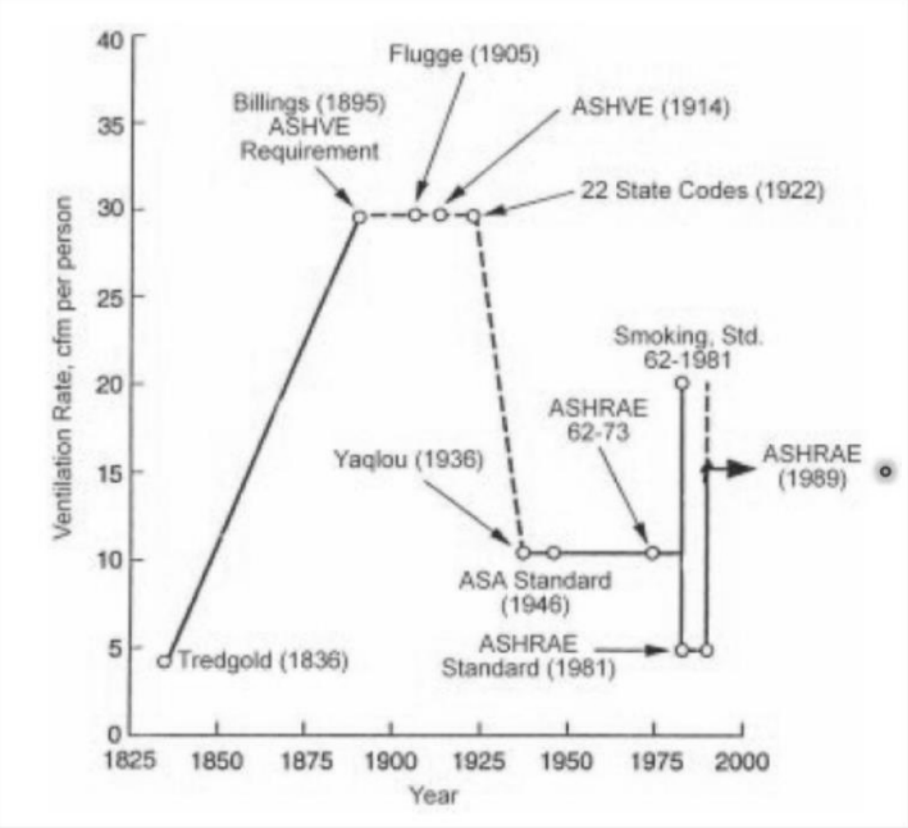
Radiant Floor



Fan Coil Unit
(or Modular Heat Pump)



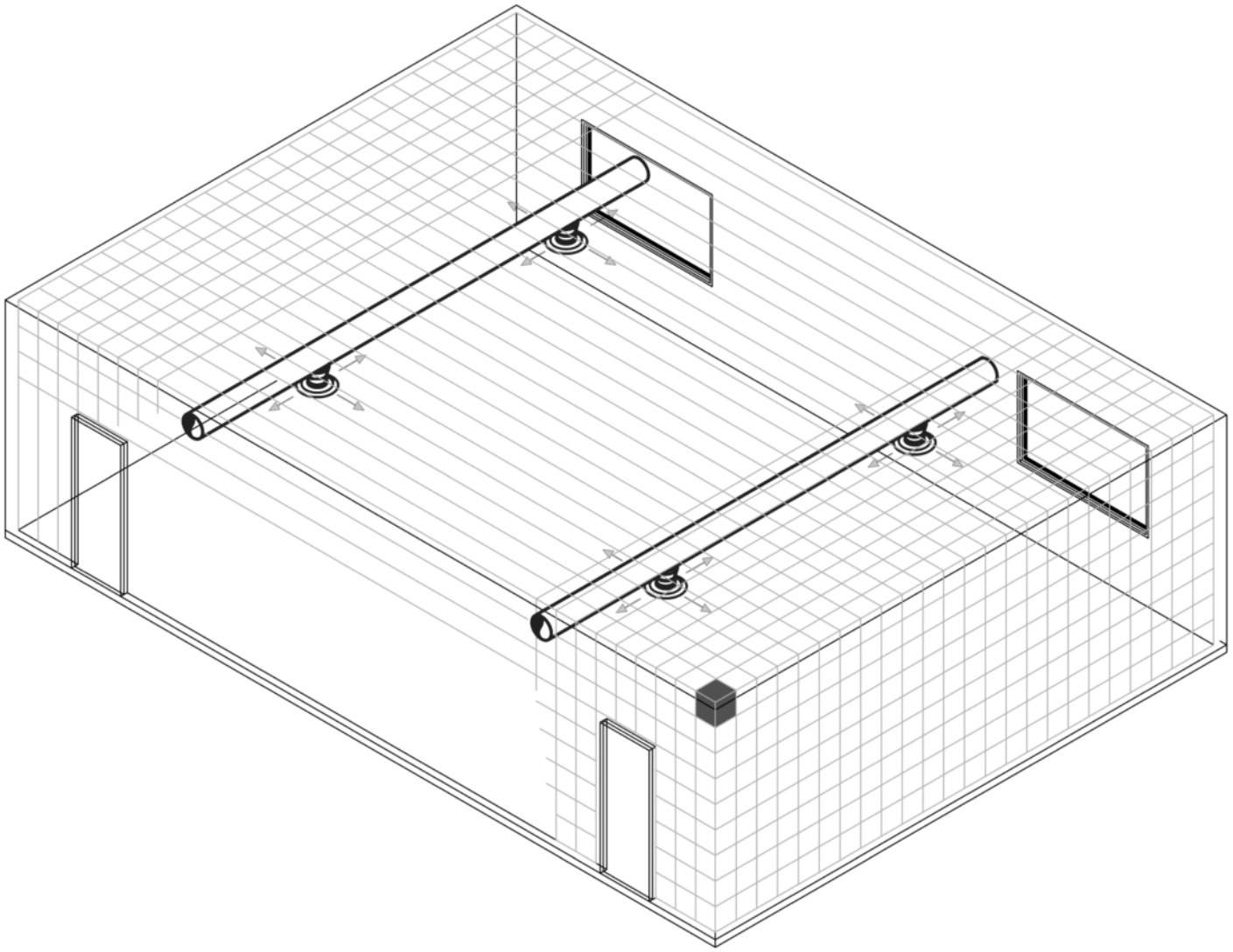
Chilled Beam



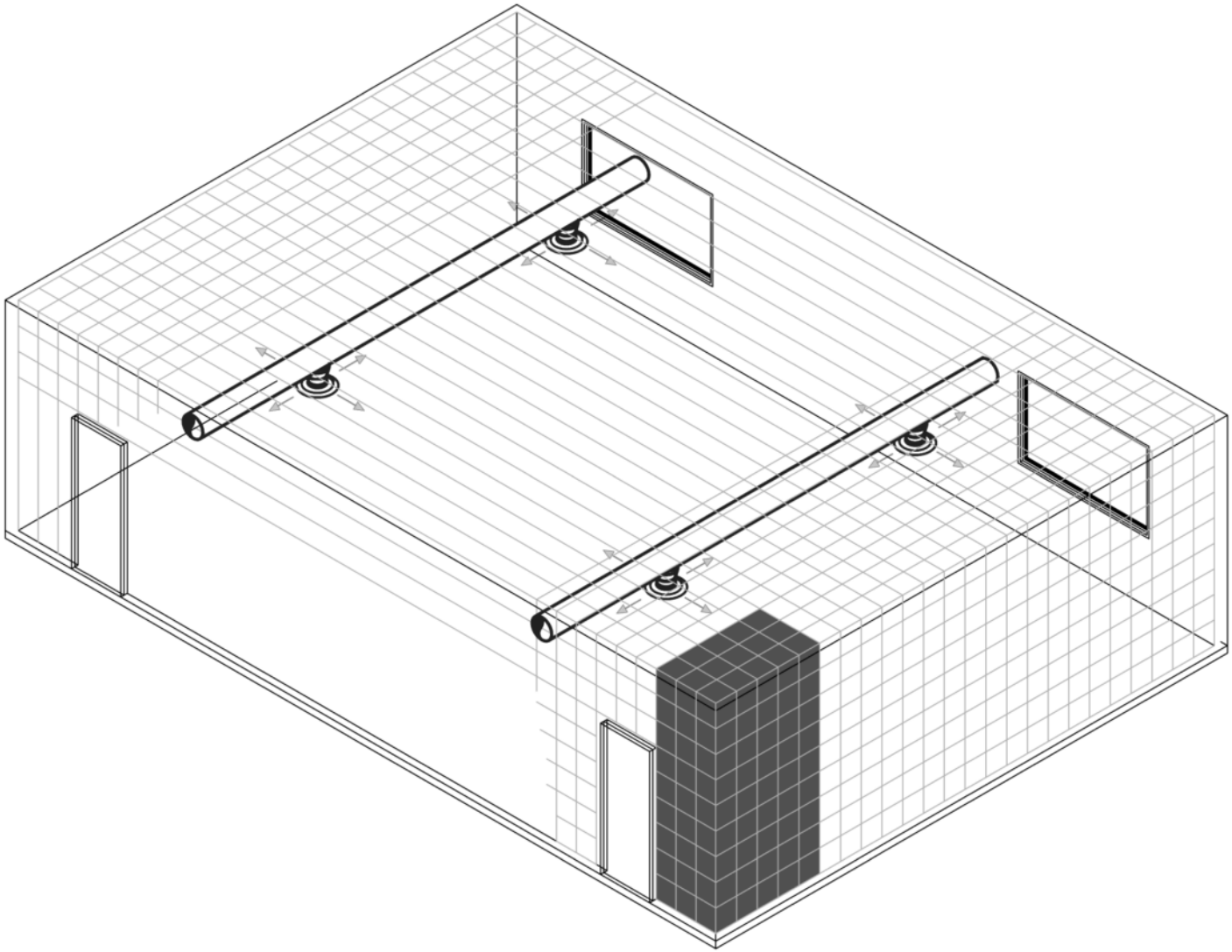
Janssen, J.E., 1999. The history of ventilation and temperature control: The first century of air conditioning. ASHRAE Journal, 41(10), p.48.

AIR CHANGE RATES EXPLAINED

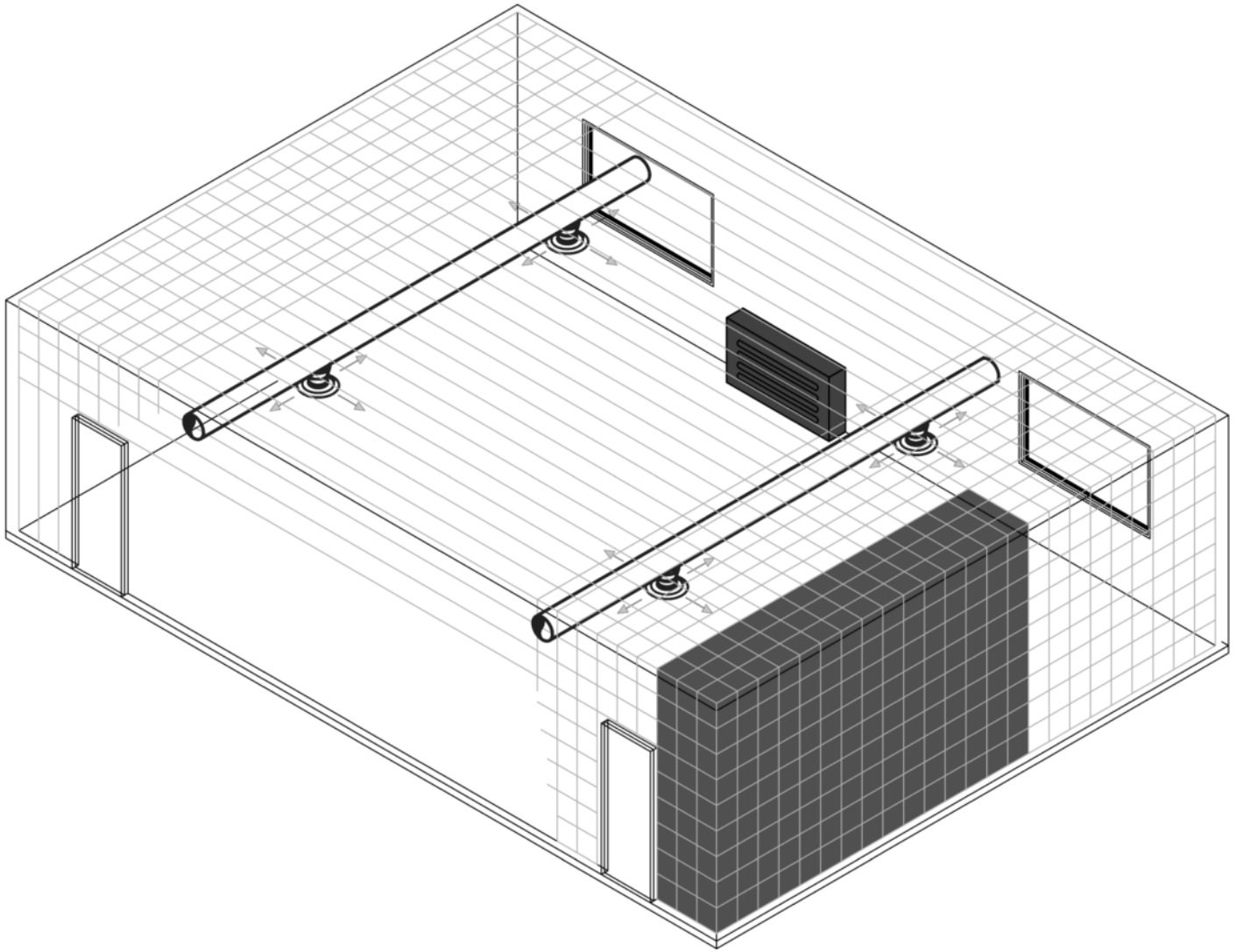
- Typical classroom: 84 m^2 or 900 ft^2
- Overall volume 9000 ft^3
- Highlighted 1 ft^3, which is 1/9000th of the total room volume



- Highlighted 150 ft^3, which is 1/60th of the room volume
- If we supply 150 ft^3 of air every minute, then we are delivering 9,000 ft^3 of air in one hour (9,000 CFM = 150 x 60)
- 150 CFM = 1 air change per hour [AC/Hr.]

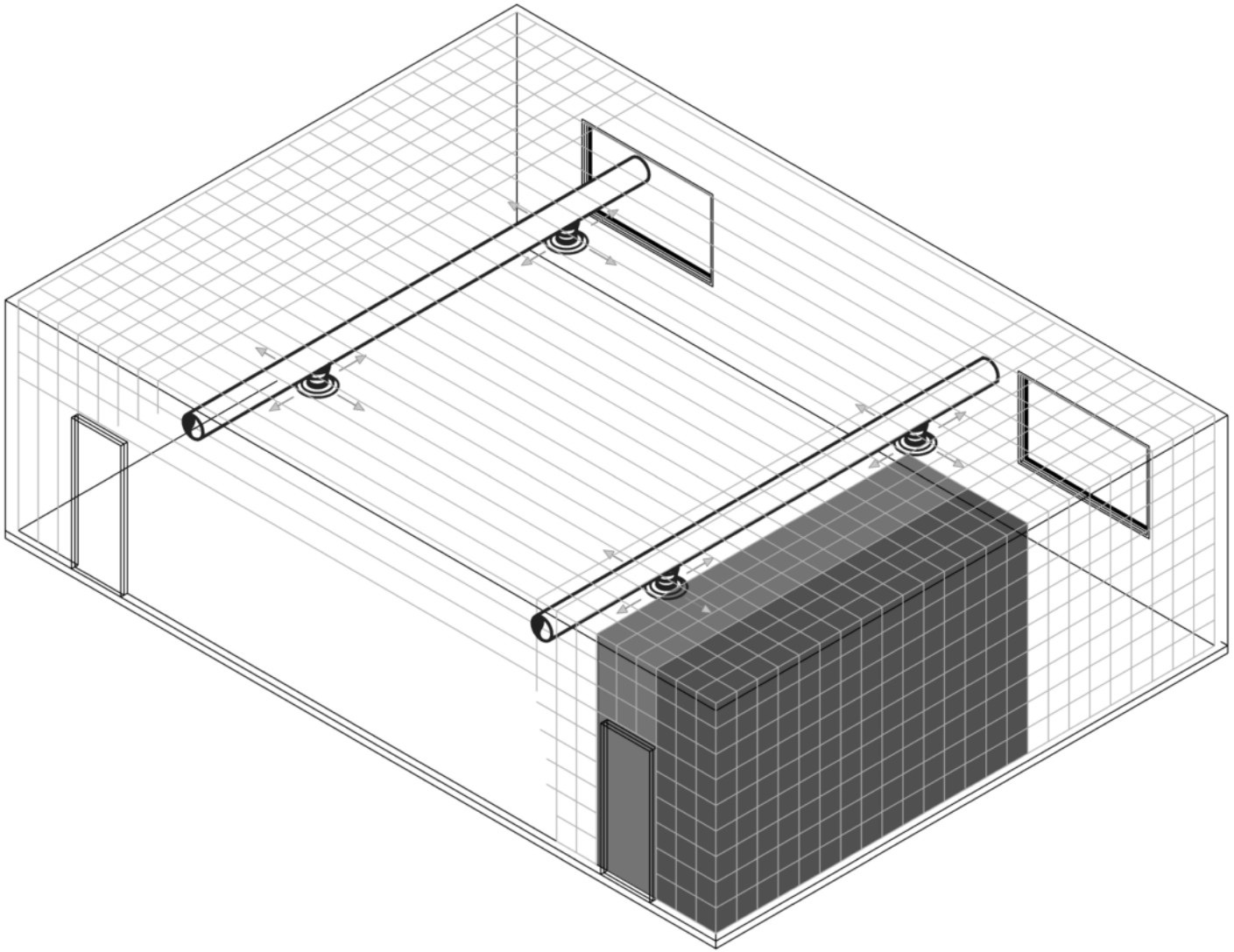


- Highlighted 450 ft^3, which is 1/20th of the room volume
- 450 ft^3 of air supplied every minute means we are delivering 27,000 ft^3 of air in one hour (27,000 CFM = 450 x 60)
- 450 CFM = 3 AC/Hr
- This is essentially the ASHRAE ventilation standard requirement for a fully occupied classroom.
- 30 students x 15 CFM per student
- Verification that this amount of outdoor air is being provided is typically verified by monitoring CO2 level in the room and maintaining CO2 at 1000 PPM
- This amount of air supplied to a classroom is typical of a DOAS system, which then requires supplementary heating and/or cooling equipment



