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Ventilation – The Vital Engineering Control to Protect Workers

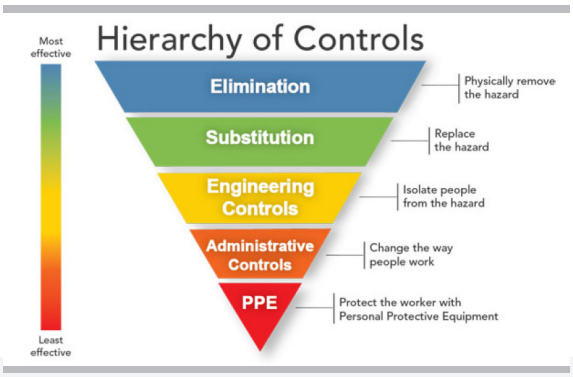
STAYING ON TOP OF THE CHANGING VARIANTS

Our workplaces are dynamic entities, always changing and encountering new challenges, and certainly this has never been more evident than today as we face a seemingly never-ending array of mutating viruses related to COVID-19. At the current time we are dealing with the Omicron variant after having dealt with Beta and Delta variants of the SARS CoV-2 virus. Throughout the COVID-19 pandemic we have tried to provide as much relevant information to help occupational health and safety representatives and joint health and safety committee members in creating a healthier and safer workplace using some of the latest and best information to protect workers. In this case we are reminding readers that there are tools in the toolbox that should continue to be utilized to protect workers. This document will focus on a key engineering control in the workplace – ventilation and its impact on worker health and safety.

THE HIERARCHY OF CONTROLS

When making and implementing a plan to control hazards, we should always start by considering the most effective controls first. Using the powerful hierarchy of controls tool, we see that the most effective way to control hazards in the workplace is to eliminate them at the source. This applies to all workplace hazards, not just those related to COVID-19.

Unfortunately, the virus that causes COVID-19 (SARS-CoV-2) has not been eradicated (and it is unknown if it ever will be) Theoretically, the virus can be eliminated from the workplace as long as the carrier of the virus (the infected person) is not at the workplace. In other words, working from home or a remote location. For most workplaces this is not an option as long as the workplace requires the physical presence of workers.



Since substitution is not a relevant control in the case of the SARS-CoV-2 virus , we move to the engineering controls level. Ventilation is a key engineering control and can help control the spread of the SARS-CoV-2 virus in the workplace, and can help reduce the spread of COVID-19.

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THE CONTROLLING VIRUS SPREAD

SARS-CoV-2 virus is known to spread from person to person through **droplets and aerosols**, which create a risk, especially to people in enclosed spaces and indoor conditions, where workers are in close proximity to one another. The effectiveness of ventilation will depend on a number of issues such as the **occupancy level of the workplace**, the **physical structure, design and maintenance of the building** where the work is being done and the **type of work being done in the workplace**.

Occupancy: In order to reduce the risk of COVID-19 (as previously stated) fewer workers in the workplace lessens the potential for the spread of infection. This of course also assumes that physical distancing (of 2m or more) will be adhered to, where possible. Some of our workplaces have hundreds of employees and others under the same roof, making this especially difficult.

Physical Structure, Design and Maintenance of the of Building: Every building is unique in its design and structure. It is important that the building be capable of safely handling the work being done inside of it, through the mechanical systems which mix fresh outdoor air and existing air in the building. These systems control heating, ventilation and air conditioning and are known as HVAC systems. HVAC systems are also only as effective as their ability to function to their design specifications; as we have often seen, many workplace HVAC systems are not being fully utilized or are not working as they were originally designed.

Type of Work Being Done in the Workplace: Each workplace is affected by hundreds, if not thousands, of factors ranging from what workers do in the workplace, to the types of chemical, biological or physical hazards encountered or created through the work process. Imagine the differences in ventilation needs between an automotive plant and an office or a hospital.

Even excellent indoor ventilation alone cannot protect people from exposure to the SARS-CoV-2 virus, particularly when workers are in close unprotected contact, or in the absence of other protective measures.

