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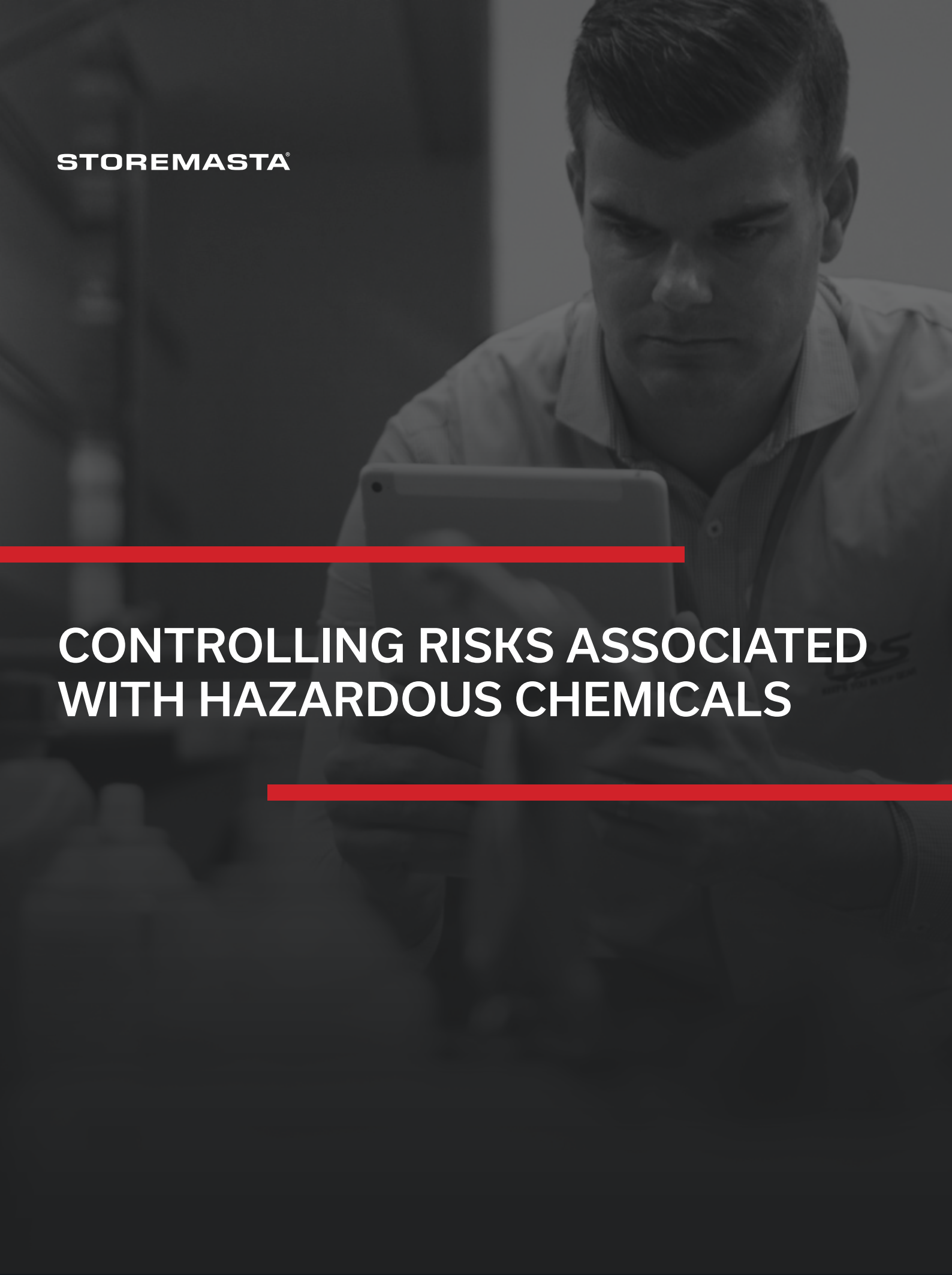


CONTROLLING RISKS ASSOCIATED WITH HAZARDOUS CHEMICALS

Contents

Hazardous chemicals are present at just about every workplace — fuels, disinfectants and sanitisers, adhesives, emulsifiers, explosives, pesticides, pharmaceuticals, solvents. Their applications are far-reaching and as complex as the hazards they can create. And whether you're a micro-business that employs 3 spray-painters, or a mining corporation with thousands of employees you are legally required to '*identify reasonably foreseeable hazards that could give rise to risks to health and safety.*' Once identified, each hazard must be properly managed.