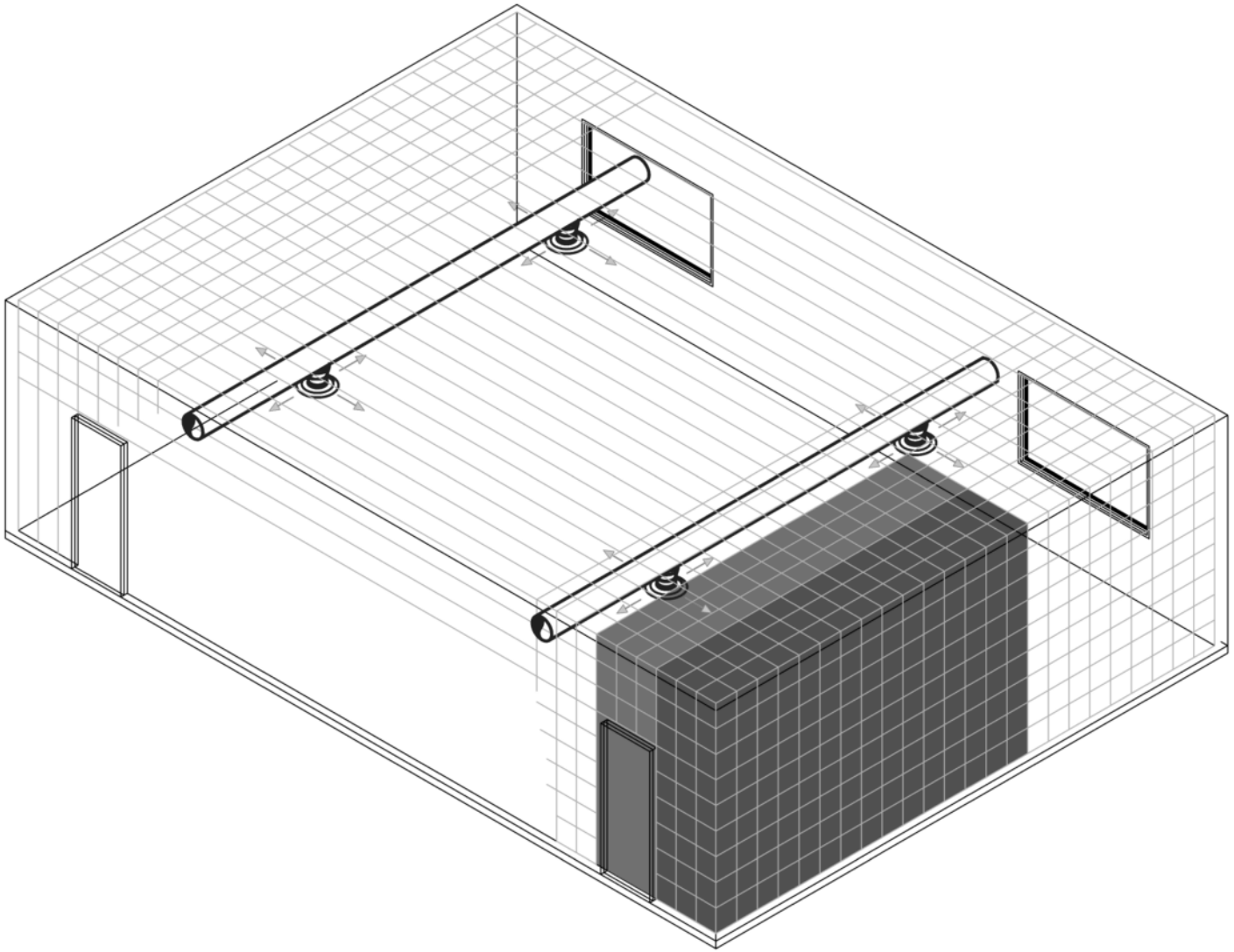
- A mixing type air handling unit (AHU) however, delivers more air to the space and uses the additional air as the medium heat (or cool) the room

- Depicted is 3 AC/hr. of outdoor air AND 3 AC/hr. of recirculated air, operating in HEATING MODE

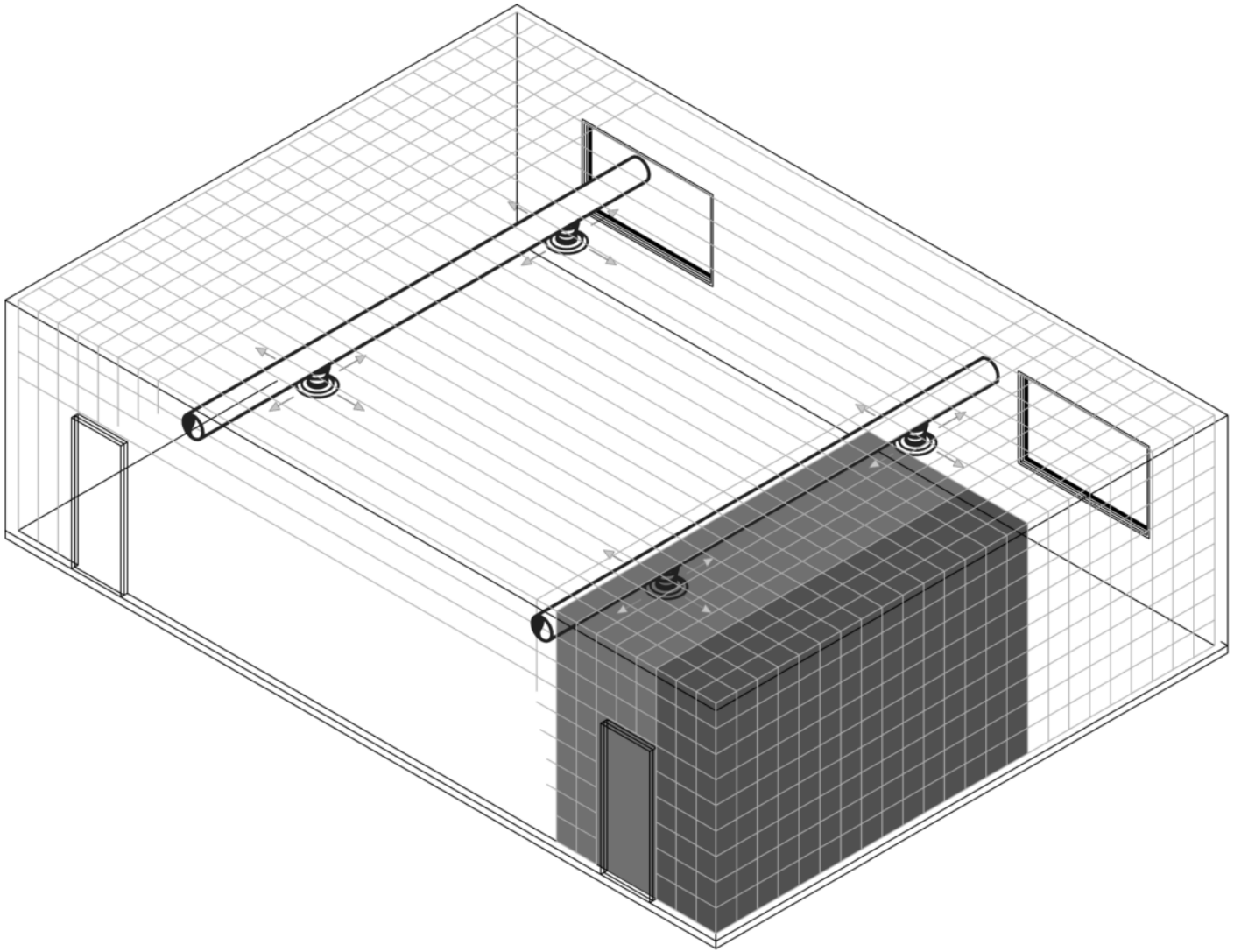


- Also depicted here 3 AC/hr. of outdoor air AND 3 AC/hr. of recirculated air, operating in COOLING MODE.

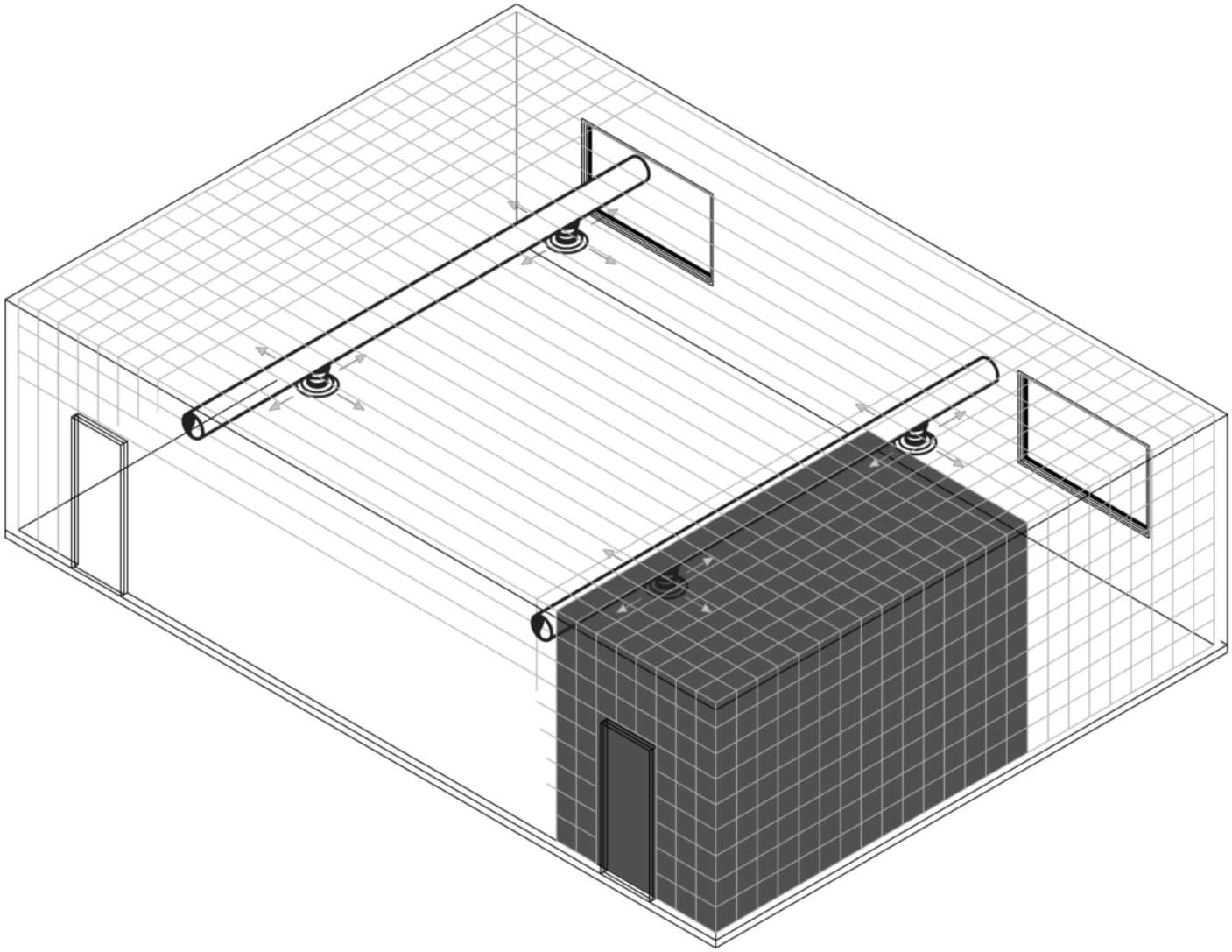
- Typical of a mixed air system that has air-conditioning capability



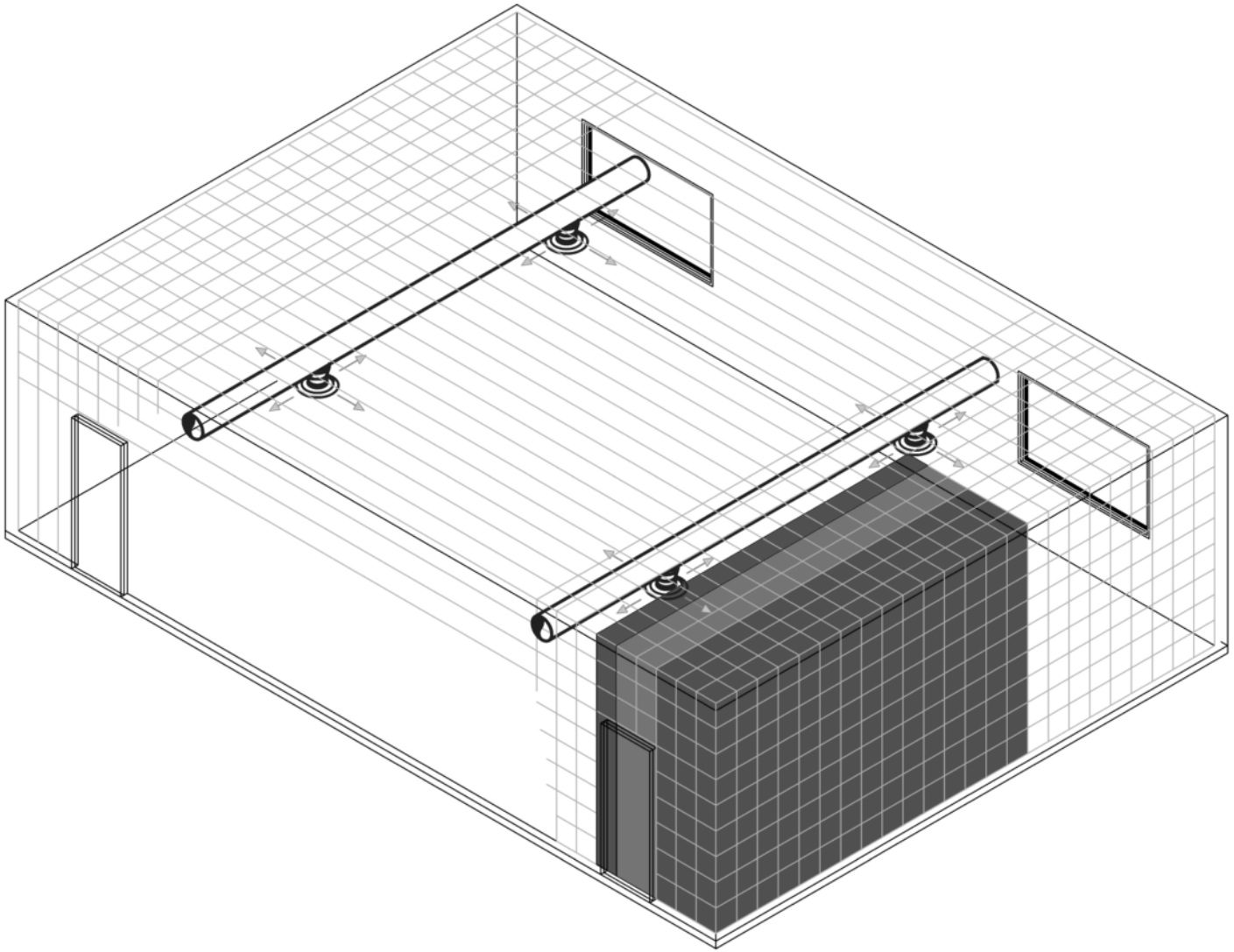
- Depicted here 3 AC/hr. of outdoor air AND 5 AC/hr. of recirculated air
- Typical of a mixed air system that does not have air-conditioning



