# CHEMICAL SPILLS

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# 1 INTRODUCTION

A chemical spill is an uncontrolled event which can potentially result in harmful exposure to a hazardous chemical and damage to the environment. Effective planning and response can minimize the impact of a chemical spill.

# 2 PURPOSE

This guideline has been developed to support the University's Chemical Safety Standards. Faculties, schools, research groups and professional services units are encouraged to use this document as a primary reference when developing local procedures to manage chemical spills.

# 3 PREVENTION

The following preventative actions may reduce the extent of a chemical spill and its impact:

- Purchase and use minimal volumes,
- Use secondary containment for the storage and transporting of chemicals e.g. bunding, drip trays or raised edges,
- Store large volumes in an approved chemical storage cabinet or purpose built Dangerous Goods (DG) depots,
- Regularly review the integrity of stored containers and chemicals.

## 3.1 CHEMICAL TRANSPORT

When transporting chemicals between laboratories, particularly liquids, secondary containment should be used to prevent or minimise the impact of a spill. Secondary containment is when a primary container is placed inside a second container. The outer container is leak proof and may be capped or sealed. Bottle carriers should be used for transport of 'Winchester' bottles containing solvents or acids.

# 4 PLANNING

Spill management and response strategies should be included in laboratory emergency planning. Staff and students using a hazardous chemical must be familiar with appropriate spill response procedures prior to commencing work. The relevant Safety Data Sheet (SDS) for a chemical should be checked for specific advice; clean-up and disposal procedures; and compatibility information.

Staff and students should be trained in spill procedures so that rapid and accurate response for a minor or major spill can be undertaken. A quick response by workers to a chemical spill is likely to limit the consequences.

A generic laboratory *spill management procedure* identifies likely minor spills in the laboratory and details the trigger for seeking external assistance in the event of a major spill. A Spill Management Procedure may be placed within the spill kit.

## 4.1 HIGH RISK ACTIVITIES

High risk activities using hazardous chemicals require a *specific emergency plan* which must include information on how to stop work quickly and respond to spills or an uncontrolled release. These processes must be detailed in a documented Safe Work Procedure.

Some hazardous chemicals, such as mercury, bromine, hydrofluoric acid or alkali metals (e.g. sodium and potassium) require very specific spill response and written emergency spill procedures to detail this spill response. All workers handling high risk chemicals must be trained in correct spills response procedures.

When preparing an emergency procedure for the use of a hazardous chemical, consider:

- Health and physicochemical hazards of the chemical
- Quantity of chemical handled
- Location of a potential spill
- Immediate danger to people
- Medical or first aid requirements in the event of an exposure
- Effective containment and clean up
- Appropriate disposal of waste material

## 4.2 CHEMICAL SPILLS KIT

Chemical spill kits must be available in laboratories where significant quantities of chemicals are handled and in Dangerous Goods stores where chemicals are stored. A chemical spill kit must include containment and clean-up materials appropriate to the type and quantity of chemicals within the work area. Chemical spills kits can be bought commercially or self-assembled.

A spills kit must be clearly labelled, visible and located in an easily accessible position. All workers within the area must be aware of its location and be trained in the use of the spills kit.

The contents of a spills kit should be reviewed during workplace inspections. If items are used from the spills kit, arrangements should be made for immediate replacement. A general purpose chemical spills kit should include:

- **Barrier/Boom** –Absorbent Boom (or 'sausages') can contain a large spill and should be used to stop material entering drains
- **Absorbent pad or wipe** – These are specifically designed for hazardous chemicals, made from inert, synthetic or natural materials, and are available commercially (Figure 2)
- **Neutralisation reagents** - sodium bicarbonate (acids) or boric acid (alkalis)
- **Gloves** – Gloves appropriate for the chemicals used in the lab (disposable neoprene or nitrile)
- **Specific PPE** for the chemicals used - ( e.g dust mask, respirator, face shield)
- **Waste Containers/Bags** in which to store waste and contaminated materials
- **Warning signs** (Appendix A)

**Figure 2: Hazardous chemical absorbent pad**

### 4.2.1 Vermiculite

Vermiculite is a hydrous silicate material which has been used to absorb both organic and aqueous material. It is a lightweight, non-reactive, inert material that will absorb up to ten times its own weight in water. However it can create dust, can be difficult to sweep up after use and will require a plastic dustpan and brush to clean up. Commercially available absorbent pads or booms designed for hazardous materials may be preferable.

