UBC Social Ecological Economic Development Studies (SEEDS) Student Report

Ductless Fume Hoods Research

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SPPH VOL

April 25. 2012

SEEDS Project: Ductless fume hoods research

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Executive Summary

Fume hoods are the primary engineering control used to minimize worker exposure to airborne contaminants such as fumes, vapours and particulate. Typical fume hoods installed at UBC are costly to run in terms of both energy and money due to the large amounts of conditioned air that is exhausted out of the lab. A previous SEEDS project identified potential for energy savings through the use of ductless fume hoods instead of conventional fume hoods (Gretka, 2012). Ductless fume hoods employ charcoal filters to remove vapours from the contaminated air and allow the filtered air to re-enter the lab space. The current report seeks to understand the current research with regards to these ductless hoods as well as WorkSafeBC regulations and applications of these hoods in other industries.

WorkSafeBC regulation does not permit recirculation of carcinogens, reproductive toxins, sensitizers or substances whose exposures are to be kept as low as reasonable achievable (Part 5 Chemical Agents and Biological Agents: Ventilation 5.70 and section 5.57(1)). Overall, contacted individuals, other universities and information from literature express concerns over the limitations of the carbon filters and strongly discourage (and in some cases prohibit) the use of ductless fume hoods. Current literature discussing the performance of ductless fume hoods is extremely limited.

In summary, the use of ductless fume hoods cannot safely replace all conventional ducted fume hoods. There is however a possibility of obtaining a variance from WSBC if the ductless hoods can be attached to a pre-existing general exhaust system and the substances being used in the hoods are of low toxicity and low volume.

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1. Definitions

ACGIH = American Conference of Governmental Industrial Hygienists

ASHRAE = American Society of Heating, Refrigerating and Air-Conditioning Engineers

CIH=Certified Industrial Hygienist

HEPA=high efficiency particulate air

IARC= International Agency for Research on Cancer

NFPA= National Fire Protection Association

OHS=Occupational Health and Safety

ROH=Registered Occupational Hygienist

SEEDS = Social Ecological Economical Development Studies

WSBC = WorkSafeBC

8-hr TWA Limit = Time weighted average concentration of a substance that cannot exceed the exposure limit over an 8 hour work period

2. Introduction

The primary goals of a fume hood are to provide a worker with a space to perform physical, chemical and biological work and to protect the worker from airborne contaminants (WorkSafeBC, 2012a). Fume hoods work by drawing air contaminants away from the worker and into the hood where the contaminant is then vented out of the lab. The energy costs of fume hoods are high due to the large amounts of conditioned air that is exhausted directly out of the room (Doxsee, 2009) and it is estimated that one fume hood can consume the same amount of energy as three average homes (Mills & Sartor, 2005). In contrast, ductless fume hoods rely on filters to capture the contaminant and allow the cleaned air to return back into the lab (National Research Council, 2011). These hoods have their own fan which draws the air through the filters. A major advantage of using a ductless fume hood is the significant decrease in energy cost since the air is recycled (Gretka, 2012).

Two main types of filters are used in ductless fume hoods. The first is a carbon filter which is used for capturing organic vapours. Carbon filters are highly porous which allows for a large surface area (hundreds of square meters per gram) to contain gases or vapours (Harper, 2011). These filters work by adsorbing vapour onto the surface as the air is drawn through. Note that adsorption refers to the process where a substance adheres to the surface which does not involve a chemical or physical change. This means that the vapour is not bonded strongly to the filter and there is a potential for desorption of the contaminant to occur. Carbon filters have a saturation point where no more vapour can be adsorbed which can lead to breakthrough. Breakthrough is where the contaminant is no longer being adsorbed onto the filter and a worker can be exposed since the contaminant is re-circulated back into the room. A second type of filter is a HEPA filter which is used to capture particulate. Unlike the carbon filter, the HEPA filter does not use adsorption but instead traps the particulate in densely packed fibres. HEPA filters are capable of filtering out 99.97% of particulate that is 0.3 µm in diameter (AirClean Systems, 2010). Note that 0.3 µm diameter is chosen as a benchmark for filter efficiency due to the difficulty in capturing this particular size; however, particles that are less than 0.3 µm and greater than 0.3 µm can be captured with 100% efficiency (Donaldson Company Inc., 2011). Appendix I lists chemicals that potentially can be used in a ductless fume hood.