- Depicted here is FREE COOLING operation of 8 AC/hr. of outdoor air AND NO recirculated air
- A mixed air system without AC capacity can still cool a Classroom, in FREE COOLING mode as ling as outdoor temperature is around 17C or cooler
- Systems with air conditioning can mechanically ‘manufacture’ air to be supplied to the space at 13C-15C
- Free cooling systems can only provide air at whatever the ambient outdoor temperature air happens to be
- But having more of that air (8 AC relative to 6 AC) allows provision of cooling as ling as the air temperature is around 17C

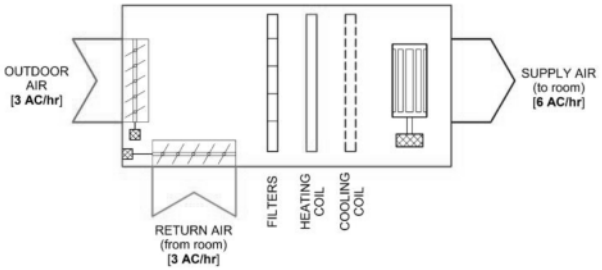


- With future mechanical upgrades, it makes sense to have ability to deliver more outdoor air at ANY time, if the current pandemic persists or future emergencies occur
- Depicted here is 4 AC/hr. of outdoor air AND 2 AC/hr. of recirculated air (for a system that provides 6 AC/hr overall airflow
- An additional 33% more outdoor air, which can be used if an ‘emergency’ situation occurs
- Heating and cooling plants need to be sized for the greater heating and cooling loads, with a caveat the additional capacity is used only for emergency operation
- All new fan, pump, heating and cooling plant equipment therefore needs to be able to operate at variable speed and/or capacity



MIXING SYSTEM
(WITH AIR CONDITIONING CAPACITY)

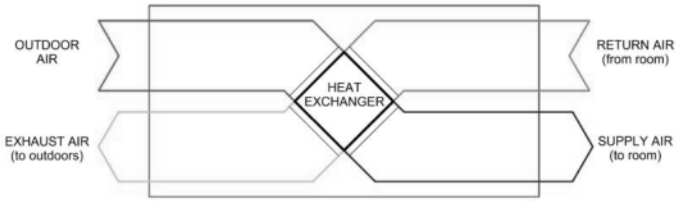
AIR SUPPLIED TO THE ROOM PROVIDES VENTILATION AND THERMAL COMFORT



Mixing type AHU

NON-MIXING SYSTEM
(HEAT RECOVERY)

AIR SUPPLIED TO THE ROOM PROVIDES VENTILATION

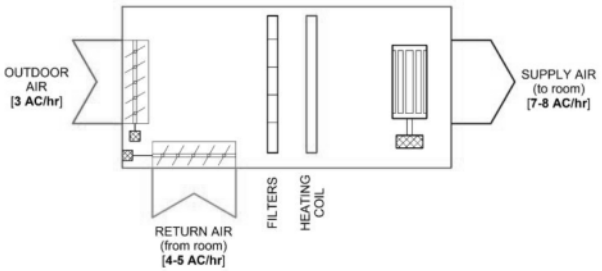


Heat recovery AHU

Typically around 3-4 AC/hr

MIXING SYSTEM
(NO AC - SIZED FOR FREE COOLING)

AIR SUPPLIED TO THE ROOM PROVIDES VENTILATION AND THERMAL COMFORT



Mixing type AHU

NON-MIXING SYSTEM

EQUIPMENT PROVIDES SEPARATE HEATING/COOLING



Convector



Radiant Floor



Fan Coil Unit
(or Modular Heat Pump)



Chilled Beam

Types of Systems – Adaptability to Enhanced Ventilation Performance

AIR SYSTEMS THAT MIX OUTDOOR AIR WITH RECIRCULATED ROOM AIR

1) Systems with capacity to provide 6-8 air changes per hour (AC/hr) and equipped with digital controls.

   The optimal category for pandemic operation, with ability to provide greater amounts of outdoor air than code requirement, as well as digitally programmed operation that does not compromise occupant comfort or risk damage to heating equipment during colder weather.

2) Systems with capacity to provide 6-8 AC/hr, but without digital controls

3) Systems with capacity to provide 6-8 AC/hr, but with non-functional outdoor air dampers, or dampers controlled in an “either/or” manner in parallel with heating valves, as with some older unit ventilators

4) Systems with overall capacity to provide 6-8 AC/hr, but with permanently restricted OUTDOOR AIR paths, as with many furnaces provided for classrooms and portables.

   Depending on system/equipment condition, Categories 2, 3 and 4 can potentially be made equivalent to Category 1 with investments in controls, damper operability, or increased size of outdoor air ducts and louvres.

CATEGORY 1

6-8 AC/Hr.
w/PROGRAMMABLE DIGITAL CONTROLS

GOLD STANDARD
(DURING PANDEMIC RESPONSE)











CATEGORY 2

6-8 AC/Hr

w/OLD, NON-PROGRAMMABLE CONTROLS





CATEGORY 3

6-8 AC/Hr

w/NON-FUNCTIONAL
OUTDOOR DAMPERS



CATEGORY 4

6-8 AC/Hr

w/RESTRICTED
OUTDOOR AIR DUCTS





5) Systems with capacity to provide 3-4 AC/hr., which therefore cannot provide enhanced OUTDOOR air ventilation.

Common in older schools
These are likely to be valid, high priority requests.

AIR SYSTEMS THAT DELIVER ONLY OUTDOOR AIR

Typically, these have capacity to provide 3-4 AC/hr.

4 AC/hr. does have capacity to provide enhanced OUTDOOR air ventilation capacity
3 AC/hr. meets ASHRAE minimum OUTDOOR air requirement

6) Typical for schools that qualify for full cooling, where make-up units deliver outdoor air to modular heat pumps or fan coil units.

When upgrades are carried out it is recommended to increase the airflow capacity of the make-up air unit(s), along with appropriate amounts of pre-heating and/or pre-cooling capacity.

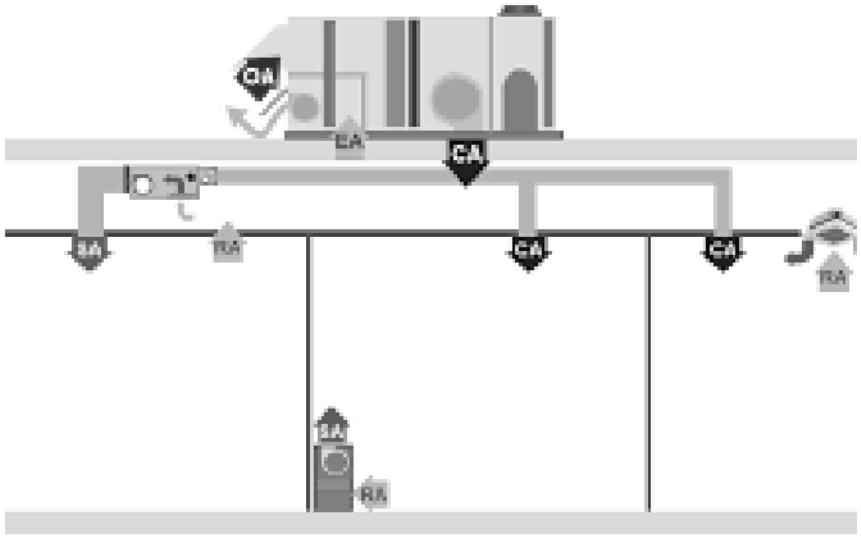
This allows replacement of the make-up equipment and the modular indoor units to be independent phases

7) Also provided in some newer schools, where providing code minimum outdoor air was done strategically to minimize energy use.

Schools will be equipped with newer equipment, not in need of urgent renewal based on age or condition. These often include HRVs, which although typically not providing any more outdoor air than code minimum, do not re-circulate room air.

These systems were designed to minimize energy use and are NOT viewed as wrongly designed. However, considering the current pandemic, and potential for future events of concern, consideration of increasing outdoor air capacity in future is recommended.

CATEGORIES 5 / 6 / 7
3-4 AC/Hr.











CATEGORY 8

HEATING ONLY ROOMS WITH NO VENTILATION

Typically, with operable windows for ventilation

These should be considered as the highest priority for upgrades

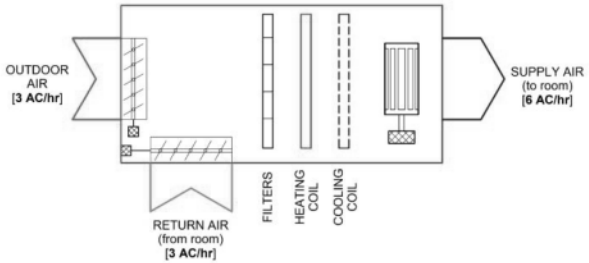
An upgrade of the heating plant will also likely be required as part of such an HVAC upgrade, since no capacity for heating of ventilation air would have been included in the original design.





MIXING SYSTEM
(WITH AIR CONDITIONING CAPACITY)

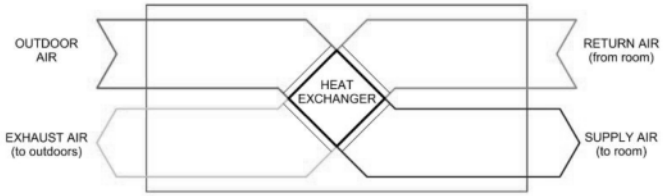
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Mixing type AHU

NON-MIXING SYSTEM
(HEAT RECOVERY)

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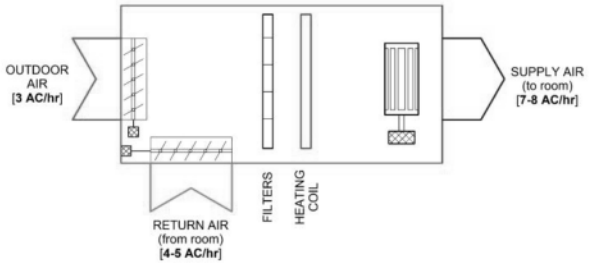


Heat recovery AHU

Typically around 3-4 AC/hr

MIXING SYSTEM
(NO AC - SIZED FOR FREE COOLING)

AIR SUPPLIED TO THE ROOM PROVIDES VENTILATION AND THERMAL COMFORT



Mixing type AHU

NON-MIXING SYSTEM

EQUIPMENT PROVIDES SEPARATE HEATING/COOLING



Convector



Radiant Floor



Fan Coil Unit
(or Modular Heat Pump)



Chilled Beam

FILTRATION

MERV

MINIMUM EFFICIENCY REPORTING VALUE

Ranges from MERV-1 to MERV-16

HEPA

HIGH EFFICIENCY PARTICULATE AIR (FILTER)

- **<u>Filtration</u>** – In commercial and institutional buildings without large sources of grease, dirt or other contaminants in the space, filters in HVAC units serving occupied spaces are typically changed 3-4 times per year, regardless of rating. Replacing them more frequently than this can be cost prohibitive and result in useable filters being thrown away, but it is recommended not to change them less frequently than this. Anecdotally in the HVAC industry, there are suggestions that electrostatically charged filters lose their effectiveness over time and that the associated MERV rating is not correct, but if the filters are changed regularly, this is not likely to be a concern and the filter will maintain close to original effectiveness throughout its lifetime.

- It is worth noting however, that increased filtration capacity has the potential to increase the total static pressure on the system, decreasing the fan's capacity, and potentially reducing the amount of fresh air delivered to a given space. Commercially available data yields the following information:

  - MERV 8 filters are considered clean at 0.25" w.g. and considered dirty at 0.6" w.g.
  - MERV 13 filters are considered clean at 0.30" w.g. and considered dirty at 1.0" w.g.

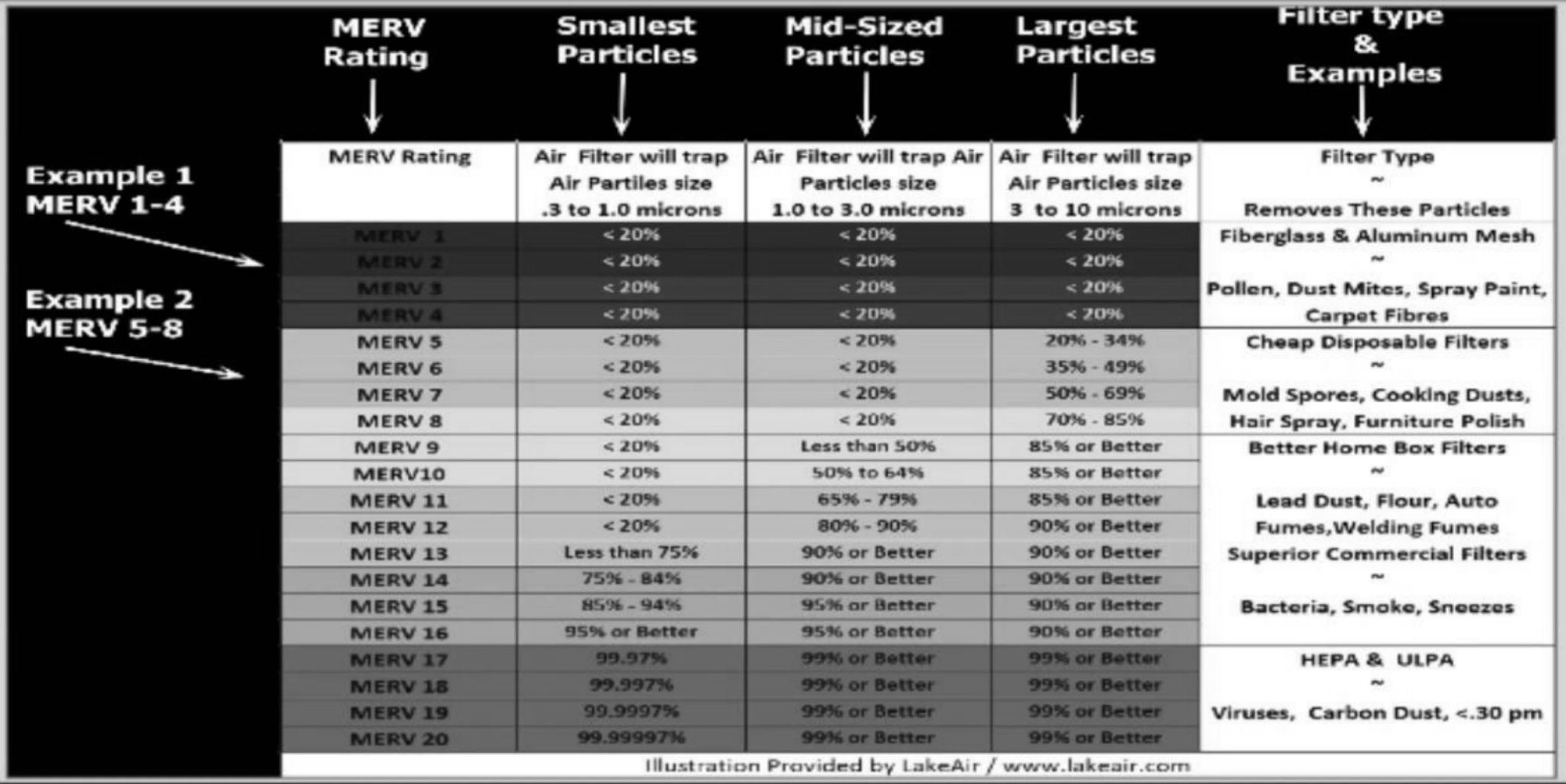
  Therefore, while the impact of upgrading to a clean or partially dirty MERV 13 filter is relatively small, the change has a greater effect on the system as filters become dirty; potentially impacting system performance if not changed at regular intervals.

- The fraction of particles removed from air passing through a filter is termed “filter efficiency” and is provided by the Minimum Efficiency Reporting Value (MERV) from an *ASHRAE 52.2* test is based on the filter efficiency.
  - MERV ranges from 1 to 16; the higher the MERV, the higher the efficiency.
  - HEPA even more efficient than MERV 16 filters.
- Filters must be sealed well to give the expected performance. Ensure the airflow passes through the filter and not around it due to leaks.