This eBook will help you meet your obligations under Sections 35-37 of the WHS Regulations. Australian WHS Regulations require you to eliminate chemical hazards — and if this is not possible — take steps to minimise or 'control' each hazard by following the ***Hierarchy of Controls***.

More specifically our eBook explains:

- How the Hierarchy of Controls fits into a compliant risk management methodology.
- The emphasis on hazard elimination (where possible).
- Determining risk control measures that are required by legislation.
- The 5 tiers of the Hierarchy of Controls.
- How to choose the most effective risk control measures.
- Your obligation to maintain (as well as review) chemical controls.

Our ultimate goal is to give you the information you need to efficiently manage the hazardous chemicals you carry — this will help you maintain a work environment that is without risks to the health and safety of your workers (as well as the environment).

3 A risk management approach to chemical hazards

Controlling chemical hazards is never a single action or an isolated effort — to be 100% chemical safety compliant a risk management approach is essential. By risk management approach we mean implementing a holistic system that ensures all chemical hazards are identified, then assessed, eliminated or controlled. This system also has review mechanisms.

Here at STOREMASTA we help our clients manage their hazardous chemicals and dangerous goods by using an in-house **risk management methodology**, **IDENTIFY - ASSESS - CONTROL - SUSTAIN**. It's a four-step system which works as follows:

Identify

The materials and substances present at the worksite. Determine which chemicals are hazardous and the ways they could negatively impact the health of people, or damage property and the environment.

Assess

The level of risk to your workers, to your business, and the wider community. If a chemical can cause an injury, fatality, or fire — evaluate the likelihood of it actually happening. Then create a priority list for action.

Control

Each chemical hazard according to the Hierarchy of Controls. Try to eliminate the hazard completely, if this cannot be achieved minimise the impact of the hazard by applying substitution, isolation, engineering, administrative, and PPE controls. Ensure mandatory controls required by legislation are implemented.

Sustain

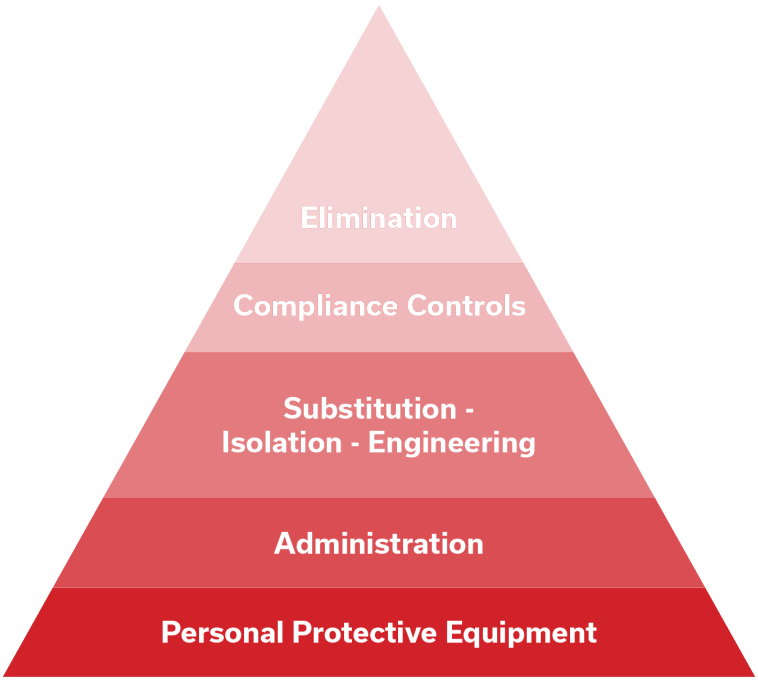
Compliance by implementing review systems. Ensure each control measure is fit for the purpose, set up and working correctly. Also make sure no new hazards have been created.

