



Chemical Storage (ventilation)

Introduction

This information sheet is an updated review of the answers to the following questions, and replaces the previously published Q&As:

- If the chemical store is a frequent work area in which the chemicals are made and dispensed, does this change the requirements for ventilation? Is there a difference in law for ventilation with regards to a work area full of chemicals as opposed to a chemical store?
- What type of extractor fan should we have to ventilate our chemical storage cupboard? My understanding is that we have an Industrial Extractor fan but should we have a Chemical Store specific extractor fan?
- Can you clarify if the exhaust fan in the chemical store should be regularly tested to ensure it is providing sufficient ventilation?
- Ventilation in corrosives cupboard: Are there any regulations regarding ventilation in corrosives and flammable cupboards?

Chemical storage

Under the regulations, the ventilation of chemical storerooms and laboratory areas is treated separately.¹ However, both areas require very good ventilation in order to minimize exposure to harmful chemicals by people who use the facilities. These requirements are set out in various Australian and Australian/New Zealand Standards listed in the references.

1. The chemical storage room requires ventilation to conform to Australian standards: [AS 2243.1:2021](#) and [AS 2243.2:2021](#)
2. The ventilation of both areas should be subject to a risk assessment as to its effectiveness, and appropriate control measures implemented if necessary. ([AS 2243.1:2021](#). 3.1.2). Section 2.8.2 states that if a risk assessment identifies the need for local exhaust ventilation, the local exhaust ventilation installed shall be in accordance with section 8.4.3 standard [AS 2243.2:2021](#)
Section 8.4.3:

'The store ventilation shall be in accordance with the design principles specified in [AS 1940](#) and shall have a capacity of not less than that specified in [AS 1940](#). While [AS 1940](#) permits the use of natural ventilation as the sole means of ventilation, mechanical ventilation should be considered to ensure sufficient airflow under all weather conditions. A higher rate of ventilation may be necessary if very volatile, toxic or corrosive substances are stored to ensure a safe working environment. Exposure standards may be used for guidance.

If required, a two-stage ventilation system fitted with vapour detection may be needed. There shall be no recirculation of exhaust air except in a cooled store where a risk assessment has been conducted and appropriate risk control measures have been implemented.

Where stores are mechanically ventilated, the ventilation system shall be exclusive to the room. If individual cabinets are ventilated, they shall be ventilated to the external atmosphere in accordance with [Clause 6.3](#).

Section 9.3.2

Ventilation shall meet the requirements of [AS 4332](#). When lighter than air gases are stored in a room or space, ventilation shall also be provided at the highest point in the room. A room in which flammable vapours or gases may accumulate may require ventilation, or be provided with vents which will relieve any explosion within the room without damage to the structure. [AS 1375](#) and [NFPA 68](#) give guidance on the design of explosion vents.”

Science ASSIST recommends a dedicated chemical store room fitted with ventilation that meets Australian Standard: [AS-2243-1-2021 Section 2.7.1](#). A dedicated chemical storeroom has additional benefits such as assisting in the security of the chemicals. It is preferable that this is incorporated at the design stage of a building, as it is much more difficult to achieve later. If the chemical storeroom and science preparation area currently share the same space, Science ASSIST recommends that you undertake a risk assessment and plan for the separation of these two areas as soon as practicable.

School Specific Guidance materials

The Victorian Department of Education has produced a useful page of resources for the storage and management chemicals in a school which can be found at: <https://www.education.vic.gov.au/hrweb/safetyhw/Pages/chemicalmgt.aspx>²

The Queensland Department of Education, Training and Employment also have a useful document regarding general guidelines for managing risks with chemicals in the education setting which can be found at [Chemical management procedure \(qed.qld.gov.au\)](#)³

Cabinet Ventilation

Section 6.3.5 Cabinet Ventilation [AS 2243.2:2021](#)

“Cabinet ventilation should not normally be required unless determined as an essential risk control measure. Cabinet ventilation is not an alternative to vapour-tight closure of all stored containers.

Ventilation for Classes 5.1 and 5.2 hazardous chemicals shall be in accordance with [AS 4326](#) and [AS 2714](#) respectively.

Where ventilation is installed, it shall be designed so that vapours are prevented from escaping into any room. Any ventilation exhaust shall be to the outside atmosphere, in a location allowing the safe dispersal of vapours, and away from ignition sources.”

Chemical Store Room Requirements

Most issues relating to ventilation in school science department chemical storerooms revolve around two major groups of chemicals, the Flammable Liquids (Dangerous Goods Class 3) and the Corrosives (Dangerous Goods Class 8).

In any ventilation system, it is important to consider that vapours of flammable liquids are heavier than air, so the ventilation system should be designed to scavenge vapours from the lower parts of the store. In addition, the ventilation system should be designed to operate either continuously, or whenever a person is in the store. If these classes of chemical are stored in dedicated storage cabinets within the storeroom,



then AS/NZS 2243.10 section 3.3.4 addresses ventilation of dedicated chemical storage cabinets. Whilst ventilation of cabinets is not normally required, good housekeeping is important in minimising vapours.