MERV with No Bypass	Gap Size 6.4 mm	19 mm	32 mm
7	6[a]	6	6
11	10	8	8
14	12/13[b]	8	8

[a]Modeled value predicted no decline for U-shaped filter (i.e., MERV 7)
[a]Straight-through = MERV 12, U-shaped = MERV 13

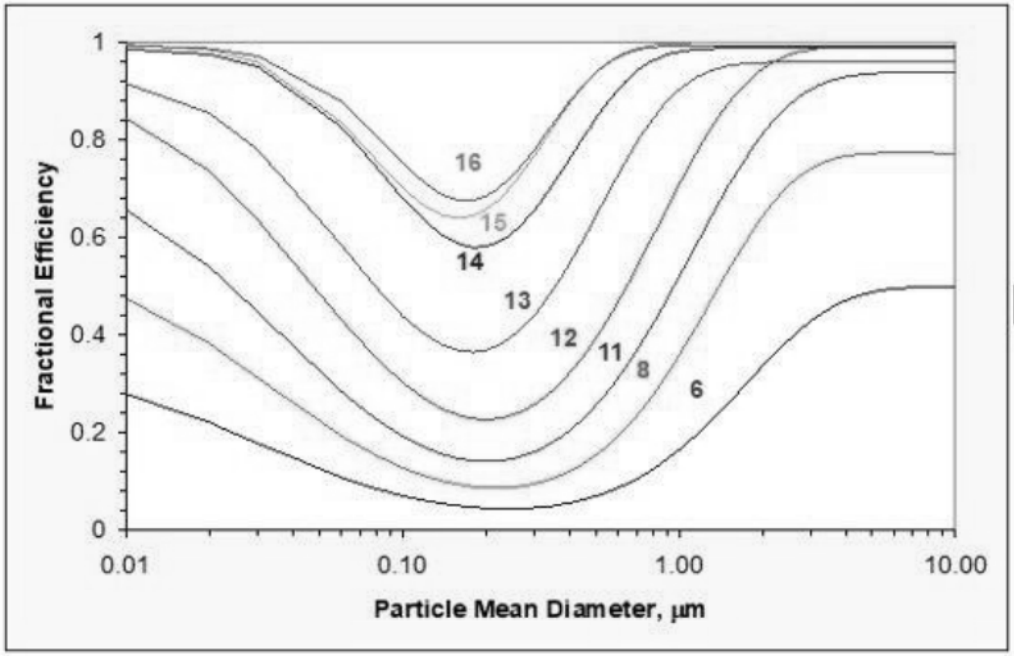
- Some filters have charged media to increase particle removal with lower pressure drop. Since the efficiency of these filters often drops off with initial use, a MERV-A value (A = ACTUAL) if available, will reflect the actual Efficiency better than a standard MERV value
- Increased filter efficiency generally results in increased pressure drop. Ensure HVAC systems can handle filter upgrades without negative impacts to pressure differentials and/or air flow rates prior to changing filters.
- Generally, particles with an aerodynamic diameter around 0.3 µm are most penetrating; efficiency increases above and below this particle size.

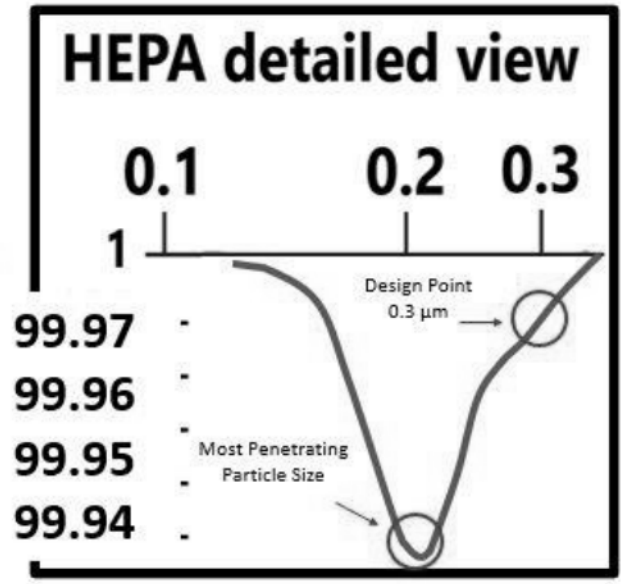


MERV Rating	Air Filter will trap Air Partiles size .3 to 1.0 microns	Air Filter will trap Air Particles size 1.0 to 3.0 microns	Air Filter will trap Air Particles size 3 to 10 microns	Filter Type ~ Removes These Particles
MERV 1	< 20%	< 20%	< 20%	Fiberglass & Aluminum Mesh ~ Pollen, Dust Mites, Spray Paint, Carpet Fibres
MERV 2	< 20%	< 20%	< 20%	
MERV 3	< 20%	< 20%	< 20%	
MERV 4	< 20%	< 20%	< 20%	
MERV 5	< 20%	< 20%	20% - 34%	Cheap Disposable Filters ~ Mold Spores, Cooking Dusts, Hair Spray, Furniture Polish
MERV 6	< 20%	< 20%	35% - 49%	
MERV 7	< 20%	< 20%	50% - 69%	
MERV 8	< 20%	< 20%	70% - 85%	
MERV 9	< 20%	Less than 50%	85% or Better	Better Home Box Filters ~ Lead Dust, Flour, Auto Fumes,Welding Fumes Superior Commercial Filters ~ Bacteria, Smoke, Sneezes
MERV10	< 20%	50% to 64%	85% or Better	
MERV 11	< 20%	65% - 79%	85% or Better	
MERV 12	< 20%	80% - 90%	90% or Better	
MERV 13	Less than 75%	90% or Better	90% or Better	
MERV 14	75% - 84%	90% or Better	90% or Better	
MERV 15	85% - 94%	95% or Better	90% or Better	
MERV 16	95% or Better	95% or Better	90% or Better	
MERV 17	99.97%	99% or Better	99% or Better	HEPA & ULPA ~ Viruses, Carbon Dust, <.30 pm
MERV 18	99.997%	99% or Better	99% or Better	
MERV 19	99.9997%	99% or Better	99% or Better	
MERV 20	99.99997%	99% or Better	99% or Better	

Illustration Provided by LakeAir / www.lakeair.com

High Efficiency Particulate Air (HEPA) Filters





- By definition, HEPA filters are at least 99.97% efficient at filtering 0.3 µm mass median diameter (MMD) particles in standard tests.
- HEPA filter efficiency is higher than MERV 16.
- It is usually not feasible to retrofit existing HVAC systems with HEPA filters due to high pressure drops and the likelihood that systems will need new filter racks.
- Adding HEPA filters to systems that are not designed for them may cause significant damage.
- To function properly, HEPA filters must be sealed properly in filter racks.
- HEPA filters can be located in HVAC systems or in In-Room or Portable HEPA Air Cleaners.

Virus Particle Size Expectation: SARS-CoV-2 Virus is based on Influenza A Studies

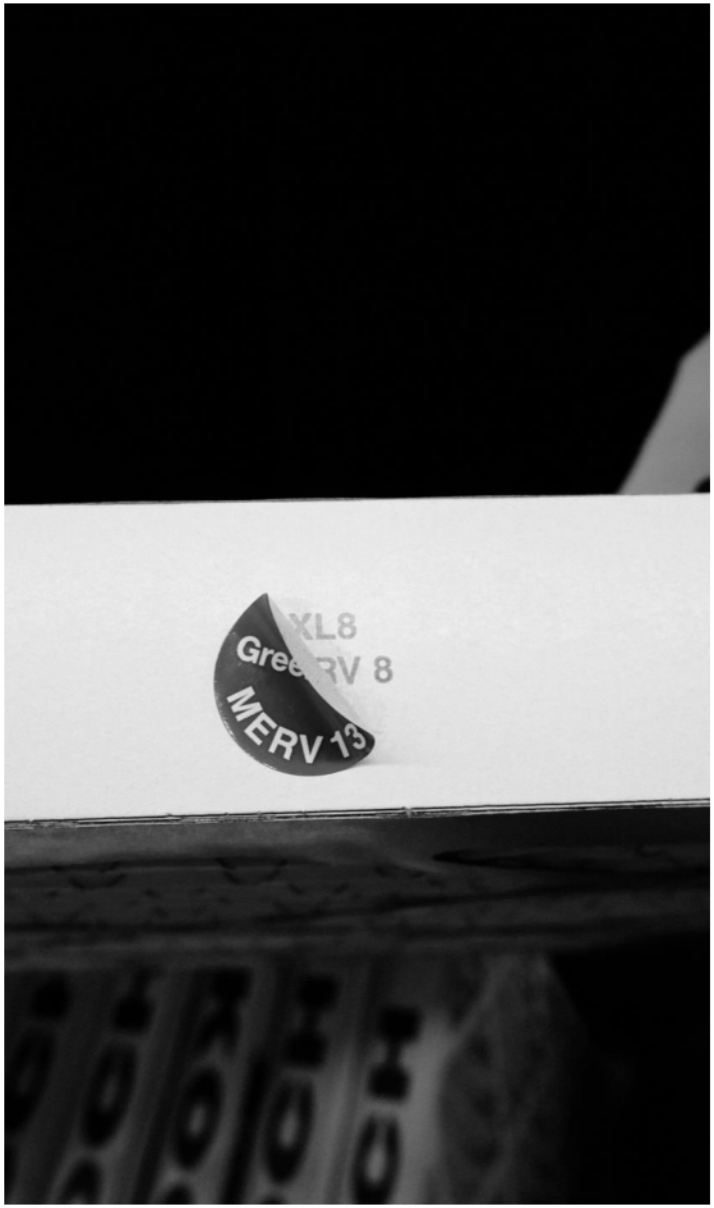
- The virus particle itself is very small, less than 0.14 micron
- Filters are rated at capture efficiency in three different ranges of particles
  - E1 is 0.3 to 1 um (micron)
  - E2 is 1 to 3 um (micron)
  - E3 is 3 to 10 um (micron)

Filter Ranges (Particle Size)	Anticipated Distribution of Virus
E1 (0.3 um to 1 um)	20%
E2 (1um to 3 um)	29%
E3 (3 um to 10 um)	51%

MERV Rating (Based on 52.2-2017)	Filter Droplet Nuclei Efficiency
4	16.80%
5	26.55%
6	32.45%
7	41.13%
8	55.57%
9	62.00%
10	64.65%
11	72.86%
12	83.39%
13	89.93%
14	94.94%
15	96.18%
16	97.40%

The filter's Droplet Nuclei Efficiency can now be used to determine the equivalent outdoor air that it will generate when calculating the time to achieve the Pre or Post - Occupancy Flushing Strategy.



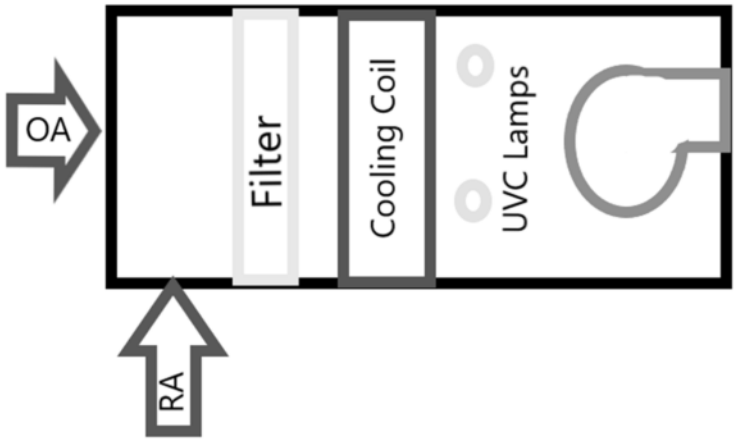

XL8
RV 8
MERV 13


18x24x2
Multi-Pleat
Koch Filter Corporation

Equivalent Outdoor Air:

Equivalent Outdoor Air is the combination of air introduced from outdoors and that recirculated from the space.

A classroom with 25-30 occupants requires roughly 3 air changes per hour of outdoor air to maintain an acceptable carbon dioxide level in the room.

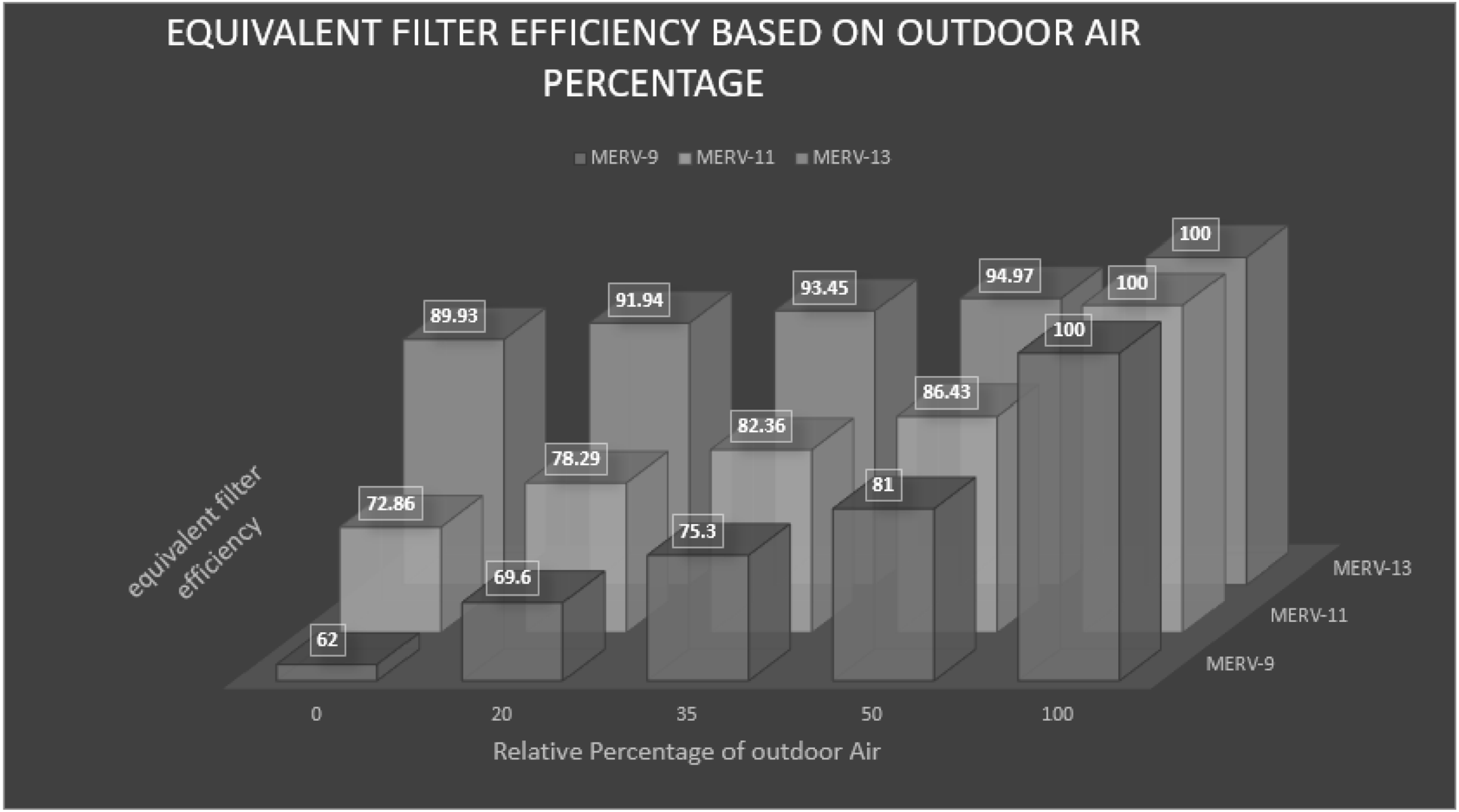


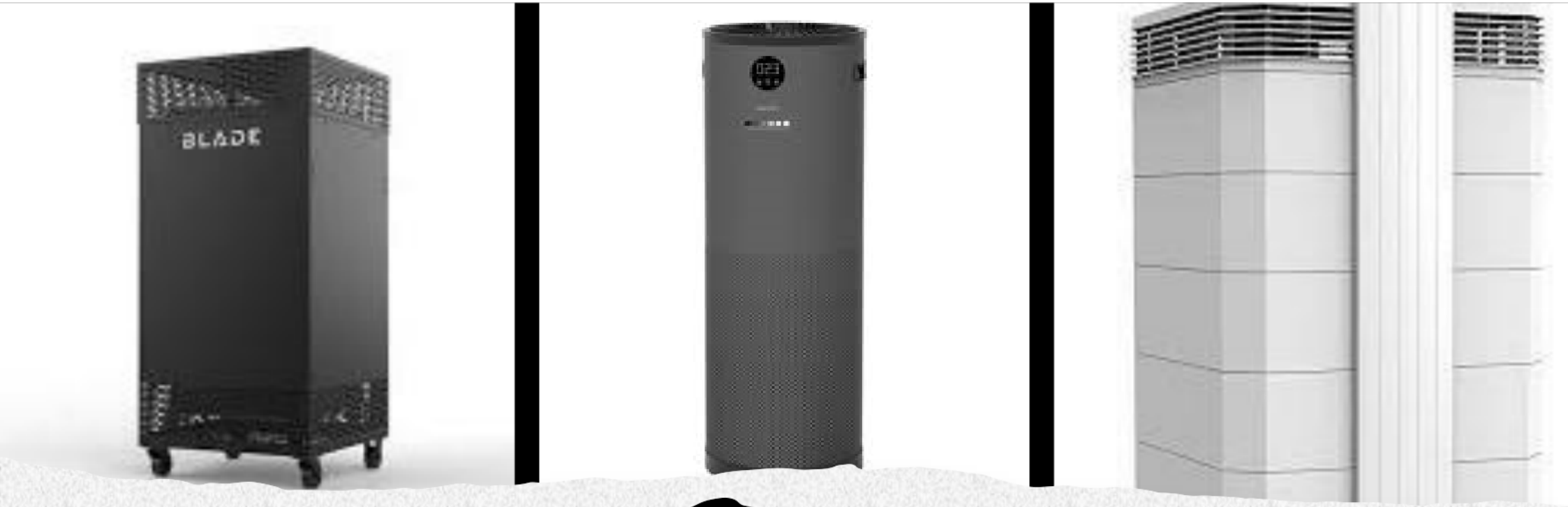
An example of a fairly typical classroom system is 3 AC/hr each of outdoor and recirculated air.