Our risk management methodology recognises that in order to properly control a hazard you need to know it exists (**IDENTIFY**), and priority should be given to the chemical hazards capable of causing the most damage, and most likely to occur (ASSESS). If the hazard cannot be completely eliminated (CONTROL), the measures you introduce to minimise the risk must be tested to ensure they are working correctly and comply with WHS legislation and Australian Safety Standards (SUSTAIN).

REMEMBER: *Attempting to control a chemical hazard outside of the methodology is an inefficient use of resources and unlikely to guarantee legislative compliance.*

4 Understanding the Hierarchy of Controls

A control measure is simply an action you take to bring a hazard to an acceptable level of risk. The Hierarchy of Control Measures is defined in the WHS Regulations and groups different types of risk control measures in a priority order. This priority order has 5 tiers.



The 5 tiers in the Hierarchy of Control are based on where the control measure is applied — at the source, path, or exposure point of a hazard.

SOURCE OF HAZARD	Packaged chemicals, raw materials, generated chemicals, emissions, hazardous waste.	Elimination and substitution controls.
PATH OF HAZARD	Breathing zone of workers, public airways, chemical decanting systems, piping, drains.	Isolation and **Engineering controls**.
EXPOSURE POINT OF HAZARD	Workers and contractors, general public, aquatic life, vegetation, wildlife, livestock, ignition source.	Administration and PPE controls.

Measures that control a hazard at the source (*elimination/substitution controls*) and along the path of the hazard (*isolation/engineering controls*) are more effective and are given priority. Controlling a hazard at the exposure point (*administration/PPE controls*) is less effective and placed at the bottom of the Hierarchy.

EXAMPLE: *Your workplace uses forklifts which are powered by LPG stored in cylinders. LPG presents a number of chemical hazards including fire and explosion hazards, asphyxiation hazards, cold-burn hazards, pressure release hazards. You would look for ways to eliminate or minimise all these chemical hazards by implementing risk controls in the following order.*

TIER 1. Eliminate chemical hazards

You begin by looking at ways to stop using the LPG cylinders completely. Changing the forklifts to diesel power is expensive and would introduce another chemical hazard (combustible liquid + carcinogenic diesel emissions), so it's not a viable option. The forklifts are essential to running your business and you realise the hazards cannot be eliminated.

Reasonable attempts must be made to eliminate every chemical hazard that exists at the workplace. Completely eliminating a chemical hazard can be tricky because often the risk is just transferred to another area. When it's not possible to eliminate a hazard you must look for ways to minimise the risk, starting at the top of the Hierarchy of Controls.

TIER 2. Identify mandatory controls

Looking through the WHS Regulations you realise there are a number of mandatory controls which apply to LPG cylinders (eg, stocks must be kept at the lowest practicable quantity for the workplace.). You take note that stock minimisation is an administrative control and flag it for implementation. If you've determined that a hazard cannot be eliminated you need to check the WHS Regulations to see if there are mandatory controls which apply to the chemicals you are using. Mandatory controls exist for:

- Chemicals with an air-borne exposure standard (check the Safety Data Sheets).
- Flammable gases and vapours used/stored in a confined space.
- Labelling and placarding of all hazardous chemicals.
- Keeping a Register and Manifest of hazardous chemicals.
- Flammable, explosive and reactive chemicals (including gas cylinders).
- Chemical spills and associated damage.
- Chemical storage and handling systems.
- Specific substances like lead, asbestos and all restricted substances listed in the Regulations.
- Induction, training and supervision of workers using hazardous chemicals.

If a mandatory control exists it must be implemented, but for practicality you should still follow the Hierarchy of Controls. In many instances these mandatory controls (on their own) won't be sufficient to sufficiently minimise the hazard, and you will need to seek additional measures.

TIER 3. Substitution/Isolate/Engineer

You've altered your ordering process and your stocks of LPG cylinders are now reduced, but the hazards still exist. You cannot find a less harmful substitute for LPG cylinders, but you realise you can reduce the asphyxiation, fire, and explosion hazards by using an isolation control (relocating your gas bottle cage outside). ***The outdoor cylinder store*** *maximises natural ventilation.*

When a hazard still exists after implementing mandatory controls, you must consider a combination of substitution, isolation and engineering controls. They work as follows:

- *Substitution controls* look for safer alternatives eg, using diluted chemicals that have a lower concentration of toxins than the original substance.
- *Isolation controls* limit contact with the hazard eg, restricting access to the **gas cylinder stores** and keeping cages locked.
- *Engineering controls* use mechanical devices or make changes to work processes eg, installing a dedicated **flammable liquids cabinet** with a self-contained spill sump.