TOOLS FOR IMPROVING WORKPLACE VENTILATION

It is advisable that each workplace's HVAC system is reviewed and understood not only by management, engineering and maintenance, but also by the occupational health and safety representatives or joint health and safety committee (JH&SC) members. There are many critical aspects that should be reviewed to ensure that the system is working optimally.

The HVAC system is the main determinant of indoor air quality. It controls the amount of air that is added to the workplace atmosphere, and also controls the cleanliness of incoming air. The HVAC system controls the rate at which the workplace air and its pollutants are either exhausted to the outside or re-circulated throughout the building. It is a vital component in protecting the health and safety of workers in the workplace.

Most HVAC systems re-circulate a large part of the indoor air to maintain comfort and reduce energy costs associated with heating or cooling outside air. When you feel air coming out of a supply duct or vent it's almost impossible to tell how much of this air is recycled or recirculated and how much is fresh outside air.

Be aware that "efficiency" in HVAC systems often comes at the expense of air quality and worker health.

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Use Your Rights to Know About Workplace Hazards and Your Right to Participate in Workplace Health and Safety

10 HVAC QUESTIONS TO ASK

1. **Does the occupational health and safety representative or JH&SC understand the workplace's unique HVAC system?** You should know what the HVAC system should control and how it works. The employer should have drawings and blueprints that show what each element of the HVAC system is capable of and what it should be running at.
2. **Has the JH&SC investigated the critical elements of the HVAC system?** There should be someone at each workplace that can clearly explain what the critical elements are and how they work.
3. **Has the HVAC system been maintained to manufacturer's specification?** Ventilation systems are mechanical objects that require regular maintenance and certainly have recommended intervals for maintenance. There should be evidence available that maintenance has been done and is verifiable.
4. **How is the HVAC system tested and verified for compliance?** You can't just assume that everything works without investigating. Depending on the system, monitoring can be done remotely or in person or using a combination of both methods. Each system is unique. Get the test results and understand how the tests were done and what they mean.
5. **Who tested the system? HVAC experts? Maintenance workers?** The workplace maintenance plan and/or occupational health and safety plan should address this. You should check that the tests conducted on the system have been completed. These should be verifiable in writing. You may want to be present when the testing is being done to verify the results. If you don't ask, you likely won't be invited to participate.
6. **Was a report on the HVAC system ever issued? Is it available?** It is possible that the inspection of the HVAC system resulted in concerns being raised by the people who did the inspection. Get your hands on the evidence and keep it as a permanent record
7. **Are there outstanding elements of the HVAC system that are off line or need repair?** You should be able to verify that all work orders have been completed and closed. Ask your tradespeople or contractors if the work has been completed. It's always a good practice to check up with the workers who did the repairs. You may even get information that you didn't expect!
8. **Are there any air quality concerns from workers?** Does anyone complain of chemical odours or "stale air? Is anyone complaining of headaches, drafts or uncomfortable temperatures? Are complaints being investigated and resolved?
9. **Is anyone doing air quality sampling to ensure that the air is safe?** Workplace air should be free of outside contaminants and meet all provincial and federal exposure limits and guidelines. Local unions can (and should) negotiate language that exceeds the minimum requirements. Aside from workplace chemical contaminants, workplace air can also deteriorate just from human breathing. As we exhale, we send carbon dioxide (CO_2) into the air. Indoor air can get stale if it is not being properly ventilated. Current air monitoring technology allows for easy and inexpensive measurement of CO_2 as an indicator to help ensure ventilation systems are delivering recommended minimum quantities of outside air to building occupants.
10. **Can the "fresh air mix" in the HVAC system be increased?** Usually there is room for increased airflow as most systems are not designed to run at 100% output. Ask your HVAC system professionals how the fresh air mix ratio can be increased. Challenge your employers to run their HVAC systems for longer periods of time including times when the building occupancies are low or during off hours, in order to get the full benefit of air dilution.

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CARBON DIOXIDE AS MARKER FOR INDOOR AIR QUALITY

The outdoor air in most locations contains up to 500 parts per million of carbon dioxide. When indoor concentrations of CO2 are elevated (compared to the outside air) the cause of the higher levels is usually due to the building's occupants.