The EQ OA calculation for this would be: **3 AC x (100% efficiency) for the outdoor air + 3 AC x (Filter Efficiency) for recirc air**

For a ventilation system using a MERV 11 filter this would be:
(3 AC) (100%) + (3AC) (72.5%) = 5.175 total AC per hour

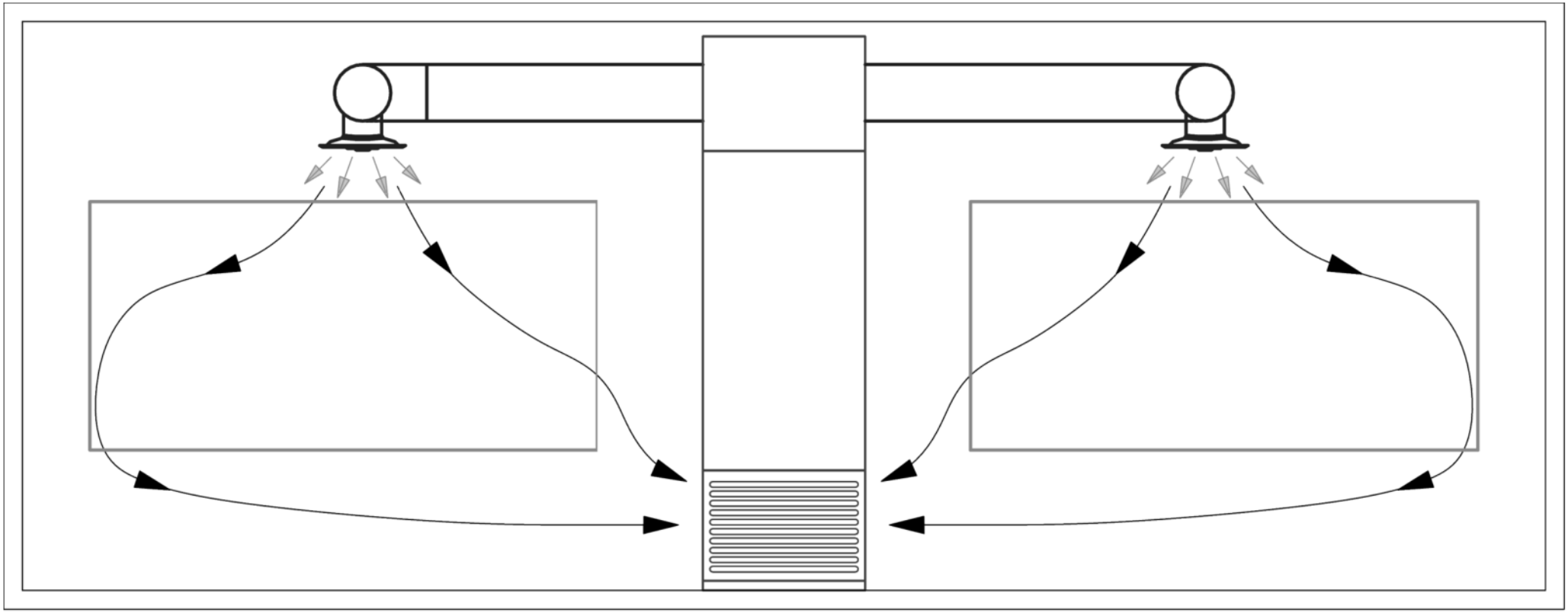
For a ventilation system using a MERV 13 filter this would be:
(3 AC) (100%) + (3AC) (90%) = 5.70 total AC per hour


EQUIVALENT FILTER EFFICIENCY BASED ON OUTDOOR AIR PERCENTAGE
MERV-9
MERV-11
MERV-13
equivalent filter efficiency
89.93
72.86
62
91.94
78.29
69.6
93.45
82.36
75.3
94.97
86.43
81
100
100
100
MERV-13
MERV-11
MERV-9
0
20
35
50
100
Relative Percentage of outdoor Air

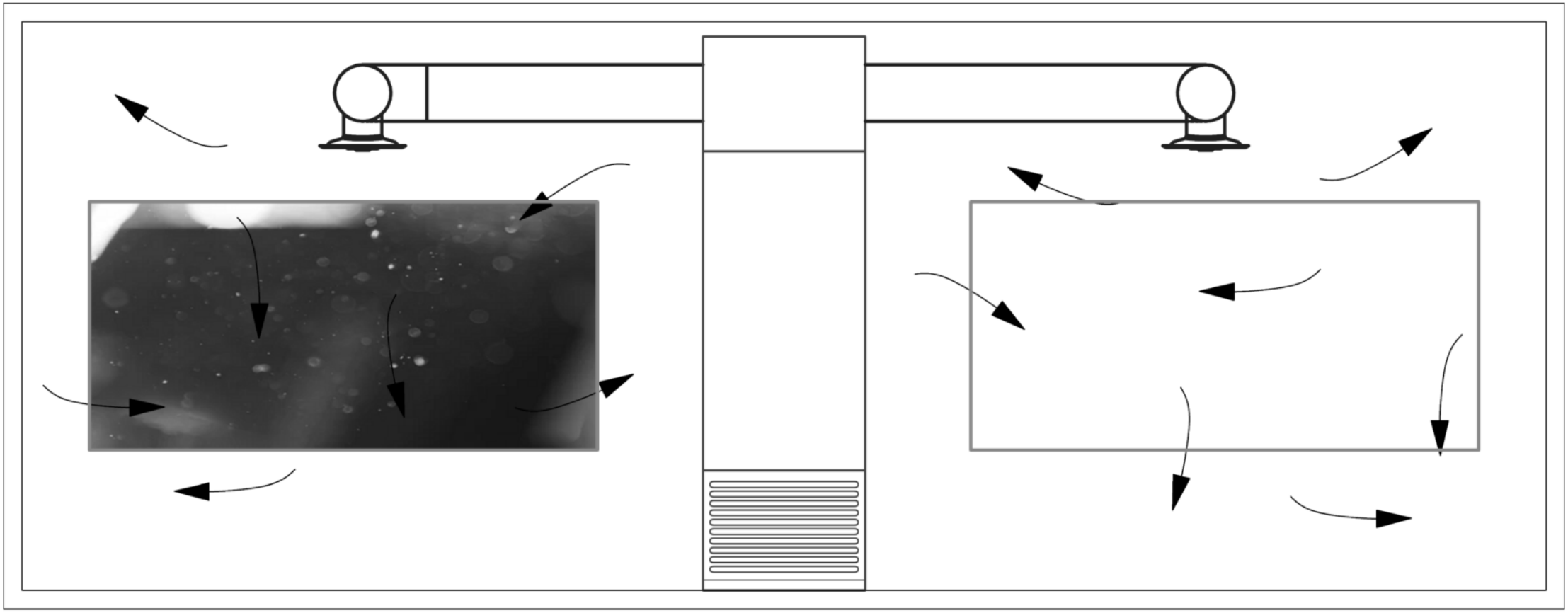


PORTABLE, STANDALONE HEPA FILTER UNITS

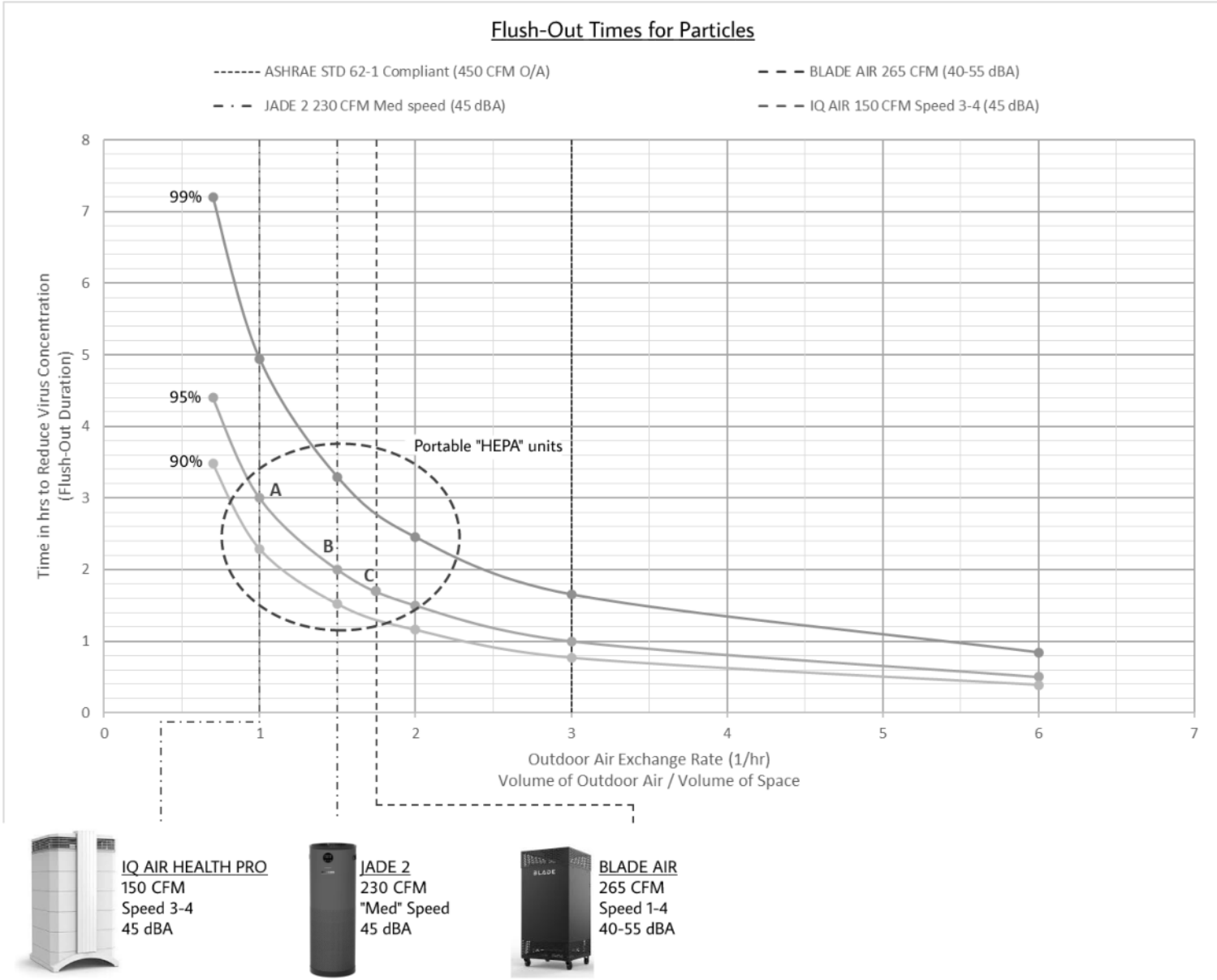
RE-CIRCULATION OF ROOM AIR / NO OUTDOO AIR

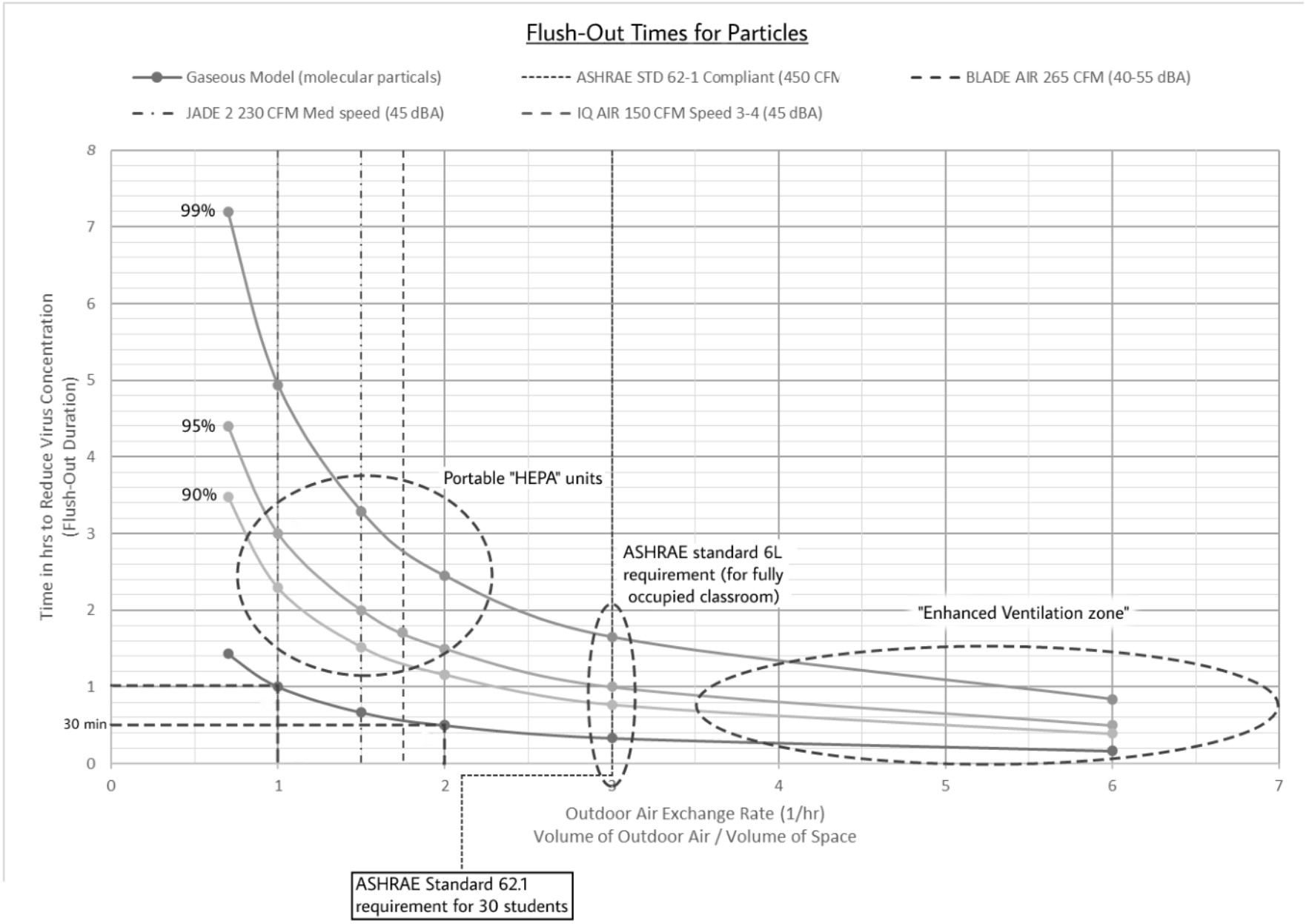


- The ventillation system is used for dilution of carbon dioxide (CO_2)
- A lower concentration of CO_2 in the air being delivered to the room which instantaneously equalized
- Outdoor air contains roughly 400 PPM and is used to dilute indoor air to around 1000 PPM of CO_2
- CO_2 equalizes concentration throughout the volume



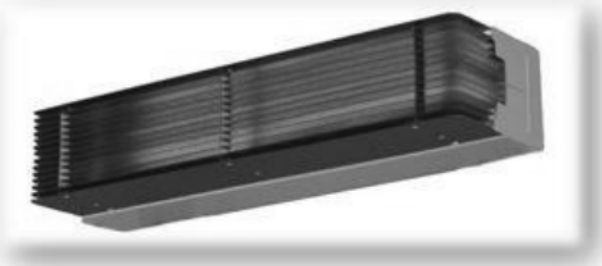
Not true for particle dust, smoke, or viral particles.
These have mass and move around the room more randomly, driven by thermal variations and air currents


Flush-Out Times for Particles
ASHRAE STD 62-1 Compliant (450 CFM O/A)
BLADE AIR 265 CFM (40-55 dBA)
JADE 2 230 CFM Med speed (45 dBA)
IQ AIR 150 CFM Speed 3-4 (45 dBA)
99%
95%
90%
Portable "HEPA" units
A
B
C
Time in hrs to Reduce Virus Concentration (Flush-Out Duration)
Outdoor Air Exchange Rate (1/hr)
Volume of Outdoor Air / Volume of Space
0
1
2
3
4
5
6
7
8
IQ AIR HEALTH PRO
150 CFM
Speed 3-4
45 dBA
JADE 2
230 CFM
"Med" Speed
45 dBA
BLADE AIR
265 CFM
Speed 1-4
40-55 dBA


Flush-Out Times for Particles
Gaseous Model (molecular particals)
ASHRAE STD 62-1 Compliant (450 CFM
BLADE AIR 265 CFM (40-55 dBA)
JADE 2 230 CFM Med speed (45 dBA)
IQ AIR 150 CFM Speed 3-4 (45 dBA)
Time in hrs to Reduce Virus Concentration (Flush-Out Duration)
99%
95%
90%
Portable "HEPA" units
ASHRAE standard 6L requirement (for fully occupied classroom)
"Enhanced Ventilation zone"
30 min
Outdoor Air Exchange Rate (1/hr)
Volume of Outdoor Air / Volume of Space
ASHRAE Standard 62.1 requirement for 30 students

EMERGING TECHNOLOGIES

Baffled
fixture shown





Typical UV-C
energy pattern
of a baffled
fixture



Perpendicular
to airflow



Parallel
to airflow



CDC Position on Emerging Air Cleaning Technologies

- CDC does not provide recommendations for, or against, any manufacturer or product. There are numerous technologies being heavily marketed to provide air cleaning during the ongoing COVID-19 pandemic.
- While variations of these technologies have been around for decades, relative to other air cleaning or disinfection methods, they have a less-documented track record when it comes to cleaning/disinfecting large and fast volumes of moving air within heating, ventilation, and air conditioning (HVAC) systems or even inside individual rooms.
- This does not imply the technologies do not work as advertised. However, in the absence of an established body of peer-reviewed evidence showing proven efficacy and safety, the technologies are still considered by many to be “emerging.”
- As with all emerging technologies, consumers are encouraged to exercise caution and to do their homework.
- Registration alone, with national or local authorities, does not always imply product efficacy or safety.