A 2011 SEEDS project conducted an audit on laboratory ventilation and fume hoods to determine the potential for energy savings at the University of British Columbia's Point Grey campus (Gretka, 2012). One of the recommendations made in the report suggested that further investigation be completed with regards to replacement of fume hoods with ductless fume hoods to see if this is a viable option at UBC. As a result of this recommendation, this project was created to research uses, benefits and limitations of ductless fume hoods for possible implementation at UBC. The main goals of this project were as follows

1. Review WorkSafeBC regulations regarding the use of ductless fume hoods

2. Obtain information about ductless fume hoods through communication with various professionals

3. Conduct a literature review of ductless fume hoods in engineering and industrial hygiene journals

4. Provide recommendations based on the results of the project

3. Methods

3.1 Personal communication

The following individuals were contacted for their insight on ductless fume hoods:

Bruce Anderson, Manager, Occupational & Research Safety Risk Management Services

Geoffrey Clark, MSc, CIH, ROH Occupational Hygienist WorkSafeBC Sr.

Ed Chessor, CIH, PEng, MBA Adjunct Professor School of Population and Public Health

Chris Nicol, Field Inspector, Lower Mainland Facilities Management, Fraser Health, Providence Health, Provincial Health, Vancouver Coastal Health

Isabel Reinelt, B.Sc., Dipl. En.Tox. Occupational Hygiene Officer WorkSafeBC

Norlabs, distributor of laboratory fume hoods

3.2 Literature Review

The databases Compendex, Google Scholar, Pubmed and Medline (OVID) were used for a literature review. Various combinations of the keywords “ductless”, “re-circulating”, “fume hood”, “laboratory”, “evaluation” and “performance” were used to search through the databases.

4. Results

4.1 WorkSafeBC regulations

The WorkSafeBC regulations "Part 5 Chemical Agents and Biological Agents: Ventilation 5.70 Discharged air" states:

"The use of a ventilation system designed to re-circulate contaminants into the work area is restricted by the provisions of Table 5-1."

Appendix II has a copy of the full table. According to Table 5-1, no recirculation is permitted for designated substances which includes any substance that is

1. Carcinogenic as identified by either ACGIH and/or IARC.

2. ACGIH reproductive toxin

3. ACGIH sensitizer

4. ACGIH L endnote (i.e. exposure from all routes should be controlled to as low as reasonably achievable)

The "OHS Guideline G5.48-1 Table of exposure limits" displays if substances have any of the above designations. Note that the designations for substances may change in the future due to new evidence of carcinogenicity and toxicity and this would impact their use in ductless fume hoods.

Laboratory fume hoods are regulated in the OHS regulation under Part 30 Laboratories Section 30.8 Laboratory Fume hoods. One of the requirements of the laboratory fume hood is that is must be connected to a local exhaust ventilation system (WorkSafeBC, 2012a).

4.2 Personal communication

Communication with Bruce Anderson summary:

- WorkSafeBC was consulted on using ductless fume hoods at UBC in the past. Based on solely activated carbon filters with no detector systems/monitoring systems, use of these fume hoods were not approved.

- Would rather see low flow fume hoods be used instead of ductless fume hoods due to the limited capabilities of the carbon filter which puts the worker at risk of exposure.

Communication with Geoff Clark (WorkSafeBC officer) summary:

- Doubtful that any chemicals that are "designated substances" would be allowed to be used in re-circulating fume hoods. Need to carefully review all substances used at UBC before recommending the use of ductless fume hoods.

- Possible for UBC to apply for a variance if the case for using ductless fume hoods can be made.
  http://www2.worksafebc.com/Topics/VariancesRegulation/Home.asp

Communication with Ed Chessor summary:

- Concerns over limited capacity of carbon filters to store and remove vapours and inefficient at removing toxic gases.

- Whether a re-circulating hood can be used depends on the hood proposed and the type and quantities of toxics that will be released.

- May be acceptable for small quantities of substances with relatively high exposure limits.

- Ductless hood can be connected to exhaust system so that it has little effect on amount of air flowing in/out of room leading to significant energy and cost savings. Note that this set up was completed (after approval by WSBC) for some labs at Fraser Health (refer to next section outlining summary points from discussion with Chris Nicol)

- Would not recommend use of a ductless hood in an unventilated room due to risks associated with spills or hoods not properly maintained.