IMPORTANT: *The WHS Regulations recommend that at combination of controls in this tier be implemented if possible.*

TIER 4. Administrative controls

Even though the gas bottle cage is outside and away from work areas and traffic, a fire or explosion could occur if an ignition source was brought into the area. You issue a new operating procedure which restricts access to the area and prohibits any machinery, maintenance work, and personal electronics that could create a spark, flame, or static electricity.

According to the WHS Regulations, if the hazard still remains after introducing Tier 3 controls (substitution/isolation/engineering), then you must implement administrative controls to further minimise the risk. Administrative controls include:

- *Safe work methods and operating procedures.*
- *Induction and training programs for workers and contractors.*
- *Ensuring workers have enough supervision.*

Administrative controls only work if people understand, accept, and carry them out. They should always be used to support other control measures.

TIER 5. Personal Protective Equipment

LPG stored in cylinders can also cause third degree cold-burn injuries if a worker's skin contacts the gas while being rapidly released. The SDS for LPG recommends thermal protection gloves when changing cylinders on the forklift. You issue these to workers but realise you will also require additional administrative controls (safe work methods, training sessions, supervision) to ensure the gloves are fitted and used correctly every time a cylinder is changed.

Personal Protective Equipment (PPE) is the 5th Tier in the Hierarchy of Controls. ***PPE*** *is the safety equipment worn by workers and includes aprons, gloves, boots, coveralls, eye-guards, and respirators. The reason PPE sits at the bottom of the Hierarchy and is the least preferred chemical control, is because PPE controls the hazard at the point of exposure (the worker). PPE only provides a temporary screen between the chemical and the worker and can be easily damaged, forgotten, or lost. Any of these would leave workers without exposure protection.*

7 Types of control measures

In this section we'll take a deeper dive into the different types of control measures — what they are, what makes them effective, and what are their limitations.

Elimination controls

Risk controls that completely remove the hazard

When dealing with hazardous chemicals, elimination controls are always the most desirable because the hazard is completely removed. Chemicals are complex and a single substance usually has multiple hazards (eg, flammable, and corrosive, and an asphyxiant), so completely removing the chemical itself is often the only way to be certain that every hazard has been eliminated.

Elimination controls include:

- **Ceasing use of a chemical** - find a way to carry out a task that does not require a chemical.
  Eg, using nails instead of chemical adhesives, using electrical powered forklifts instead of diesel power.
- **Outsourcing** - outsourcing hazardous tests and tasks that involve chemicals.
  Eg, buying premixed or diluted chemicals instead of mixing/diluting onsite, outsourcing welding.
- **Dispose of unused/out-of-date chemicals** - a number of chemical hazards could be eliminated by disposing of surplus/unused chemicals.

Limitations of Elimination controls

Elimination controls are ideal but they can be extremely difficult to implement without closing down an entire production line or operational arm of the business.

In many cases the risk is never fully eliminated — new hazards are introduced during new work methods, and the risk is merely transferred to another area of the business. A follow-up risk assessment is essential.

REMEMBER: *Elimination controls are the most cost-effective when used during planning stages. Carrying out a risk assessment before making changes to the business can eliminate chemical hazards before they areever introduced.*

Substitution controls

Risk controls that substitute one hazard for a smaller hazard

Substitution controls look for safer alternatives to processes that involve hazardous chemicals. Changing chemicals sounds simple enough but you'll need to carefully evaluate if the new substance is effectively doing the job, and if working conditions have been changed. As with elimination controls, a follow-up **risk assessment** is required.

Substitution controls include:

- **Changing chemicals** — finding a chemical or substance that is less toxic, corrosive, or flammable than the one currently being used. Eg, changing to water-based paints.
- **Changing form** — sometimes a chemical can be purchased in a different form which decreases the exposure risk. Eg, purchasing a paste rather than a powder to reduce hazardous dusts.
- **Dilution** — purchasing a lower concentration or diluting the chemical can be an effective substitution control.