Ultraviolet Energy (UV-C)

- Ultraviolet energy inactivates viral, bacterial and fungal organisms
- Types of disinfection systems using UV-C energy:
  - In-duct air and/or surface disinfection
  - Upper-room or upper-air disinfection
  - Portable room decontamination
- Requires special PPE to prevent damage to eyes and/or skin from overexposure.
- Exposure to UV-C energy can cause temporary eye and skin damage

Electronic Air Cleaners

- Removal typically occurs by electrically charging particles using corona wires or by generating ions (e.g., pin ionizers) and:
- The fraction of particles removed from air by an electronic filter is termed “removal efficiency.” Although the testing methodology of ASHRAE 52.2 can be used to determine the efficiency of many of these devices, they are not officially covered by that standard.

Gas-Phase Air Cleaners

- Gas-phase air cleaners are those used to remove ozone, volatile organic compounds and odors from the air.
- Most contain sorbent materials such as carbon (e.g., activated charcoal).
- While there may be exceptions, most sorbent beds alone are not generally efficient at removing viruses from airstreams.
- Carbon/sorbent impregnated fiber filters will remove particles; check for a MERV rating to show efficiency just as you do with standard particulate filters.

MAINTENANCE PRACTICES

- ✓ FILTER CHANGES (ROUTINE MAINTENANCE BY SD)
- ✓ CONTROLS RE-COMMISSIONING
  (Performed by In-House Staff or DDC Company or Cx. Agency)
- ✓ AIRFLOW REVIEWS (BALANCING AGENT)
- ✓ DUCT CLEANING PROGRAM

PRIORITIZING FUTURE HVAC UPGRADES/ PLANNING FOR CLIMATE RESILICENCY

- CURRENT EFFECTIVENESS OF VENTILATION CAPACITY AND FILTER EFFICIENCY

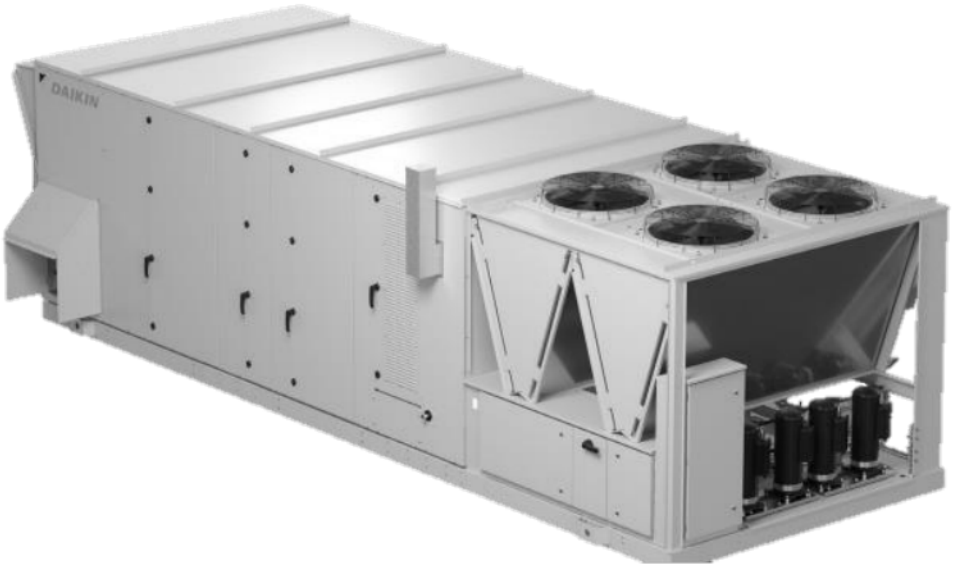
- CONSIDER ENHANCED / FLEXIBLE CAPACITY FOR CLIMATE CHANGE RESILIENCY

  - VENTILATION RATES (Fans with capacity above code minimum)
  - FILTERS (Flexibility to change filter efficiency to respond to epidemiolocal, smoke, allergy emergencies)
  - HEATING / COOLING PLANT CAPACITY FOR CLIMATIC EXTREMES
  - PLAN FOR FUTURE COOLING CAPACITY (Vapour barriers on pipe and duct insulation, condensate pans for AHU's)

VENTILATION EFFECTIVNESS CHART

Table 6-4 Zone Air Distribution Effectiveness

Air Distribution Configuration	E_z
Well-Mixed Air Distribution Systems	
Ceiling supply of cool air	1.0
Ceiling supply of warm air and floor return	1.0
Ceiling supply of warm air 15°F (8°C) or more above space temperature and ceiling return	0.8
Ceiling supply of warm air less than 15°F (8°C) above average space temperature where the supply air-jet velocity is less than 150 fpm (0.8 m/s) within 4.5 ft (1.4 m) of the floor and ceiling return	0.8
Ceiling supply of warm air less than 15°F (8°C) above average space temperature where the supply air-jet velocity is equal to or greater than 150 fpm (0.8 m/s) within 4.5 ft (1.4 m) of the floor and ceiling return	1.0
Floor supply of warm air and floor return	1.0
Floor supply of warm air and ceiling return	0.7
Makeup supply outlet located more than half the length of the space from the exhaust, return, or both	0.8
Makeup supply outlet located less than half the length of the space from the exhaust, return, or both	0.5
Stratified Air Distribution Systems (Section 6.2.1.2.1)	
Floor supply of cool air where the vertical throw is greater than or equal to 60 fpm (0.25 m/s) at a height of 4.5 ft (1.4 m) above the floor and ceiling return at a height less than or equal to 18 ft (5.5 m) above the floor	1.05
Floor supply of cool air where the vertical throw is less than or equal to 60 fpm (0.25 m/s) at a height of 4.5 ft (1.4 m) above the floor and ceiling return at a height less than or equal to 18 ft (5.5 m) above the floor	1.2
Floor supply of cool air where the vertical throw is less than or equal to 60 fpm (0.25 m/s) at a height of 4.5 ft (1.4 m) above the floor and ceiling return at a height greater than 18 ft (5.5 m) above the floor	1.5
Personalized Ventilation Systems (Section 6.2.1.2.2)	
Personalized air at a height of 4.5 ft (1.4 m) above the floor combined with ceiling supply of cool air and ceiling return	1.40
Personalized air at a height of 4.5 ft (1.4 m) above the floor combined with ceiling supply of warm air and ceiling return	1.40
Personalized air at a height of 4.5 ft (1.4 m) above the floor combined with a stratified air distribution system with nonaspirating floor supply devices and ceiling return	1.20
Personalized air at a height of 4.5 ft (1.4 m) above the floor combined with a stratified air distribution system with aspirating floor supply devices and ceiling return	1.50





Air Source Heat Pumps





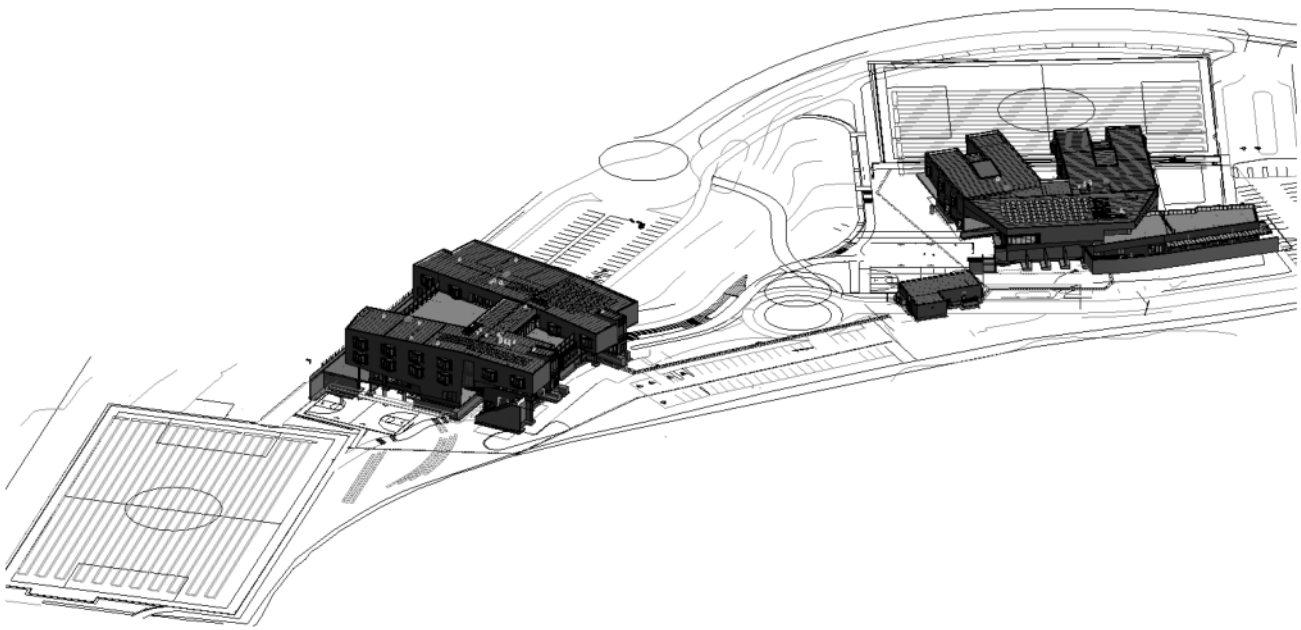
Electric Boilers

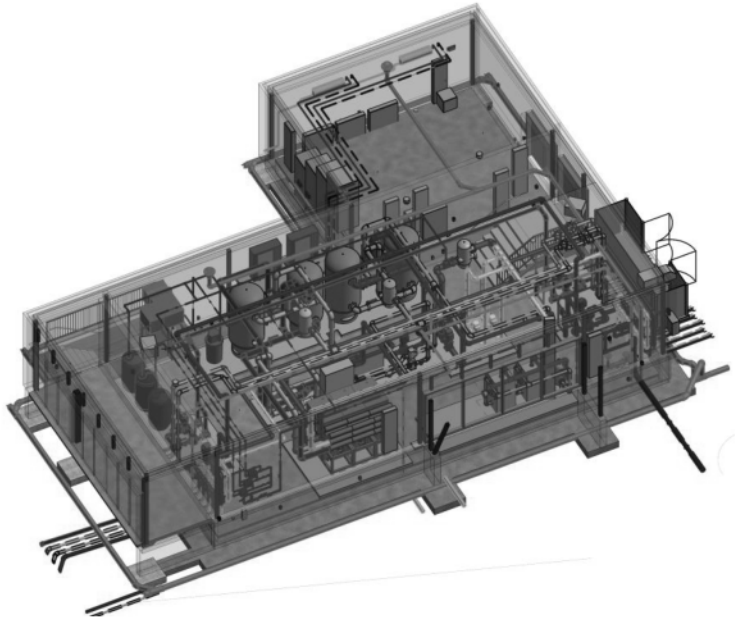


Heat Recovery Unit

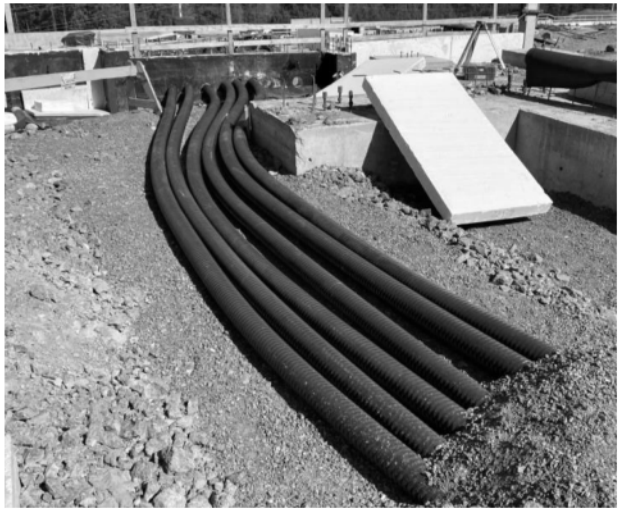

AERMEC
AERMEC


BIOMASS











VTAP Best Practices Guidelines: Request for Comments

From:	Graham, Megan 1 EDUC:EX <Megan.Graham@gov.bc.ca>
To:	Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, tberger@abbotsfordchristian.com, Patti Dundas <dundas_p@surreyschools.ca>, cmorris@sd61.bc.ca, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>, bob.beukers@abbyschools.ca, josh.currie@sd23.bc.ca, shawn@fisabc.ca, matt.foley@burnabyschools.ca
Cc:	Stephen McNicholls <stephen@smcn.ca>
Sent:	June 7, 2022 2:36:51 PM PDT
Attachments:	2.0 Draft Detailed -Best Practices Guidelines Ventilation in BC Schools.docx

Hi all,

We are putting out a final request for comments and/or edits regarding the Best Practices Guidelines discussed at our last VTAP meeting. We are hoping to have comments received **on or before next Friday, June 17** in order to finish revisions and solidify the document by next meeting.

Thank you for taking the time to provide your feedback, and please feel free to get in touch with me if you have any questions or concerns.

Warm regards,

Megan Graham | Planning Analyst
Minor Capital Programs & Finance Unit
Ministry of Education
Phone: (250) 208-0732

Ventilation Technical Advisory Panel Agenda

Meeting #06
7/12/2022
10:00am –11:00am
Location: Zoom Video Conference Call

Members:	Francois Bertrand, Damien Crowell, Megan Graham, Chuck Morris, Collette O'Reilly, Steve Hopkins, Bob Beukers, Stephen McNicholls, Shawn Chisholm, Matt Foley, Tym Berger, Ravnit Aujla, Grant Sheppard, Josh Currie
Guests:	N/A
Regrets:	N/A

TIME	TOPIC		LEAD
10:00 – 10:05am	**1.0 Meeting Agenda**	Information	Damien Crowell
10:05 – 10:25am	**2.0 Best Practices Guidelines**	Information	Stephen McNicholls
10:25 – 10:50am	**3.0 Guidelines Discussion**	Information	All
10:50 – 10:55am	**4.0 Roundtable and/or Questions**	Information	All
10:55 – 11:00am	**5.0 Wrap up/Items for Future Meetings**	Information	Damien Crowell

Next Meeting: TBD

CONFIDENTIAL

Ventilation Technical Advisory Panel
Minutes – Meeting #06

Date: Tuesday – July 12, 2022
Time: 10:00 to 11:00am
Location: Video Conference Call
Members: Francois Bertrand, Damien Crowell, Megan Graham, Aimee King, Steve Hopkins, Bob Beukers, Josh Currie, Stephen McNicholls, Shawn Chisholm, Matt Foley

Guests: N/A

Regrets Chuck Morris, Collette O'Reilly, Ravnit Aujla, Tym Berger, Patti Dundas, Ravnit Aujla

Agenda Item	Discussion/Action items
1. Meeting Agenda & Introductions	• Agenda was circulated in advance of the meeting and no concerns were raised.
2. Best Practices Document Review	• Walk-through of updated Best Practices guidelines with request for members to provide feedback during meeting. • Members expressed budget concerns regarding more frequent duct-cleaning. Suggestion for structured duct-cleaning program. • Purpose of document not meant to be prescriptive in nature. **Action Item:** • Damien and HVAC specialist to meet outside of VTAP meeting to discuss amendments to duct-cleaning aspect of guidelines. • Changes to document to be completed by end of week (July 14).
3. Roundtable and/or Questions	• No further monthly meetings deemed necessary unless environment changes. Suggestion to potentially continue meetings at frequency of twice per year.
4. Wrap-up/Items for Future Meetings	• Future meeting TBD. • Location: Video Conference Call
5. Adjournment	• Meeting adjourned at 10:30am.