Communication with Chris Nicol (Fraser Health) summary:

- Oversaw the implementation of 7 ductless hoods at acute care sites in OR clean utility rooms for the specific purpose of using small volumes of formalin solution (diluted formaldehyde) for specimen preservation

- Hoods were installed with exhaust ducted into existing general exhaust system (Note that without being attached to exhaust system, WSBC would not approve the use of ductless fume hoods)

- Airclean 3000 hoods are $11,500 with filters at $1250 per unit/year. Total saved was well above $250,000 due to avoiding installation of direct vented hood at the locations

- Filters are easy to change and light weight and are disposed in regular waste

- Hoods have a good ergonomic design

Communication with Isabel Reinelt (WorkSafeBC) summary:

- Ductless hoods could be okay in some applications however it depends what is stated in Section 5.57 Table 5-1 “Recirculation of discharged air”.

Communication with Norlab summary:

- Ductless hoods pass ASHRAE 110 tracer gas testing

- Other universities have been interested in the ductless hoods: University of Saskatchewan and McMaster University (Carbasho, 2011)

- Length of filter life depends on what chemicals are used and in what quantities. Mainly rely on a detector system to notify when filters need to be changed.

- Need to supply manufacturer with exact volumes, type of substances and test conditions being used in the hoods to see if ductless hoods are suitable.

- Filters can be disposed of in regular waste; however it is recommended that the worker wear a respirator while changing out filters and that filters are placed into sealed bags.

- Ductless hoods cannot be used for perchloric acid

- Require 40 inches to get fume hood through lab door and 9 ft ceilings.

4.3 Literature review results

There is limited research in evaluation of ductless fume hoods and any relevant reviews on the ductless fume hoods were outdated. The following is a summary of what was found:

- Ductless fume hoods should be used with small amounts of substances that have low toxicity and good warning properties such as a detectable odour (Abrams, Reist, & Dement, 1986; First, 2003; Kiefer, 1996; National Research Council, 2011).

- Ductless hoods where the air is re-circulated back into the lab should only be used for nuisance vapours and dusts that will not create a fire hazard (National Research Council, 2011; NFPA, 2004).

- One common issue encountered in the literature addresses the failure of filters and the potential for a worker to be exposed. Charcoal filters do not adsorb hot vapour or steam effectively (Harrison, 2001; Koenigsberg, 1990, 1992).

- Should not be used where large amounts of substances are vaporized or with unknown materials (Goldner, 1993).

- A thorough review by a working group from the National Institute of Health (NIH) concluded that ductless fume hoods were not suitable for use in the NIH research labs (NIH, 2005). Some of the reasons for this decision were

    1. Specific filters must be used for each chemical and not all chemicals have corresponding filters.

    2. Monitoring systems for detecting breakthrough are unreliable. Chemicals have the potential to be de-adsorbed from the filter.

    3. Ductless hoods have limited ability to contain vapour from spills (1989 report showed 500 mL spill was not contained)

    4. Ductless fume hoods depend on someone to maintain hood, change filters, choose filters. Opportunity exists for mistakes to occur.

    5. Rely on controlled situations (ie staff and type of research doesn't change). The NIH labs are always changing.

    6. Other comparable research agencies do not allow ductless fume hoods in their facilities.

Applications of where ductless fume hoods were used:

- Health care industry for protection against gluteraldehyde vapour during disinfection/sterilization (Rutala, 1999; Rutala & Weber, 2008). The Occupational Safety and Health Administration (OSHA) outlines the use of the hoods when handling gluteraldehyde. OSHA requires a "preventative maintenance program in accordance with the manufacturer's recommendations" due to the filters decreasing efficiency over time (OSHA, 2006).

- Ductless fume hoods used for the process of histology stains. One medical school used filters for the main stain ingredients: xylene, alcohol and ammonium sulfate (Goldner, 1993).

- Control against odours associated with slide preparation as long as the filters are effective and suitable for the chemicals being used (Kiefer, 1996).

- Control particulate exposures as long as filters are changed out routinely (Kiefer, 1996). The Health Safety Executive based in the UK allows the use of ductless fume hoods with HEPA filters for protection against small quantities of nanoparticles (< 1 gram). Hoods must have alarms for saturation and low airflow. Also, HSE requires that proper training and rigorous maintenance checks take place (Health and Safety Executive, n.d.).