Limitations of substitution controls

Substitution controls merely exchange or transfer the risk, the hazard still exists. New policies and working procedures will need to be issued, training sessions will need to be scheduled, and the work area monitored for unforeseen impacts or new hazards.

Isolation controls

Risk controls that put distance between chemicals and workers

Isolation controls use distance, barriers, and physical enclosures to keep workers (and incompatible substances) away from the chemicals. Some isolation controls are required by Australian Standards (eg, keeping a distance of at least 5 metres between flammable and toxic gases).

Examples of isolation controls include:

- **Chemical stores** — locating flammable liquids stores and **gas bottle cages outside** and away from work operations, vegetation, and refuse. Then restricting access to these areas.
- **Safety cabinets** — keeping chemicals in dedicated safety cabinets manufactured according to their hazard class. Even though cabinets are still accessed by staff the exposure time is reduced and the chemicals are in a stable environment.
- **Closed systems** — handling volatile and extremely hazardous substances in sealed glove boxes.
- **Chemical segregation** — minimising fire, explosion and reactive hazards by segregating incompatible substances and materials. This can be achieved through physical distance or installing screens and barrier walls between chemicals of different hazard classes.
- **Barriers** — physical barriers can be used to protect chemical stores from unauthorised access or damage. Barriers include bump rails to protect a chemical store from forklift impact, or a lockable gate and fence around a gas bottle store.

Limitations of isolation controls

Isolation controls reduce the amount of the people exposed to the chemicals, but the hazard still exists. At some point gloves boxes and enclosures will require maintenance and cleaning, while segregated **chemical stores** are still accessed by workers and contractors. As with all risk control measures, isolation controls must be supported by consistent procedures and supervision.

Engineering controls

Risk controls that physically change the workplace

Engineering controls utilise machinery, mechanical devices and structural changes to job areas to reduce the impact of a hazard.
Here at **STOREMASTA** we specialise in manufacturing **chemical safety cabinets** which are both engineering and isolation controls.

Other engineering controls include:

- **Decanting stations** — can be as simple as a drum dolly with a lid, as well as a fully enclosed lubrication system that pumps lubricants and combustible liquids to multiple locations around a factory.
- **Mechanical lifting devices** — include gas bottle trolleys and forklifts that secure and restrain compressed gas cylinders while being unloaded or in use.
- **Process automation** — robots offer a safer alternative to many chemical-based processes eg, spray painting.
- **Process changes** — can create safer working conditions. Eg, decreasing the temperature during some manufacturing processing can reduce chemical vapour emissions, while wet cleaning methods (rather than dry sweeping) can reduce dust and other air-borne contaminants.
- **Local Exhaust Ventilation (LEV) systems** — extract air-borne contaminants (eg, wood dust) before they reach the breathing zone of workers.
- **Mechanical ventilation** — is often required in confined spaces and chemical stores.
  The equipment require the installation of ducting, exhaust fans, and exposure alarms.

Limitations of engineering controls

Engineering controls rely on an effective risk assessment being conducted before implementation. Machinery and equipment should never be purchased without considering essential factors like chemical quantities, exposure times, local climate, power supply, and available raw materials as well as who will be carrying out the installation. Engineering controls can fail when a machine is not correctly sized for the task, or is installed incorrectly.

All hazard control measures rely on worker participation and mechanical devices, machinery and tools all require workers to carry out ongoing maintenance. The failure of engineering controls is also linked to operator error - influenced by fatigue, distraction, lack of training, and insufficient supervision.

Administrative controls ~ a worker has to do something

Risk controls based on a worker having to do something

Administrative controls are the policies, procedures and training that direct workers and contractors at the job site. They support substitution, isolation, engineering, and PPE controls and even the risk management process itself.