Ventilation Technical Advisory Panel Meeting #6 (July 12, 2022)

From:	Crowell, Damien EDUC:EX <Damien.Crowell@gov.bc.ca>
To:	Bertrand, Francois EDUC:EX <Francois.Bertrand@gov.bc.ca>, Chuck Morris <cmorris@sd61.bc.ca>, Collette O'Reilly <coreilly@vsb.bc.ca>, XT:Hopkins, Steve EDUC:IN <steve.hopkins@sd47.bc.ca>, Bob Beukers <Bob.Beukers@abbyschools.ca>, Stephen McNicholls <stephen@smcn.ca>, Graham, Megan 1 EDUC:EX <Megan.Graham@gov.bc.ca>, Shawn Chisholm <shawn@fisabc.ca>, matt.foley@burnabyschools.ca, Aujla, Ravnit EDUC:EX <Ravnit.Aujla@gov.bc.ca>, Josh Currie <Josh.Currie@sd23.bc.ca>, King, Aimee EDUC:EX <Aimee.King@gov.bc.ca>, tberger@abbotsfordchristian.com
Cc:	Sheppard, Grant EDUC:EX <Grant.Sheppard@gov.bc.ca>, Croshaw, Geoff EDUC:EX <Geoff.Croshaw@gov.bc.ca>
Sent:	July 13, 2022 7:54:50 AM PDT
Attachments:	image001.png, Minutes for Meeting #06 - July 12 2022.docx, Updated Draft - Best Practices Guidelines Ventilation in BC Schools_07July2022.docx

Hello all,

Attached are the Ventilation Technical Advisory Panel Meeting minutes (July 12, 2022) along with an updated draft Best Practices Guidelines for Ventilation in BC School document – the only change to the guideline was to the duct cleaning section which now states the following:

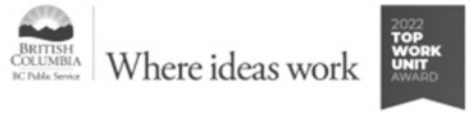
DUCT CLEANING

It is recommended that school districts have a plan in place that involves a routine schedule of duct cleaning for all facilities.

Please contact me if you have any suggestions by end of day on July 14th. Thanks,

Damien

Damien Crowell | Director | Capital Projects | Ministry of Education & Child Care
Phone 250.893.6477 | email: Damien.Crowell@gov.bc.ca



CONSIDERATIONS FOR IMPROVING HVAC SYSTEM PERFORMANCE

Context

This document is intended to provide some considerations to school districts with regards to improving Heating Ventilation Air Conditioning (HVAC) system performance given the recent pandemic situation. Note that this document is not intended to supersede any requirements from ASHRAE or other regulatory bodies.

Maintenance for School HVAC Systems/Equipment

VERIFICATION OF OUTDOOR AIR DELIVERY

Delivery of at least minimum ASHRAE recommended amount of outdoor air is the target of a correctly functioning ventilation system. Air handling units are typically equipped with dampers intended to modulate introduction of outdoor air, typically connected to the school's digital control system.

Whether dampers are correctly functioning is important to verify. Control systems are programmed to modulate dampers, typically based on readings from building carbon dioxide (CO2) levels and, whereas less sophisticated controls may be based solely on outdoor temperature.

Dampers and their associated control mechanisms do go out of calibration or experience component failures. What the controls system indicates on a controls graphics display screen cannot be assumed to be true at the damper location. Linkages break, slip or become disconnected. Or become seized due to lack of maintenance.

Periodically, damper operation should be verified by physically witnessing dampers respond to control signals. Under normal circumstances this is recommended to occur every three years, but when emergency situations such as the current pandemic occur, a district wide damper review should be performed.

VERIFICATION OF OVERALL CONTROLS FUNCTIONALITY

As an extension of the above, it is recommended a review of controls programming, and a re-commissioning exercise be performed, as per manufacturer's/mechanical engineer's recommendations.

This exercise will identify energy saving opportunities such as HVAC equipment operating outside school occupancy schedules, incorrect temperature setpoints, elevated heating plant water temperature setpoints and variable speed motors running at higher speed than necessary.

DUCT CLEANING

DRAFT

It is recommended that school districts have a plan in place that involves a routine schedule of duct cleaning for all facilities.

FILTERS

It is recommended that school districts replace or clean filters as recommended by the filter manufacturer, or at least three times annually. In cases where electro-statically charged filters are used to increase MERV-rating, the charge will deteriorate over time. Changing filters on a regular basis will mitigate this issue.

Maintenance staff should also review filters and how they fit into their holding racks. Instances where air can bypass the filter media results in a reduced overall MERV rating, as any air that does bypass does not get filtered at all.

Upgrade Considerations for School HVAC Systems/Equipment

VENTILATION

When planning for future HVAC upgrades with a particular focus on ventilation improvements, School Districts should consider upgrades based on an analysis of the type and condition of existing systems.

Age of any type of system and/or equipment, along with performance, will be factors supporting need for upgrades. Consideration should also be given to the potential of repair and/or re-commissioning systems.

The highest priority projects should be for spaces and/or schools with no mechanical ventilation.

To comply with ASHRAE Standard 62.1, *"Ventilation for Acceptable Indoor Air Quality"*, ventilation systems serving standard sized classrooms should have the ability to deliver around 450 cubic feet per minute (CFM) of outdoor air. This equates to roughly 3 air changes per hour (AC/hr).

Some ventilation systems mix outdoor air with air recirculated from the room. Others are strictly outdoor air systems. The latter category may be heat recovery type units and are sometimes categorized as dedicated outdoor air systems (DOAS).

Mixing type systems deliver between 6 and 8 AC/hr of total supply air.

- 6 AC/hr when mechanical cooling is provided
- 7 AC/hr when relying on ambient outdoor temperature for free cooling (north facing rooms)
- 8 AC/hr when relying on ambient outdoor temperature for free cooling (east / south / west facing rooms)

Mixing systems with capacity to deliver 6-8 AC/hr were more useful than DOAS systems during the pandemic, with the ability to deliver greater quantities of outdoor air. Many

school districts implemented pandemic mode ventilation operation to deliver greater amounts of outdoor air than the ASHRAE minimum, even during colder (or warmer) weather, as long as heating (or cooling) plant capacities could support heating (or cooling) the additional outdoor air.

When outdoor temperature was suitable, systems could provide outdoor air up to 100% of their airflow capacity. Logically, therefore, mixed air systems provided more benefit than DOAS systems for pandemic response.

Post-pandemic, providing enhanced amounts of outdoor air runs counter to energy targets. It is anticipated, however, that ASHRAE will be publishing updated standards for classroom ventilation which may recommend increasing capacity of ventilation systems to a level greater than pre-pandemic values.

Heating and cooling plant equipment will not need to be sized for anything more than the new level of enhanced ventilation, and under normal circumstances should not be operated using this incremental capacity increase. The updated capacity should be reserved only to combat future health or climate emergencies.

The increase in new ASHRAE recommended outdoor air rates will apply equally to mixing and non-mixing ventilation systems, so either system type can be considered for future HVAC capital upgrade projects. Mixing systems may be viewed as more useful, however, in light of their ability to deliver more outdoor air than DOAS systems when ambient temperature is mild.

In light of the above, the Ventilation Technical Advisory Panel has categorized ventilation systems in the following order from most effective to least effective, which School Districts may choose to use as a guide toward future ventilation upgrades. Applicable system enhancements that would improve overall effectiveness of each categorized ventilation system have also been provided for consideration.

<u>Category 1</u>: Mixing systems with capacity to provide a total air flow (combination of outdoor and recirculated) of 6-8 air changes per hour (AC/hr).

- 8 AC/hr when relying on ambient outdoor temperature for free cooling (east / south / west facing rooms)
- 7 AC/hr when relying on ambient outdoor temperature for free cooling (north facing rooms)
- 6 AC/hr when mechanical cooling is provided

<u>Category 1(a): Systems with capacity to provide 6-8 air changes per hour (AC/hr) of total air flow and equipped with digital controls.</u>

> ***Enhancement*** *– None necessary. The optimal category for pandemic operation, with ability to provide greater amounts of outdoor air than code requirement, as well as digitally programmed operation that does not compromise occupant comfort or risk damage to heating equipment during colder weather*

DRAFT

The following, 1(b), 1(c) and 1(d), have fan capacity to provide 6-8 AC/hr of TOTAL airflow, but have restrictions that limit ability to introduce and/or properly control OUTDOOR air.

Depending on system/equipment condition, these can potentially be made equivalent to Category 1(a) systems with upgrades to controls, damper operability, or increased size of outdoor air ducts and louvres.

Category 1(b): Systems with capacity to provide 6-8 AC/hr, but without digital controls

No associated digital controls. Enhanced outdoor air can be provided, but potentially in a manner not controlled as to time of day and/or maintaining interior comfort. Excessive energy use could potentially be an unintended consequence.

Enhancement – Consider upgraded or new digital control system

Category 1(c): Systems with capacity to provide 6-8 AC/hr, but with non-functional outdoor dampers

Where damage of component failure has occurred, resulting in non-functional dampers due to broken linkages, seized actuators or dampers being out of alignment.

Also, with older unit ventilators, outdoor air dampers are sometimes controlled in an “either/or” manner in parallel with heating valves, as with some older unit ventilators.

Enhancement – Consider replacement or repair of failed or damaged dampers and/or damper actuators

Category 1(d): Systems with overall capacity to provide 6-8 AC/hr, but with restricted OUTDOOR AIR paths

Often seen with furnaces provided for classrooms and portables.

Enhancement – *Consider replacement of outdoor air ducts, with larger ducts capable of delivering 100% outdoor air. This would not only allow increased amounts of outdoor air as a response to future health emergencies, but also allow the ventilation system(s) to be operated in free cooling mode when outdoor temperatures are suitable (for climatic areas that do not have mechanical cooling)*

Category 2: **Outdoor Air Systems with capacity to provide 1-5 AC/hr of TOTAL airflow.**

DRAFT

- Outdoor air systems with total airflow capacity of 4-5 AC/hr do meet or exceed current ASHRAE ventilation rates and have ability to deliver enhanced amounts of outdoor air.
- Outdoor air systems with total airflow capacity of 3 AC/hr meet current ASHRAE ventilation rates, but do not have ability to deliver enhanced amounts of outdoor air
- Outdoor air systems with total airflow capacity less than 3 AC/hr do not meet current ASHRAE ventilation rates.

Category 2(a): Outdoor air systems with capacity of at least 4 AC/hr of OUTDOOR air

Where outdoor air systems are sized for at least 4 AC/hr of outdoor air, these already have ability to deliver enhanced amounts of outdoor air, if required for any future emergency.

Enhancement *– None necessary.*

Category 2(b): Outdoor air systems with capacity of 3 AC/hr of OUTDOOR air

Common in schools that qualify for full cooling, where make-up units deliver outdoor air to modular heat pumps or fan coil units.

Enhancement - when upgrades are carried out, an increase of airflow capacity of the make-up air unit(s) should be considered, along with appropriate amounts of pre-heating and/or pre-cooling capacities.

This will also allow replacement of the make-up equipment and the modular indoor units independently, allowing HVAC capital funding to be carried out over multiple years, with a clear delineation between phases.

These systems are also common where DOAS ventilation systems are installed, where providing code minimum outdoor air was done strategically to minimize energy use. These systems were designed to minimize energy use and are NOT viewed as wrongly designed. These schools will likely be equipped with newer equipment, which should not yet need renewal based on age or condition. These sometimes include Heat Recovery Ventilators (HRVs), which although typically not providing any more outdoor air than code minimum, do have the benefit that they do not re-circulate any room air.

Such designs often are also associated with terminal heating/cooling equipment, such as fan coils, heat pumps, chilled beams and/or radiant floors

Enhancement *– It is expected that ASHRAE will be recommending increased minimum ventilation rates for Classrooms. Considering the current pandemic, and potential for future events of concern, increasing outdoor air capacity in future should be considered.*

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<u>Category 3</u>: Mixing Systems with capacity to provide 1-5 AC/hr of TOTAL airflow.

- Mixing systems with total airflow capacity between 1-5 AC/hr of TOTAL airflow likely do not have capacity to provide ASHRAE recommended ventilation rates of OUTDOOR air.

<u>Category 3(a): Mixing systems with capacity to provide 1-5 AC/hr of TOTAL supply air</u>

Common in older schools. These likely do not have capacity to meet the current ASHRAE standard of 3 AC/hr of OUTDOOR air.

Enhancement *- Consider new equipment with increased ventilation capacity.*

<u>Category 4</u>: No Mechanical Ventilation

<u>Category 4(a):</u> Schools designed to use Natural Ventilation

These utilize windows or other means of introducing outdoor air, such as trickle vents. Air is diverted to the highest level(s) of the building, where it is expelled. If these are operating as intended, then no upgrades to these are necessarily required.

Enhancement *– None required unless the natural ventilation system is not providing an adequate quantity of outdoor air or maintaining indoor thermal comfort. Funding was provided by government to school districts during the pandemic to purchase HEPA filter units for all classrooms that don't have mechanical ventilation systems.*

<u>Category 4(b): Schools with heating but no mechanical ventilation. Typically, with operable windows for ventilation.</u>

It is rare to find these in districts that qualify for mechanical cooling, which by default use ventilation air as the cooling medium.

Enhancement *- Category 4(b) systems should be considered as the least effective. An upgrade of the heating plant will also likely be required as part of such an HVAC upgrade, since no capacity for heating of ventilation air would have been included in the original design. Funding was provided by government to school districts during the pandemic to purchase HEPA filter units for all classrooms that don't have mechanical ventilation systems.*

<u>Design for Climate Resiliency</u>

In all cases of replacement ventilation systems, consideration of equipment with capacity to deliver more outdoor air than code minimum is recommended. Most new motor driven fan and pump equipment is available with variable speed motors, so amounts of outdoor

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air can be adjusted to provide optimal indoor air quality based on prevailing conditions, in the interest of energy savings.

In cases where schools currently provide heating, but not cooling, with ventilation as the delivery medium, consider future provision of at least partial cooling. This could include pipe and duct insulation with vapour barriers, and condensate drain pans in air handling units, to minimize potential future costs.

The provision of separate heating and cooling pipe loops, with cooling lines installed in future can also be considered. 2-pipe switchover systems are also an alternative. Partial cooling may also be considered acceptable, with heat pumps sized to meet heating demand, and not increased in capacity to meet peak cooling load.

Heating and cooling pumps and pipes should be considered for enhanced outdoor air capacity, with the caveat that pumps are provided with variable speed motors, which can be adjusted to provide optimal indoor air quality based on prevailing conditions, to minimize energy use.

FILTRATION

Standard Filter Capacity

HVAC equipment not compatible with installation of MERV-13 (or higher) filters should also be considered for renewal, to provide improved indoor air quality during times of need.

The ability to easily switch between MERV-13 and filters with lesser MERV rating provides flexibility to respond to prevailing conditions, allow reduced fan energy opportunities and minimize potential equipment degradation bases on prevailing conditions.

Filter efficiency should not be viewed in isolation of outdoor air delivery. The efficiency of the filter is deemed to be relative to re-circulated air, whereas outdoor air is assumed to be virus free, unless drawn from an exterior location where people may congregate.

The differences in efficiency between different MERV-rated filter is therefore mitigated, the more outdoor air is mixed with re-circulated air.

At the point where 100-percent outdoor air is introduced to an air handling unit, the filter efficiency is effectively a non-factor. The conclusion being that enhanced rates of outdoor air should be provided while we are in pandemic mode, within the boundaries of occupant comfort and the risk of damage due to freezing of heating pipes.

HEPA Filter Application

HEPA filter units have an application for rooms that do not have ventilation systems. Self-contained HEPA units have limitations on the rate they can recirculate air, due to fan

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noise constraints. HVAC systems should be viewed holistically, however, with consideration of the combined benefit of filtration and introduction of outdoor air.

ENERGY PLANTS

In cases where requested HVAC upgrades include new heating/cooling plant equipment, equipment with capacity to support delivery of more outdoor air than code minimum should be considered. Motor driven fans and pumps, as well as heating and cooling equipment, are available with options for variable speed operation.

Operation of system components can therefore be adjusted to provide optimal indoor air quality based on prevailing conditions, in the interest of energy savings.