- Ductless fume hoods equipped with pre-filters and multilayer filters were used in a temporary organic chemistry student lab facility while a new lab was being built over a 17 month period. Some of the experiments were modified to avoid producing toxic gases (Amburgey-Peters, 2002). Up to 200 mL of solvents were being used in the hoods, generally consisting of acetone, dichloromethane, diethyl ether and pyridine. Communication with the chemistry instructor (Judith Amburgey) revealed that the chemistry department is currently using ductless hoods to hold their waste containers (halogenated, non-halogenated and aqueous solid). The containers are normally capped unless waste is being added.

4.4 Other university policies

In summary, the use of ductless fume hoods in many other universities is strongly discouraged (Columbia University, 2008; Princeton University, 2011; University of Hawaii, 2009; University of Milwaukee, n.d.; University of Toronto, 2010; Yale University, 2006). These academic institutions recognize that the charcoal filters are not able to effectively capture 100% of the vapour that passes through. There have also been concerns over the capability of sensors to detect vapours as well as reports that charcoal filters can end up costing more (filters approximately 20-25% of cost of hood) than ducted hoods in the long run (Yale University, 2006). In general the universities which have a policy on ductless fume hoods only permit these to be used for low volumes of low toxicity substances after approval has been given by the health and safety department. The University of Waterloo health and safety website states that ductless fume hoods cannot be used for flammable solvents due to the Ontario Fire Code (University of Waterloo, n.d.).

Some universities have prohibited the use of ductless fume hoods such as Queen's, East Carolina University and John Hopkins University (NIH, 2005; Queen's University, 2005). The University of California recently updated its stance on ductless fume hoods and only allows these to be used if traditional fume hoods are not feasible (University of California-Irvine, 2011).

4.5 Other considerations

Some other considerations of using ductless fume hoods includes

- Potential for filters to be handled as hazardous waste depending on what substances are being used in the hood

- Storage space for extra filters

- Administrative items: extensive training for the workers so that they understand the limitations and uses of the ductless fume hoods (ductless hoods with pre filters need to be checked every month (AirClean Systems, 2006))

- When the carbon filters are replaced, the worker has to wear a NIOSH approved respirator and be trained to wear the respirator (AirClean Systems, 2006)

- Make up air in the lab has to be adjusted if a ductless fume hood is installed since less air will be exhausted out. Must maintain sufficient air changes per hour. Guidelines for how many air changes per hour are summarized in another SEEDS report (Gretka, 2012).

- Ductless hoods cannot be placed in high traffic areas or near doors. AirClean specifically states that the right hand side of the unit must be away from a wall or turbulent places (AirClean Systems, 2006).

5. Recommendations

After review of the available literature on ductless fume hoods, the potential use of ductless fume hoods at UBC is limited. The use of ductless fume hoods requires that ongoing monitoring be performed and relies heavily on workers to know when and how to change the filters. A limitation in reviewing ductless fume hoods is the lack of peer-reviewed literature on the hoods to prove that they are capable of protecting a worker when they are being used in a typical laboratory setting.

Recommendations are the following

1. Achieve energy cost savings through proper use of fume hoods already on campus. From the audit completed in 2011, 32 of the 132 fume hoods checked were being used as storage (Gretka, 2012). Items placed in front of the fume hood affect air flow effectiveness and use unnecessary space. The same report also documented that variable air volume boxes that were available on some hoods were not being used.

2. Use ductless hoods only for low hazard and low volumes of substances. It is possible to get a variance from WSBC to use ductless fume hoods that are attached to a local exhaust system and are used for low toxic substances that are handled in small volumes.

3. References

Abrams, D. S., Reist, P. C., & Dement, J. M. (1986). An evaluation of the effectiveness of a recirculating laboratory hood., *47*(1), 22–26.

AirClean Systems. (2006). Operator's manual. Propylene ductless hoods.

AirClean Systems. (2010). Filtration. Retrieved from http://www.aircleansystems.com/tech_filtration.htm

Amburgey-Peters, J. C. (2002). Implementing temporary facilities for organic chemistry laboratory, *79*(5).