They include:

- **Policies and site rules** — defining restricted areas (chemical stores), prohibited activities (smoking, electronics), visitor entry (login and temporary ID), mandatory PPE (masks).
- **Safe work procedures** — having consistent procedures for individual job tasks that are periodically reviewed and updated.
- **Induction and training** — providing regular training to ensure workers understand chemical hazards, how to undertake job tasks safely, as well as use PPE and other tools.
- **Rostering and supervision** — rotating rosters to minimise long term exposure to chemicals, observing staff while they handle chemicals, then enforcing policies and safe work procedures.
- **Inspections, auditing and maintenance** - designing and using inspection checklists, carrying out safety checks, and calibrating essential equipment and machinery.
- **Supply chain** — reducing chemical orders, having suppliers collect empty containers and waste more frequently.
- **Housekeeping** — ensuring chemical storage and handling areas are kept neat, clean and correctly segregated.
- **Personal hygiene** — having workers wash their hands after using chemicals and not allowing personal items (food, clothing, cosmetics, medication etc) into work areas.

Limitations of Administrative controls

Administrative controls on their own are never a reliable way to control chemical hazards. While they look great on paper, they rely on workers to carry them out, supervisors to enforce them, and managers to review them. They work best when supporting other control measures.

Personal Protective Equipment (PPE) controls

Risk controls based on a worker having to wear something

PPE is the equipment and protective clothing worn while using or handling chemicals. It ranges from full coverage gear that completely separates the body and respiratory system from the chemicals — to chemical resistant clothing and guards — to disposable aprons and coveralls that offer simple splash protection.

Selecting PPE is not as simple as consulting the chemical's Safety Data Sheet (SDS) as considerations have to be made for the way the chemical is being used at your job site and the personal needs of individual workers.

Your selection should be based on:

- **Hazard class, chemical properties, and form of the substance** — eg, a highly corrosive chemical that is incompatible with metals and in liquid form might require clothing with no metal studs, chemical resistant gloves that are elbow length, and coverall pulled down over boots to prevent any hazardous liquid spilling inside.
- **Job being undertaken** — eg, if you are handling a large quantity of chemicals for a long period of time your may need to pre-test chemical gloves for safe exposure times.
- **Consultation with workers** — eg, a worker who requires prescription glasses may find it difficult to work while wearing chemical resistant goggles.
- Fitting out individuals — eg, workers are more likely to wear PPE if it is comfortable to wear and fits properly.
- **Maintenance** — eg, consider the durability of the PPE and who will be cleaning and maintaining each item.
- **Storage** — eg, **storing PPE in a dedicated cabinet** that is easily accessible before and after a shift makes it easier for workers to follow safe work procedures. Sometimes workers won't wear their PPE if they feel it takes too long to suit-up.

Limitations of PPE controls

As a control measure, PPE is problematic in two key areas. First PPE does nothing to reduce the actual chemical hazard, it merely provides a temporary barrier between a hazardous substance and a worker. If the PPE is forgotten, doesn't fit properly, or damaged the worker is left without any exposure protection.

The second problem is the effectiveness of PPE relies exclusively on human behaviour. Without proper training and supervision, PPE can actually create more problems than it solves if workers mistakenly believe they are fully protected when actually the chemical hazard still exists.

REMEMBER: *PPE controls must be implemented along with administrative controls which direct the selection, fitting, use, maintenance, storage, and replacement of individual items of PPE.*

12 Compliance controls

Controlling chemical hazards is never a single action or an isolated effort — to be 100% chemical safety compliant a risk management approach is essential. By risk management approach we mean implementing a holistic system that ensures all chemical hazards are identified, then assessed, eliminated or controlled. This system also has review mechanisms.

WHS legislation

WHS Regulations (current in your state or territory)
Explosives Regulations (current in your state or territory)
Australian Dangerous Goods Code (ADG Code)