### 4.2.2 Neutralisation

Neutralisation for very large spills is not practical. In these cases absorbents (booms or pads) should be used to remove the bulk of the spilt material before neutralising any residual material in the spill area. The wet slurry which remains may need to be collected by an absorbent wipe or dust pan and brush, or if the product is harmless may be washed away by flushing with water.

Small amounts of acid and alkalis can be neutralised to produce a safer product.

- Acids can be neutralised by soda ash ($Na_2CO_3$), sodium bicarbonate ($NaHCO_3$), calcium carbonate ($CaCO_3$).
- Alkalis can be neutralised by citric acid, boric acid or sodium bisulphate.

However the amount of neutralising reagent to use can be difficult to determine, although pH paper or the absence of fizzing (if using sodium bicarbonate) can help to determine complete neutralisation. The neutralisation reaction also generates heat. If heat is generated too rapidly splattering of chemicals can occur. Solid neutralising agents should be added cautiously and slowly by sprinkling over the spill. A P1 mask can be used to avoid breathing any solid or powder material.

Biological Spills kits may contain bleach or hospital-grade disinfectant. Please refer to Biosafety guidelines.

### 4.2.3 Specific requirements

It is important to ensure that a spill kit contains the materials suitable for the chemicals that are being used within the laboratory and that workers are trained in any required specific procedures. For example a bromine spill may require the use of sodium thiosulphate; alkali metals would NOT involve the use of water. A specific mercury spills kit is recommended when elemental mercury is used within the laboratory.

## 5 RESPONSE

## 5.1 INITIAL RESPONSE

An initial spill response is:

1. **Warn others** of immediate danger.
2. If safe to do so, **control the source** of release or contain the spill. Otherwise move away from the source. Be aware that fumes may pose an immediate risk.
3. **Evacuate and secure** the immediate area.
4. **Determine if local and/or emergency services** assistance is required.

All workers should wear appropriate personal protective equipment (PPE) when attending to a chemical spill (refer 5.4). This can be added to the spill kit.

Undertake risk assessment to determine if a spill is low or high risk and for the appropriate response actions to be undertaken. Considerations in determining the risk posed by a spill include the:

- **Hazard** of chemical e.g. flammable, toxic, corrosive, gas, liquid, solid
- **Quantity** of spill e.g. 5 mL, 50 mL, 500 mL, 5 L or 50 L
- **Location** of spill e.g. inside lab., outside lab., floor, bench, fume –cupboard, stairwell

As a guide, if any of the following apply, the spill should be considered as high risk.

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|---|---|
| **Hazard** | If the situation presents an immediate threat to human health or safety or the environment; is unknown, or is an immediate fire hazard such as an uncontrolled gas leak. |
| **Quantity** | More than 2 litres of a volatile, flammable solvent, concentrated corrosive liquid (acid or base) or 100 g of a highly reactive solid.<br>Note: some chemicals that are GHS Category 1 chemicals or **DG** packing group 1 may require response at lower quantities e.g. mercury or 40% hydrofluoric acid, evacuation should be considered at much lower volumes ie < 100mL or 100 g |
| **Location** | If the chemical is outside of the laboratory or outside of the area where the material is normally used, or in a public area. |

A spill can be dealt with locally or in some instances an external response and assistance from emergency services will be required (refer to Figure 1 – Spills response decision making flowchart).