CONTROLS

For HVAC upgrades where digital controls are currently not installed, include for such in planning for renewed or replacement systems. Correctly commissioned and operating controls are a necessity to ensure HVAC equipment operates correctly, depending on building occupancy status, outdoor temperature, and indoor ventilation requirements.

Future HVAC infrastructure may have enhanced heating/cooling plant, ventilation fan and heat transfer medium pump capacities, which can be scaled back during non-emergency times. Ensuring these do not consume any more energy than necessary will be paramount to reducing energy consumption and carbon emissions.

Many systems also will, at least in the short term, not be equipped with enhanced capacity. Nevertheless, these can currently deliver enhanced quantities of outdoor air during non-peak heating or cooling weather. Properly commissioned and operating controls can support increased outdoor air rates during shoulder seasons, without compromising the thermal comfort of building occupants, or risking freezing of heating systems as outdoor temperatures drop to a level where increased outdoor air cannot be supported.

Programmable controls systems should be provided with simple ‘toggles’ to allow building operators a straightforward method to switch between ‘normal’ and ‘emergency’ modes. Emergency mode should also have sub-categories, whereby enhanced outdoor air delivery can be put into operation during an emergency such as the current SARS-CoV-2 pandemic, but minimal outdoor air is introduced during wildfire smoke seasons.

ENERGY USE

It is obvious that in spite of consideration for enhanced capacity of future HVAC systems, minimization of energy utilization and carbon emissions must remain an important aspect to planning of renewed or replacement infrastructure.

Design of all HVAC systems is to be from the perspective of higher capacity equipment but intended to operate only as necessary to maintain thermal comfort and required ventilation.

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- ANSI/ASHRAE STANDARD 55
  "THERMAL ENVIRONMENTAL CONDITIONS FOR HUMAN OCCUPANCY"

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  "VENTILATION FOR ACCEPTABLE INDOOR AIR QUALITY"

Standards/Documents in Response to the Pandemic

- BUILDING READINESS (2020)
  https://www.ashrae.org/technical-resources/building-readiness

- FILTRATION & DISINFECTON (2020)
  https://www.ashrae.org/technical-resources/filtration-disinfection

- ASHRAE EPIDEMIC TASK FORCE (2022)
  "Understanding and Applying ASHRAE Core Recommendations for Mitigating Aerosol Infection Risk"

  https://attendee.gotowebinar.com/recording/4538704157456640268

- ASHRAE TECHNICAL COMMITTEE 9.7
  "Design Guidance for Education Facilities: Prioritization for Advanced Indoor Quality"
  Expected to be released by ASHRAE in Fall 2022

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BRITISH COLUMBIA
Ministry of Education and Child Care



GUIDANCE FOR

HVAC SYSTEMS

This version of the document supersedes all previous versions

VERSION	SECTION AMENDED (ex. 1.2 or all)	TYPE OF REVISION (annual review, update, addition)	ISSUED ON
1.0	–	New Guidance	August 08, 2022

CONTEXT AND PURPOSE OF THIS DOCUMENT

This document is intended to provide some considerations to school districts with regards to improving Heating Ventilation Air Conditioning (HVAC) system performance given the recent pandemic situation.

Note that this document is not intended to supersede any requirements from ASHRAE or other regulatory bodies.

TABLE OF CONTENTS

CONTEXT AND PURPOSE OF THIS DOCUMENT 2

1| MAINTENANCE FOR SCHOOL HVAC SYSTEMS/EQUIPMENT 4

1.1. VERIFICATION OF OUTDOOR AIR DELIVERY 4

1.2 VERIFICATION OF OVERALL CONTROLS FUNCTIONALITY 4

1.3. DUCT CLEANING 4

1.4. FILTERS 5

2| UPGRADE CONSIDERATIONS FOR SCHOOL HVAC SYSTEMS/EQUIPMENT 6

2.1 VENTILATION 6

2.2. FILTRATION 11

2.3. ENERGY PLANTS 12

2.4. CONTROLS 12

2.5. ENERGY USE 13

3| ASHRAE RESOURCES 14

1

MAINTENANCE FOR SCHOOL HVAC SYSTEMS/EQUIPMENT

1.1. VERIFICATION OF OUTDOOR AIR DELIVERY

Delivery of at least minimum ASHRAE recommended amount of outdoor air is the target of a correctly functioning ventilation system. Air handling units are typically equipped with dampers intended to modulate introduction of outdoor air, typically connected to the school's digital control system.

Whether dampers are correctly functioning is important to verify. Control systems are programmed to modulate dampers, typically based on readings from building carbon dioxide (CO2) levels and, whereas less sophisticated controls may be based solely on outdoor temperature.

Dampers and their associated control mechanisms do go out of calibration or experience component failures. What the controls system indicates on a controls graphics display screen cannot be assumed to be true at the damper location. Linkages break, slip or become disconnected. Or become seized due to lack of maintenance.

Periodically, damper operation should be verified by physically witnessing how dampers respond to control signals. Under normal circumstances this is recommended to occur every three years, but when situations such as the current pandemic occur, a district wide damper review should be performed.

1.2. VERIFICATION OF OVERALL CONTROLS FUNCTIONALITY

As an extension of the above, it is recommended a review of controls programming, and a re-commissioning exercise be performed, as per manufacturer's/mechanical engineer's recommendations.

This exercise will identify energy saving opportunities such as HVAC equipment operating outside school occupancy schedules, incorrect temperature setpoints, elevated heating plant water temperature setpoints and variable speed motors running at higher speed than necessary.

1.3. DUCT CLEANING

It is recommended that school districts have a plan in place that involves a routine schedule of duct cleaning for all facilities.

1.4. FILTERS

It is recommended that school districts replace or clean filters as recommended by the filter manufacturer, or at least three times annually. In cases where electro-statically charged filters are used to increase MERV-rating, the charge will deteriorate over time. Changing filters on a regular basis will mitigate this issue.

Maintenance staff should also review filters and how they fit into their holding racks. Instances where air can bypass the filter media results in a reduced overall MERV rating, as any air that does bypass does not get filtered at all.



2

UPGRADE CONSIDERATIONS FOR SCHOOL HVAC SYSTEMS/EQUIPMENT

2.1. VENTILATION

When planning for future HVAC upgrades with a particular focus on ventilation improvements, School Districts should consider upgrades based on an analysis of the type and condition of existing systems.

Age of any type of system and/or equipment, along with performance, will be factors supporting need for upgrades. Consideration should also be given to the potential of repair and/or re-commissioning systems.

The highest priority projects should be for spaces and/or schools with no mechanical ventilation.

At a minimum, ventilation systems serving standard sized classrooms should have the ability to deliver around 450 cubic feet per minute (CFM) of outdoor air, per ASHRAE Standard 62.1 "*Ventilation for Acceptable Air Quality*". This equates to roughly 3 air changes per hour (AC/hr).

Some ventilation systems mix outdoor air with air recirculated from the room. Others are strictly outdoor air systems. The latter category may be heat recovery type units and are sometimes categorized as dedicated outdoor air systems (DOAS).

Mixing systems with capacity to deliver 6-8 AC/hr were more useful than DOAS systems during the pandemic, with the ability to deliver greater quantities of outdoor air. Many school districts implemented pandemic mode ventilation operation to deliver greater amounts of outdoor air than the ASHRAE minimum, even during colder (or warmer) weather, as long as heating (or cooling) plant capacities could support heating (or cooling) the additional outdoor air.

When outdoor temperature was suitable, systems could provide outdoor air up to 100% of their airflow capacity. Logically, therefore, mixed air systems provided more benefit than DOAS systems for pandemic response.

Beyond the pandemic, providing enhanced amounts of outdoor air runs counter to energy targets. It is anticipated, however, that ASHRAE will be publishing updated standards for classroom ventilation in Fall 2022, which may recommend increasing capacity of ventilation systems to a level greater than pre-pandemic values.

Heating and cooling plant equipment will not need to be sized for anything more than the new level of enhanced ventilation, and under normal circumstances should not be operated using this incremental capacity increase. The updated capacity should be reserved for times within the year where there is a higher than normal rate of respiratory illness transmission or climatic considerations, such as periods of air quality deterioration due to wildfire smoke.

The increase in new ASHRAE recommended outdoor air rates will apply equally to mixing and non-mixing ventilation systems, so either system type can be considered for future HVAC capital upgrade projects. Mixing systems may be viewed as more useful, however, in light of their ability to deliver more outdoor air than DOAS systems when ambient temperature is mild.

In light of the above, the Ventilation Technical Advisory Panel has categorized ventilation systems in the following order from most effective to least effective, which School Districts may choose to use as a guide toward future ventilation upgrades. Applicable system enhancements that would improve overall effectiveness of each categorized ventilation system have also been provided for consideration.

CATEGORY 1: Mixing systems with capacity to provide a total air flow (combination of outdoor and recirculated) of 6-8 air changes per hour (AC/hr).

- 8 AC/hr when relying on ambient outdoor temperature for free cooling (east / south / west facing rooms)
- 7 AC/hr when relying on ambient outdoor temperature for free cooling (north facing rooms)
- 6 AC/hr when mechanical cooling is provided



CATEGORY 1(A): Systems with capacity to provide 6-8 air changes per hour (AC/hr) of total air flow and equipped with digital controls.

> ***Enhancement*** *– None necessary. The optimal category for pandemic operation, with ability to provide greater amounts of outdoor air than code requirement, as well as digitally programmed operation that does not compromise occupant comfort or risk damage to heating equipment during colder weather*

The following, 1(b), 1(c) and 1(d), have fan capacity to provide 6-8 AC/hr of TOTAL airflow, but have restrictions that limit ability to introduce and/or properly control OUTDOOR air.

> *Depending on system/equipment condition, these can potentially be made equivalent to Category 1(a) systems with upgrades to controls, damper operability, or increased size of outdoor air ducts and louvres.*



CATEGORY 1(B): Systems with capacity to provide 6-8 AC/hr, but without digital controls

No associated digital controls. Enhanced outdoor air can be provided, but potentially in a manner not controlled as to time of day and/or maintaining interior comfort. Excessive energy use could potentially be an unintended consequence.

> ***Enhancement*** *– Consider upgraded or new digital control system*



CATEGORY 1(C): Systems with capacity to provide 6-8 AC/hr, but with non-functional outdoor dampers

Where damage of component failure has occurred, resulting in non-functional dampers due to broken linkages, seized actuators or dampers being out of alignment.

Also, with older unit ventilators, outdoor air dampers are sometimes controlled in an "either/or" manner in parallel with heating valves, as with some older unit ventilators.

> ***Enhancement*** *– Consider replacement or repair of failed or damaged dampers and/or damper actuators*



CATEGORY 1(D): Systems with overall capacity to provide 6-8 AC/hr, but with restricted OUTDOOR AIR paths

Often seen with furnaces provided for classrooms and portables.

> ***Enhancement*** *– Consider replacement of outdoor air ducts, with larger ducts capable of delivering 100% outdoor air. This would not only allow increased amounts of outdoor air as a response to future periods of increased respiratory illness transmission, but would also allow the ventilation system(s) to be operated in free cooling mode when outdoor temperatures are suitable (for climatic areas that do not have mechanical cooling)*

CATEGORY 2: Outdoor Air Systems with capacity to provide 1-5 AC/hr of TOTAL airflow.

- Outdoor air systems with total airflow capacity of 4-5 AC/hr do meet or exceed current ASHRAE ventilation rates and have ability to deliver enhanced amounts of outdoor air.
- Outdoor air systems with total airflow capacity of 3 AC/hr meet current ASHRAE ventilation rates, but do not have ability to deliver enhanced amounts of outdoor air.
- Outdoor air systems with total airflow capacity less than 3 AC/hr do not meet current ASHRAE ventilation rates.



CATEGORY 2(A): Outdoor air systems with capacity of at least 4 AC/hr of OUTDOOR air

Where outdoor air systems are sized for at least 4 AC/hr of outdoor air, these already have ability to deliver enhanced amounts of outdoor air, if required for any future events of concern.

> ***Enhancement*** *– None necessary.*

CATEGORY 2(B): Outdoor air systems with capacity of 3 AC/hr of OUTDOOR air

Common in schools that qualify for full cooling, where make-up units deliver outdoor air to modular heat pumps or fan coil units.

> ***Enhancement*** *- when upgrades are carried out, an increase of airflow capacity of the make-up air unit(s) should be considered, along with appropriate amounts of pre-heating and/or pre-cooling capacities.*
>
> *This will also allow replacement of the make-up equipment and the modular indoor units independently, allowing HVAC capital funding to be carried out over multiple years, with a clear delineation between phases.*

These systems are also common where DOAS ventilation systems are installed, where providing code minimum outdoor air was done strategically to minimize energy use. These systems were designed to minimize energy use and are NOT viewed as wrongly designed. These schools will likely be equipped with newer equipment, which should not yet need renewal based on age or condition. These sometimes include Heat Recovery Ventilators (HRVs), which although typically not providing any more outdoor air than code minimum, do have the benefit that they do not re-circulate any room air.

Such designs often are also associated with terminal heating/cooling equipment, such as fan coils, heat pumps, chilled beams and/or radiant floors

> ***Enhancement*** *– It is expected that ASHRAE will be recommending increased minimum ventilation rates for Classrooms. Considering the current pandemic, and potential for future events of concern, increasing outdoor air capacity in future should be considered.*



CATEGORY 3: Mixing Systems with capacity to provide 1-5 AC/hr of TOTAL airflow.

- Mixing systems with total airflow capacity between 1-5 AC/hr of TOTAL airflow likely do not have capacity to provide ASHRAE recommended ventilation rates of OUTDOOR air.

CATEGORY 3(A): Mixing systems with capacity to provide 1-5 AC/hr of TOTAL supply air

Common in older schools. These likely do not have capacity to meet the current ASHRAE standard of 3 AC/hr of OUTDOOR air.

Enhancement *- Consider new equipment with increased ventilation capacity.*

CATEGORY 4: No Mechanical Ventilation

CATEGORY 4(A): Schools designed to use Natural Ventilation

These utilize windows or other means of introducing outdoor air, such as trickle vents. Air is diverted to the highest level(s) of the building, where it is expelled. If these are operating as intended, then no upgrades to these are necessarily required.

Enhancement *– None required unless the natural ventilation system is not providing an adequate quantity of outdoor air or maintaining indoor thermal comfort. Funding was provided by government to school districts during the pandemic to purchase HEPA filter units for all classrooms that don't have mechanical ventilation systems.*



CATEGORY 4(B): Schools with heating but no mechanical ventilation. Typically, with operable windows for ventilation.

It is rare to find these in districts that qualify for mechanical cooling, which by default use ventilation air as the cooling medium.

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Design for Climate Resiliency

In all cases of replacement ventilation systems, consideration of equipment with capacity to deliver more outdoor air than code minimum is recommended. Most new motor driven fan and pump equipment is available with variable speed motors, so amounts of outdoor air can be adjusted to provide optimal indoor air quality based on prevailing conditions, in the interest of energy savings.

In cases where schools currently provide heating, but not cooling, with ventilation as the delivery medium, consider future provision of at least partial cooling. This could include pipe and duct insulation with vapour barriers, and condensate drain pans in air handling units, to minimize potential future costs.

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Heating and cooling pumps and pipes should be considered for enhanced outdoor air capacity, with the caveat that pumps are provided with variable speed motors, which can be adjusted to provide optimal indoor air quality based on prevailing conditions, to minimize energy use.



2.2. FILTRATION

Standard Filter Capacity

HVAC equipment not compatible with installation of MERV-13 (or higher) filters should also be considered for renewal, to provide improved indoor air quality during times of need.

The ability to easily switch between MERV-13 and filters with lesser MERV rating provides flexibility to respond to prevailing conditions, allow reduced fan energy opportunities and minimize potential equipment degradation bases on prevailing conditions.

Filter efficiency should not be viewed in isolation of outdoor air delivery. The efficiency of the filter is deemed to be relative to re-circulated air, whereas outdoor air is assumed to be virus free, unless drawn from an exterior location where people may congregate.

The differences in efficiency between different MERV-rated filters is therefore mitigated, the more outdoor air is mixed with re-circulated air.

At the point where 100-percent outdoor air is introduced to an air handling unit, the filter efficiency is effectively a non-factor. The conclusion being that enhanced rates of outdoor air should be provided while we are in pandemic mode, within the boundaries of occupant comfort and the risk of damage due to freezing of heating pipes.

HEPA Filter Application

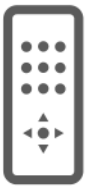
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In cases where requested HVAC upgrades include new heating/cooling plant equipment, equipment with capacity to support delivery of more outdoor air than code minimum should be considered. Motor driven fans and pumps, as well as heating and cooling equipment, are available with options for variable speed operation.

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It is obvious that, in spite of consideration for enhanced capacity of future HVAC systems, minimization of energy utilization and carbon emissions must remain an important aspect to planning of renewed or replacement infrastructure.

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