Australian Standards

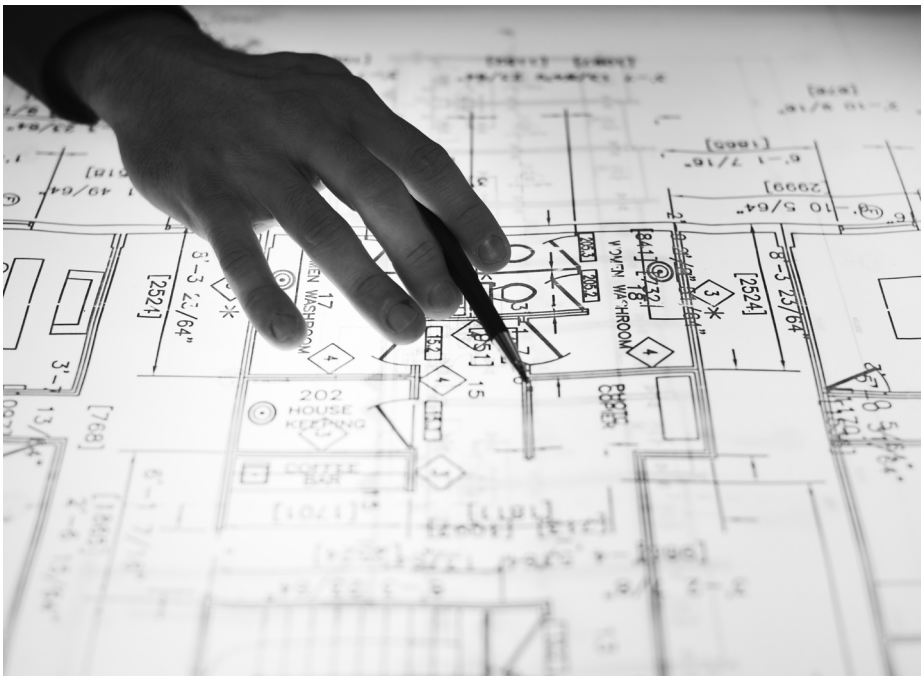
AS1940:2017 — The storage and handling of flammable and combustible liquids
AS2714:2008 — The storage and handling of organic peroxides
AS3780:2008 — The storage and handling of corrosive substances
AS4326:2008 — The storage and handling of oxidizing agents
AS4332:2004 — The storage and handling of gases in cylinders
AS4452:1997 — The storage and handling of toxic substances
AS5026:2012 — The storage and handling of Class 4 dangerous goods

Codes of Practice

Model Code of Practice: Welding processes
Model Code of Practice: Spray painting and powder coating
Model Code of Practice: How to manage and control asbestos in the workplace

The above lists are not exhaustive so always check with the WHS Regulator in your state or territory. We always recommend consulting with an external consultant who specialises in Hazardous Chemicals and Dangerous Goods to help you implement compliance controls.

13 Choosing the right control measures



Choosing control measures can seem overwhelming, especially if you have a lot of chemical hazards. But if you follow the risk management methodology we presented in Section 1 and carry out a risk assessment, you will already have a priority list.

Without a risk assessment we can't tell you which are the best controls because each job site is unique. Chemical controls will always be influenced by the:

- Physical properties and hazard class of the chemicals
- Quantities kept onsite
- Way the chemicals are used or handled
- Profile of your workers
- Geographical location of the job site

IMPORTANT: *When implementing chemical controls you may need to introduce temporary measures while installing new equipment or carrying out workplace renovations. Eg, wearing additional PPE while a fume hood is being installed.*

14 Maintaining chemical controls

Once you've implemented chemical controls you have a legal obligation (under Section 37 of the WHS Regulations) to ensure that each **control measure remains effective**.

To fulfil this obligation you should:

- Carry out initial testing to verify the control measure is installed, setup, and being used correctly.
- Conduct a follow-up risk assessment to ensure the control measure is fit for purpose and suitable for the nature and duration of the work. This risk assessment will also determine if any new hazards have emerged.

15 Next steps

Now you have an understanding of the process required to control chemical risks and hazards we recommend the following actions:

Carry out a risk assessment

Conduct a full risk assessment to systematically identify chemical hazards and evaluate the level of risk to your business. This includes all the areas where chemicals are received, transferred, used, generated, discarded, or stored.

Review your existing control measures

Inspect, audit and test the chemical control measures you already have in place to ensure they are fit for the purpose and actually working. Most especially your chemical stores.

Consult Dangerous Goods specialists

Get in touch with the expert team of auditors at STOREMASTA who combine their legislative and compliance knowledge with genuine field experience. We can help you evaluate your chemical storage, decanting and transfer controls as well as the suitability of your emergency decontamination equipment.

Contact STOREMASTA by:

- Heading over to our website **www.storemasta.com.au**
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