Carbasho, T. (2011). Interdisciplinary science program influences lab renovation at McMaster. Tradeline Inc. Retrieved from http://www.science.mcmaster.ca/isci/images/stories/news/tradeline%20article.pdf

Columbia University. (2008). Chemical fume hood policy. *Environmental Health and Safety*. Retrieved from http://ehs.columbia.edu/fhPolicy.html

Donaldson Company Inc. (2011). High efficiency particulate air HEPA filtration facts. Retrieved from http://www.donaldson.com/en/aircraft/support/datalibrary/042665.pdf

Doxsee, K. M. (2009). Chapter 10 Green laboratories: facility-independent experimentation. *Green chemistry education. Changing the course of chemistry* (pp. 147–154). Washington, DC: American Chemical Society.

First, M. W. (2003). Laboratory chemical hoods: a historical perspective., *64*(2), 251–259.

Goldner, H. (1993). Ductless hoods are helpful but they have limitations. *R & D*, *35*(8), 53.

Gretka, V. (2012, March). UBC energy audit: laboratory ventilation and fume hoods. University of British Columbia.

Harper, M. (2011). Sampling and analysis of gases and vapors. *Patty's Industrial Hygiene* (6th ed., Vols. 1-2, Vol. 1). New Jersey: John Wiley & Sons.

Harrison, D. J. (2001). Controlling exposure to laboratory animal allergens, *42*(1).

Health and Safety Executive. (n.d.). Risk management of carbon nanotubes. Retrieved from http://www.hse.gov.uk/pubns/web38.pdf

Kiefer, M. (1996). HETA 96-0164-2614 Florida department of agriculture and consumer services. Division of plant industry. NIOSH. Retrieved from http://www.cdc.gov/niosh/hhe/reports/pdfs/1996-0164-2614.pdf

Koenigsberg, J. (1990). Evaluating ductless fume hoods, *62*(2), 63.

Koenigsberg, J. (1992). How does your fume hood rate? New assessment of current fume hood design and operations, *69*(5), 408–412.

Mills, E., & Sartor, D. (2005). Energy use and savings potential for laboratory fume hoods, *30*, 1859–1864.

National Research Council. (2011). *Prudent practices in the laboratory: handling and management of chemical hazards.* Washington, DC: National Academies Press.

NFPA. (2004). NFPA 45 Standard on fire protection for laboratories using chemicals.

NIH. (2005). Ductless fume hood review. Retrieved from http://www.ors.od.nih.gov/sr/dohs/Documents/DOHS%20Ductless%20Fume%20Hoods%20Review_2007.pdf

OSHA. (2006). Best practices for the safe use of glutaraldehyde in health care. Retrieved April 21, 2012, from http://www.osha.gov/Publications/3258-08N-2006-English.html

Princeton University. (2011). Section 6B: controlling chemical exposures. *Environmental Health and Safety*. Retrieved from http://web.princeton.edu/sites/ehs/labsafetymanual/sec6b.htm

Queen's University. (2005). Fume hoods-procedures for installation, maintenance and use. Retrieved from http://www.safety.queensu.ca/safety/policy/eh&s/fumehoods.pdf

Rutala, W. A. (1999). Disinfection of endoscopes: review of new chemical sterilants used for high-level disinfection, *20*(1), 69–76.

Rutala, W. A., & Weber, D. J. (2008). Guideline for disinfection and sterilization in healthcare facilities. CDC. Retrieved from http://www.cdc.gov/hicpac/pdf/guidelines/Disinfection_Nov_2008.pdf

University of California-Irvine. (2011). UCI EH&S position statement ductless fume hood systems. Retrieved from http://www.ehs.uci.edu/programs/energy/EHSPosition_DuctlessFumeHoods.pdf

University of Hawaii. (2009). UH Manoa ductless fume hood use guidelines. Retrieved from http://www.hawaii.edu/ehso/lab/DUCTLESS%20FUME%20HOOD%20USE.pdf

University of Milwaukee. (n.d.). Ductless fumehood policy. *Safety and Health*. Retrieved from http://www4.uwm.edu/usa/safety/laboratory_safety/ductless_fumehoods.cfm

University of Toronto. (2010). Laboratory fume hood standard. Selection, use, ,installation and maintenance. Retrieved from http://www.ehs.utoronto.ca/Assets/ehs+Digital+Assets/ehs3/Chemical+Safety/Fume+hood+standard+2008.pdf

