WHS Guidelines – Working with Chemicals

1. Scope

These guidelines are applicable to all environments where chemicals are used. The purpose of this document is to detail minimum requirements for working with chemicals, to list common hazards and mitigation strategies and to provide information to assist personnel when conducting risk assessments and developing proper and safe procedures and appropriate documentation.

2. Introduction

When conducting risk management activities, managers and WHS delegates should:

- Ensure that minimum requirements are in place
- Using the hazard summary table below and their experience and expertise, identify any other hazards in the environment and implement appropriate mitigation strategies

3. Definitions

Chemicals are classified in many different ways. Due to their hazardous nature priority is given to managing the risks associated with chemicals that fall into the following overlapping categories: hazardous substances, dangerous goods and scheduled poisons (see this link for definitions).

4. Minimum Requirements

- In each environment, the procurement and management of chemicals must be controlled by a person who has either completed the University's course in chemical safety or has thoroughly read and understood the University's guidelines on this subject.

5. Hazard Summary Table

Hazard	Possible consequences	Mitigation Options
Exposure to harmful substance (inhalation, absorption or ingestion)	Poisoning, burns, eye, skin and respiratory irritation, headaches and dizziness	– Substitute with a less hazardous alternative – Limit the volume of chemicals – Read and understand MSDS sheets – Develop safe working procedures – Provide training to users – Wear appropriate protective clothing including gloves, goggles and respirators

		– Use a fume hood or local exhaust to improve ventilation – Install area monitoring devices – Install eye-wash stations and emergency showers – Avoid using chemicals where food is consumed – Wash hands after handling chemicals – Only use correctly labelled chemicals
Fire & Explosion	Burns, projectile injuries	– Ensure chemicals are properly stored – Avoid ignition sources – Segregate incompatible chemicals as per the MSDS sheet – Store minimal quantities of chemicals – Provide training to users – Have emergency plans in place – Have fire fighting equipment nearby – Only use correctly labelled chemicals

6. Hazard Descriptions

Exposure

(a) Absorption

The simplest way for chemicals to enter the body is through direct contact with the skin or eyes. Skin contact with a chemical may result in a local reaction, such as a burn or rash, or absorption into the bloodstream. Absorption into the bloodstream may then allow the chemical to cause toxic effects on other parts of the body. The MSDS usually includes information regarding whether or not skin absorption is a significant route of exposure.

Wear gloves and other protective clothing to minimize skin exposure. Symptoms of skin exposure include dry, whitened skin, redness and swelling, rashes or blisters, and itching. In the event of chemical contact on skin, rinse the affected area with water for at least 15 minutes, removing clothing while rinsing, if necessary. Seek medical attention if symptoms persist.

Avoid use of solvents for washing skin. They remove the natural protective oils from the skin and can cause irritation and inflammation. In some cases, washing with a solvent may facilitate absorption of a toxic chemical.

Chemical contact with eyes can be particularly dangerous, resulting in painful injury or loss of sight. Wearing safety goggles or a face shield can reduce the risk of eye contact. Eyes that have been in contact with chemicals should be rinsed immediately with water continuously for at least 15 minutes. Contact lenses should be removed while rinsing—do not delay rinsing to remove the lenses. Medical attention is necessary if symptoms persist.

(b) Inhalation

The respiratory tract is the most common route of entry for gases, vapors, particles, and aerosols (smoke, mists and and fumes). These materials may be transported into the lungs and exert localized effects, or be absorbed into the bloodstream. Factors that influence the absorption of these materials may include the vapor pressure of the material, solubility, particle size, its concentration in the inhaled air, and the chemical properties of the material. The vapor pressure is an indicator of how quickly a substance evaporates into the air and how high the concentration in air can become – higher concentrations in air cause greater exposure in the lungs and greater absorption in the bloodstream.

Most chemicals have an odor that is perceptible at a certain concentration, referred to as the odor threshold; however, there is no relationship between odor and toxicity. There is considerable individual variability in the perception of odor. Olfactory fatigue may occur when exposed to high concentrations or after prolonged exposure to some substances. This may cause the odor to seem to diminish or disappear, while the danger of overexposure remains.