General good housekeeping issues for chemical storerooms.

- Ensure that all chemical bottles are securely sealed before being placed in the storeroom.
- Clean any spills or drips from any bottles before returning to the storeroom.
- Seal bottles of volatile liquids with “Parafilm” or similar.
- Never decant chemicals in the storeroom, this should be done in the preparation area.
- Do not store other items, e.g., glassware, in the storeroom.

School chemical storerooms that store flammable or combustible chemicals (as is usual in a secondary science facility) need to be equipped with ventilation as set out in the Australian Standard [AS1940: Storage and Handling of Flammable and Combustible Substances](#). The rate of ventilation required in the standard is 0.3 m³ per minute per square metre of floor space or 5 m³ per minute, whichever is the greater.

Requirements for a Chemical Preparation room

School chemical preparation rooms are subject to the ventilation requirements for laboratories specified in [AS 2243.1](#) , and in addition:

“procedures shall be implemented to ensure Laboratory personnel are not exposed to concentrations of hazardous substances greater than the lowest practically achievable level and in any case less than the exposure standard.” ([AS 2243.2- 2021: Section 3.1 \(a\)](#)).

School science preparation areas use several hundreds of chemicals, all with their own allowable exposure levels. As schools will have no capacity to measure the levels that are present, the effective solution is to provide excellent extractive ventilation to minimise exposure to persons present.

Extraction Fans

The fan needs to be specifically suitable for a chemical store. A school chemical storeroom may contain flammable, corrosive and/or toxic vapours, therefore it is recommended that the choice of fan should consider the following design features.

They include the following provisions for a ventilation system:

- The fan must be suitable for the hazardous area.
- It must be able to run continuously. Domestic fans do not meet this criterion.
- To meet the requirements of [AS1940: Storage and Handling of Flammable and Combustible substances](#) Needs to be spark proof, does not generate static electricity or hot spots.
- Needs to be able to be run continuously (domestic fans do not meet this criteria).
- It must extract air at the rate required in [AS1940](#) 0.3 m³ per minute per square metre of floor space in the room, or 5 m³ per minute, whichever is greater.
- Vents may be required in the storeroom to allow fresh air to replace the air being extracted at the appropriate rate.
- The school may need specialist input to ensure that these criteria are met.

Schools store a large range of chemicals below specific quantities for manifest threshold information.⁵ The standards are written for industry and cover a lot more than the ventilation requirements. With the school science departments using a large range of chemicals but maintaining relatively small quantities of each, the issues of storage become more complex. Science ASSIST has developed a [Recommended List of chemicals](#),⁶ which includes detailed information for each chemical including “specific guidance for storage areas”.

Chemical store and prep room Risk assessment

Science ASSIST recommends that the ventilation of both preparation and storage areas are subject to a risk assessment process to assess effectiveness. Signs that the ventilation may be inadequate could include (but are not limited to) the following:

- **Allergic reactions:** Persons present exhibit allergic (“hay fever”) type responses to the environment.
- **Odours:** There are detectable chemical odours upon entering the work space. This could include a build-up of volatiles within storage units such as those used for flammables and corrosives. This is often obvious when the door of a storage cabinet is opened and it indicates inadequate ventilation or poor housekeeping. However, it could also apply to the sensation noted upon entering the room. Be aware that the initial smell response is most important as, due to “smell fatigue”, these initial responses often rapidly fade and may not be detectable after even a short time, even though the chemical is still present. It is important to note that not all vapours are detected by the human nose, so just because an air contaminant cannot be detected by smelling, does not mean that there is no hazard.
- **Condensation:** Condensation build up on the outside of storage bottles, and on the walls of storage units (usually corrosives or flammables units).
- **Labels:** Degradation of chemical labels due to condensation and corrosion.
- **Corrosion:** Corrosion of fittings in storage units (usually, rusting adjacent to the storage of corrosive substances). This is usually most observable on metal door knobs.

Should a risk assessment indicate inadequate ventilation, then appropriate control measures would need to be implemented to improve it to the required standard.

Combined Chemical store and prep room

The various standards strongly discourage, but do not prohibit, the combination of chemical storage with preparation areas. The accepted good practice is for these two areas to be adjacent but separated.

Science ASSIST recommends that a combined chemical store and preparation room undertake a risk assessment and plan the separation of these two areas as soon as practicable.

Reasons for their separation would include the following:

- **Ignition sources:** The need for chemical storerooms storing flammable and combustible materials to be free from ignition sources, which would include power points, electrical switches, burners, and standard (not spark proof) overhead lighting. The operation of a school science preparation area commonly includes these sources. Combining the two safely is difficult.
- **Security:** The need for chemicals to be stored securely and with access only by authorised staff. A dedicated lockable chemical storeroom provides this security. A more open and accessible preparation room may not. In this context, we also note the increasing risk to schools posed by illegal chemical use for both illicit drug and terrorist applications.