People exhale carbon dioxide—adult breath contains about 35,000 to 50,000 ppm of CO2 which may be up to 100 times higher than outdoor air. Without adequate ventilation to dilute and remove this "CO2 pollution" generated by the occupants, CO2 can accumulate. Since the virus that causes COVID-19 is found in the breath that we exhale, we can see that dilution ventilation will lessen the exposure of occupants to the SARS-CoV-2 virus. Therefore, we can say that **"the solution to indoor pollution is dilution!"**

HOW MUCH CARBON DIOXIDE IS TOO MUCH?

The occupational safety standards for industrial workplaces hover around 5,000 ppm for CO2, however we must not be deceived by this limit. Indoor air quality experts agree that individuals exposed to elevated CO2 concentrations tend to report drowsiness, lethargy and a general sense that the air is stale. High CO2 levels are an indication that the air in the workplace is being "overly recycled" and is lacking the "outside fresh air" component. Indoor air monitoring results showing levels of CO2 exceeding 800 ppm are indicators that there is a problem with high room occupancy or an issue with the building's ventilation system's fresh air mix ratio. In either case, further investigation is warranted.

Other less technical solutions to improve CO2 levels include opening windows, doors and other outdoor access points to allow for additional direct outdoor air to enter the room or building being occupied. These solutions may cause disruptions from a heating or cooling perspective but are sure to lower indoor CO2 levels. Be prepared to bundle up (or wear short sleeves) if this is the route taken. These types of actions may also affect indoor exhaust ventilation effectiveness. One solution may lead to another problem! Monitor air quality after any changes are made.

AIR FILTRATION

Air filters are an integral and important part of any HVAC system. Air filters allow for the removal of particulate contaminants in the supply air that would be harmful to the building occupants, or build up in the ductwork or equipment. Air filters also remove dirt that would cause blockages or imbalances of elements in the air handling systems including vents, coils, fans and other parts.

Most filters are tested and rated according to the ASHRAE Standard 52.2-2007. This ASHRAE standard assigns varying filters a minimum efficiency reporting value (MERV rating) based on their ability to remove particles at various sizes and airflow rates. The standard also reports a filter's resistance to airflow. Ventilation devices such as fan powered terminals and return grilles typically use low to mid efficiency filters. High efficiency filters such as HEPA filters are typically installed near the air outlet to avoid possible contamination from ductwork leakage. The higher the efficiency of the filter usually means the greater the pressure drop in air speed.

The SARS CoV-2 virus can be trapped in filtration systems that use filters with a MERV rating of 13 or higher. (MERV 13 filters remove over 85% of 1-3 micrometre, also called micron or µm, sized particles). Research has indicated that the particle size of the SARS-CoV-2 virus is around 0.1 µm. However, the virus does not move through the air by itself, rather the virus is trapped in respiratory droplets and droplet nuclei (dried respiratory droplets) that are predominantly 1 µm in size and larger. If a MERV 13 filter cannot be accommodated in the HVAC system, then use the highest MERV rating you can. Remember that this must be done in conjunction with HVAC professionals.

If ventilation systems cannot be altered and the workplace occupancy cannot be reduced, then the use of portable air filtration devices with High Efficiency Particulate Air (HEPA) filters could be considered together in combination with established public health infection control measures.

CONCLUSION

As we have discussed, workplace ventilation plays a vital role in keeping workers healthy and safe, and can play an even more important role in these ever changing COVID-19 times. SARS-CoV-2 transmission in the workplace depends on multiple factors, of which ventilation is only one (however a very important one).

Workers have a right to know about hazards in the workplace, a right to participate in workplace safety through their occupational health and safety representatives and a right to refuse unsafe work. A detailed focus on workplace ventilation can utilize all three of these rights including the right to refuse unsafe work when all other steps fail. Getting to know and understand your workplace's ventilation system is a good step to improving worker health and safety now, and in the future beyond the COVID-19 Pandemic.

Any questions with regard to this fact sheet can be addressed to the Unifor National Health, Safety and Environment Department at healthandsafety@unifor.org or 1 (800) 268-5763.

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