Symptoms of over-exposure may include headaches, increased mucus production, and eye, nose and throat irritation. Narcotic effects, including confusion, dizziness, drowsiness, or collapse, may result from exposure to some substances, particularly many solvents. In the event of exposure, close containers or otherwise increase ventilation, and move to fresh air. If symptoms persist, seek medical attention.

Volatile hazardous materials should be used in a well-ventilated area, preferably a fume hood, to reduce the potential of exposure. Occasionally, ventilation may not be adequate and a fume hood may not be practical, necessitating the use of a respirator.

(c) Ingestion

The gastrointestinal tract is another possible route of entry for toxic substances. Although direct ingestion of a laboratory chemical is unlikely, exposure may occur as a result of ingesting contaminated food or beverages, touching the mouth with contaminated fingers, or swallowing inhaled particles which have been cleared from the respiratory system. The possibility of exposure by this route may be reduced by not eating, drinking, smoking, or storing food in the laboratory, and by washing hands thoroughly after working with chemicals, even when gloves were worn.

(d) Injection

The final possible route of exposure to chemicals is by injection. Injection effectively bypasses the protection provided by intact skin and provides direct access to the bloodstream, thus, to internal organ systems. Injection may occur through mishaps with syringe needles, when handling animals, or through accidents with pipettes, broken glassware or other sharp objects that have been contaminated with toxic substances.

If injection has occurred, wash the area with soap and water and seek medical attention, if necessary. Cautious use of any sharp object is always important. Substituting cannulas for syringes and wearing gloves may also reduce the possibility of injection.

(e) Labelling

Having correctly labelled containers reduces the risk of accidental exposure to harmful substances and/or unexpected reactions. If a chemical is decanted from a manufacturer's container to another container the following information must be included on the label:

- Hazard warning words or symbols (eg. HAZARDOUS)
- Ingredients, including concentrations – provide the full name not just the chemical formula
- Risk and safety phrases
- Name of the person who decanted the substance or prepared the solution
- The date that the substances was decanted or prepared.

Fire & Explosion

Flammable and combustible liquids vaporize and form flammable mixtures with air when in open containers, when leaks occur, or when heated. Information on the properties of a specific liquid can be found in that liquid's material safety data sheet (MSDS), or other reference material.

(a) Storage

Minimising quantities of chemicals will reduce the risk and severity of fire and explosion. Small volumes of hazardous substances and dangerous goods are permitted to be used and stored in the open laboratory, clinic or workshop - provided that the volumes match day-to-day usage. Hazardous substances or dangerous goods that are used infrequently must be stored in a dedicated storage area (eg. a labeled laboratory cupboard). Larger quantities of dangerous goods (> 10 L or 10 Kg) must be stored in Australian Standard compliant chemical storage cabinets or outside of the work area in a purpose built dangerous goods depot.

(b) Incompatible chemicals

Incompatible chemicals should not be stored together. Storing chemicals alphabetically, without regard to compatibility, can increase the risk of a hazardous reaction, especially in the event of container breakage. There are several resources available online as well as the manufacture's MSDS sheet that detail incompatible chemcials.

The recommended methodology for sorting chemicals within the work area includes:

- Separate the liquids and solids
- Group the chemicals by chemical classification e.g. non-hazardous, hazardous substance only, dangerous goods
- Segregate dangerous goods by class e.g. Class 3 Flammable Liquids, Class 6.1 Toxic Substances, Class 8 Corrosive Substances
- Store large quantities of dangerous goods in Australian Standard compliant chemical storage cabinets e.g. 25 L of flammable liquids in a small Class 3 flammable liquid cabinet
- Store smaller quantities of dangerous goods in laboratory cupboards or on shelving with solids positioned above liquids and the different dangerous goods classes segregated using a separate laboratory cupboards for each class or by using separate plastic spill trays or tubs
- Check the incompatibility of common substances to identify any possible problems within dangerous goods classes (eg. acids and alkalis) and further segregate chemical as required
- Non-hazardous chemicals and hazardous substances that are not dangerous goods can generally be stored together and sorted alphabetically.

Use common sense when setting up chemical storage. Segregation that disrupts normal workflow can increase the potential for spills.