University of Waterloo. (n.d.). Fume hoods. Retrieved from http://www.safetyoffice.uwaterloo.ca/hse/fume_hoods/fume_hoods.htm

WorkSafeBC. (2012a). Part 30 laboratories. Retrieved from http://www2.worksafebc.com/Publications/OHSRegulation/Part30.asp#SectionNumber:30.1

WorkSafeBC. (2012b). Regulation Part 5 Chemical Agents and Biological Agents. Retrieved April 9, 2012, from http://www2.worksafebc.com/publications/OHSRegulation/Part5.asp#SectionNumber:5.64

Yale University. (2006). Laboratory chemical hygiene plan. Retrieved from http://www.chem.yale.edu/resources/docs/chemicalhygiene.pdf

4. Acknowledgements

This project would not have been possible without the support of Karen Bartlett, Lillian Zaremba and Brenda Sawada. A thorough literature review was completed with the guidance of Sally Taylor. The following individuals also provided their valuable time and knowledge to the project and deserve acknowledgement: Bruce Anderson, Isabella Reinelt, Geoff Clark, Ed Chessor and Chris Nicol.

5. Appendix

Appendix I

Table 1A shows some of the chemicals that can be filtered by carbon filters. The manufacturer states that the carbon filters can trap up to 11 lbs of the listed chemicals and the chemicals listed are generally suitable with the carbon filter. There are many more chemicals that are listed by the manufacturer however they are not as effectively filtered (AirClean Systems, 2010). See manufacturer website for more details.

Table 1A. Types of chemicals that may be used with carbon filters according to AirClean Systems (AirClean Systems, 2010).

Filter type	**Chemicals**
Activated bonded carbon filters	Hydrocarbons: benzene, naphthalene, styrene, toluene, toluidine, xylene, cyclohexane, cyclopentane, hexane, octane, ethyl benzene, pyrene Acids: acetic, acetic anhydride, acrylic, butyric, caprytic, carbolic, lactic, phenol, propionic, valeric, phenic, oxatic, caprylic, carbolic Alcohols: ethyl, amyl, butyl, cyclohexanol, isopropyl, propyl, amyl alcohol, benzyl alcohol Esters: butyl acetate, cellosolve® acetate, ethyl acetate, ethyl acrylate, isopropyl acetate, methyl methacrylate Ethers: amyl, butyl, propyl, ethylene glycol monobutyl, cellosolve®, dioxane, methyl cellosolve® Ketones: methyl isobutyl ketone, methyl ethyl ketone, dipropyl ketone, diethyl ketone, ethyl butyl ketone, methyl amyl ketone, cyclhexanone Miscellaneous (only some are listed here): adhesives, animal odours, degreasing solvents, ozone, turpentine, varnish
Activated bonded carbon chemisorptive filters*	Glutaraldehyde, formaldehyde, ammonia/amines, alkaline fumes, inorganic acids, hydrogen sulphide, mercury vapor

*Carbon filters with a chemical additive that can chemically/physically react with the contaminant.

Appendix II

Table 2A: Recirculation of discharged air Table 5-1 taken from WorkSafe BC (WorkSafeBC, 2012b)

Recirculation permitted without written approval	A nuisance particulate with an 8-hour TWA limit of at least 10 mg/m^3, provided that its concentration in the discharged air is less than 10% of the TWA limit. Asbestos fibre or other particulate, except a biological contaminant, provided that it is exhausted from a portable vacuum cleaner or bench-top containment unit, fitted with an effective HEPA filter. A welding fume (including its components identified under section 5.57(1)) exhausted from a portable welding fume extractor fitted with an air cleaner, provided that its concentration in the discharged air is less than 10% of the applicable exposure limit. A biological contaminant discharged from a biological safety cabinet that is installed and operated in accordance with the requirements in Part 30 (Laboratories). Non-allergenic softwood dust, provided that its concentration in the discharged air is less than 10% of the 8-hour TWA limit.
Recirculation only with written approval by the Board	Allergenic wood dust. Non-allergenic hardwood dust. Any contaminant not otherwise listed in this Table.
No recirculation permitted	A substance identified under section 5.57(1), unless otherwise identified in this Table.