- **Chemical exposure:** The need to separate persons (typically school science technicians, as they spend the most time in this environment) from chronic low-level chemical exposure. Whilst science teaching areas are identified as potentially hazardous, the workplace health and safety data indicate that, by far, the most serious workplace injury claims are not caused by single events such as explosions, but by sensitisation to chemicals caused through long-term chronic chemical exposure.⁸ The separation of chemical storage from preparation areas, and the provision of adequate ventilation to both, largely eliminates this problem.
- **Ventilation:** There can be the possibility of competing extractive ventilation systems. Whilst the chemical storeroom requires significant extractive ventilation as set out above, a science preparation room will commonly have a fume cupboard with a strong extractive ventilation system of its own. These two units are clearly not compatible within the same room, as they would be drawing air from the same space and working in opposition. It could mean that either the chemical storeroom ventilation is preventing the effective operation of the fume cupboard, or that the fume cupboard is preventing the effective operation of the chemical store room ventilation, or both.

Maintenance and testing of ventilation systems

We are not aware of any guidance material, such as Regulations, Australian Standards or Codes of Practice, that set out how often the ventilation in a chemical store should be tested. However, the [Model Work Health and Safety Regulations](#)⁷ do require that control measures be maintained and reviewed to ensure that they are effective.

“A duty holder who implements a control measure to eliminate or minimise risks to health and safety must ensure that equipment is maintained so that it remains, effective, including by ensuring that the control measure is and remains:

- fit for purpose; and*
- suitable for the nature and duration of the work; and*
- installed, set up and used correctly.”¹*

Ventilation systems should be maintained, but the legislation is not prescriptive about how this is done. It is up to school systems to have testing and maintenance schedules in place for ventilation, fire alarms and sprinkler systems. It is reasonable and practical for schools to test the efficiency of the exhaust fan in the chemical store at the same time as the fume cupboard has its annual testing.

Relevant standards

[AS 2243.1:2021](#) Safety in laboratories, Part 1: Planning and operational aspects

[AS 2243.2:2021](#) Safety in laboratories, Part 2: Chemical aspects and storage

[AS 1940:2017](#) The storage and handling of flammable and combustible liquids

The following documents may provide further information.

[Science Facilities:](#) laboratory standards.

[Science ASSIST Information sheet: Safety Shower and Eyewash](#) safety showers.



References

- ¹ Safe Work Australia website, (2020, July), '*Managing risks of hazardous chemicals in the workplace – Code of Practice July 2020*', retrieved from <https://www.safeworkaustralia.gov.au/doc/model-code-practice-managing-risks-hazardous-chemicals-workplace>
- ² Victorian Government Department of Education website, (2018, July 9), '*Chemical management procedure*', retrieved from <https://www.education.vic.gov.au/hrweb/safetyhw/Pages/chemicalmgt.aspx>
- ³ Queensland Department of Education website, (2022, March 29), '*Chemical management procedure*', retrieved from <https://ppr.qed.qld.gov.au/pp/chemical-management-procedure>
- ⁴ Safe Work Australia website, (2020, July), '*Managing risks of storing chemicals in the workplace Guidance material*', <https://www.safeworkaustralia.gov.au/doc/managing-risks-storing-chemicals-workplace>
- ⁵ Worksafe Queensland, (2018, January), '*A guide for flammable and combustible liquids under the Work Health and safety Act 2011*', https://www.worksafe.qld.gov.au/___data/assets/pdf_file/0024/22866/guide-for-flammable-and-combustible-liquids.pdf
- ⁶ Science ASSIST website, (2021, March), '*List of recommended chemicals for science in Australian schools 2021*', retrieved from <https://assist.asta.edu.au/resource/4669/list-recommended-chemicals-science-australian-schools-2021>
- ⁷ Safework Australia website, (2022, June 6), '*Model WHS regulations*', retrieved from <https://www.safeworkaustralia.gov.au/doc/model-whs-regulations>
- ⁸ Safework Australia website, (2022), '*Workplace exposure standards for airborne contaminants*', retrieved from <https://www.safeworkaustralia.gov.au/doc/workplace-exposure-standards-airborne-contaminants-2022>
- Standards Australia website, (2021) AS/NZS 2243.1:2021 *Safety in laboratories Part 1: Planning and Operational Aspects*. Standards Australia: Sydney. AS/NZS 2243.2:2021 *Safety in laboratories, Part 2: Chemical aspects and storage*. Standards Australia: Sydney. Reproduced by ASTA with the permission of Standards Australia Limited under licence CLF1222asta. Copyright in AS/NZS 2243.1:2021 and AS/NZS 2243.2:2021 vests in Standards Australia and Standards New Zealand. Users must not copy or reuse this work without the permission of Standards Australia or the copyright owner.