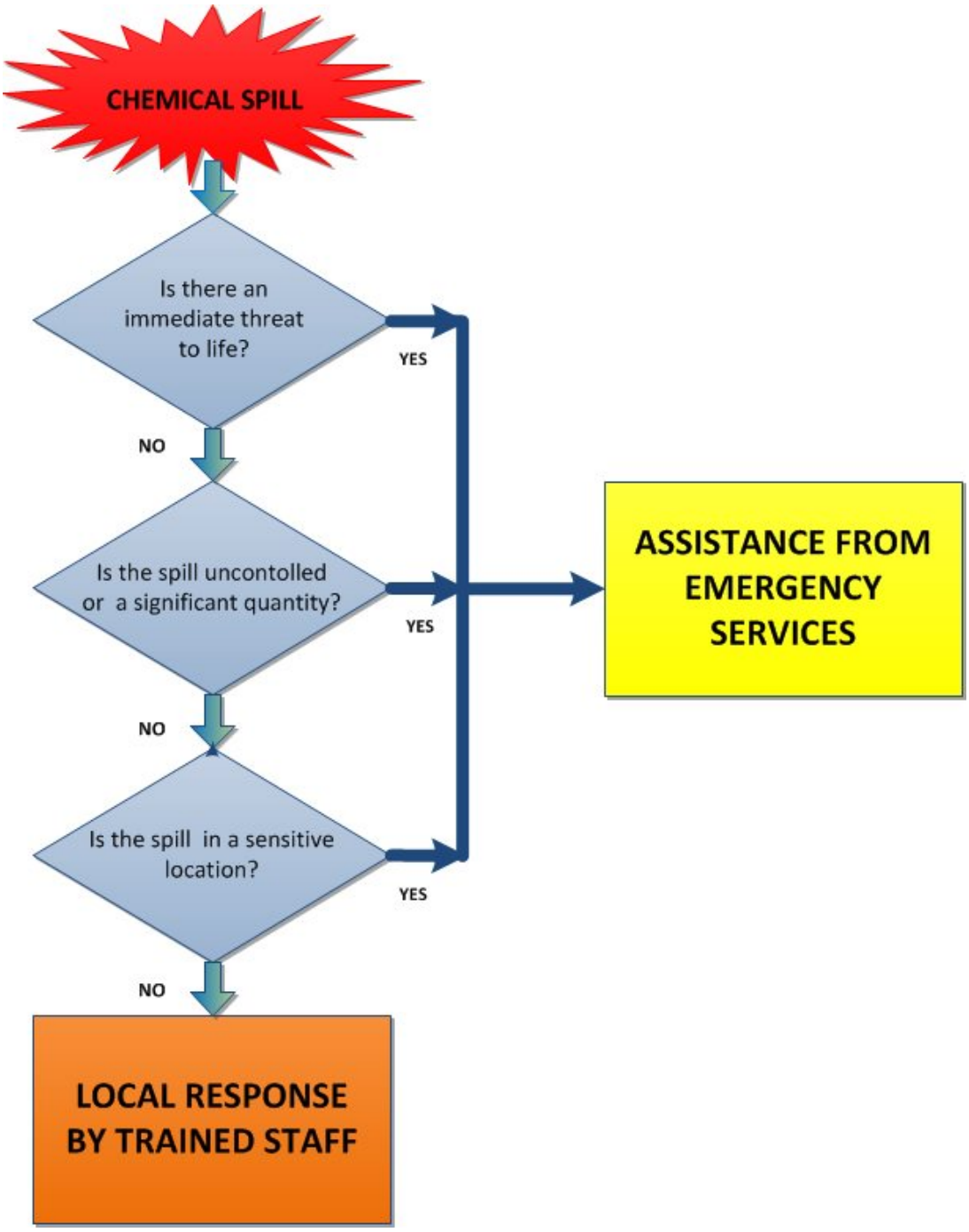


**Figure 1: Spills response decision-making flowchart**

A high risk chemical spill will usually result in the immediate evacuation of the area, if not the entire building. For example: A 2.5 L container of concentrated nitric acid dropping onto the floor would require evacuation of a laboratory. The consequence of breathing nitric acid fumes is severe and the volume is large representing a high risk to persons in the laboratory area.

A low risk chemical spill is one that experienced workers can clean up easily. For example: a spill of 5ml of concentrated sulphuric acid in a fume cupboard. Although the risk from concentrated acid is high, it is only a small volume that is contained within a fume cupboard and can be cleaned up using absorbent chemical wipes.

## 5.2 EMERGENCY SPILL RESPONSE

1. **Evacuate the area** immediately if there is an immediate threat of fire, explosion or risk to health. If possible, as you leave, close doors to prevent further spread or contamination and turn off any ignition sources if a flammable material is involved. Emergency stop buttons are available in some laboratories which will shut the power down to the area. Removing ignition sources in this way can prevent a fire.
2. **Isolate and control access** to the spill area. Do not allow non-essential workers to enter the spill area**.**

If the emergency services are required:

3. **Raise the alarm**

   Notify Emergency Services directly on **Triple Zero (000**) and University Security (**9351-3333)**

4. **Identify the people, chemical/s and hazards involved.**

Where possible, provide the following information:

- Name and telephone number of caller,
- Building and room number of the incident,
- Name and type of material,
- Known hazard of the material,
- Amount of material spilled,
- Explanation of what happened,
- Condition of any injured personnel,
- Status of area

Ensure staff/students involved in the incident are available to assist the Emergency Services. Physical and chemical properties of a chemical can be found on the SDS or label. It may be possible to delegate another person to source the SDS while the alarm is being raised.

5. **Apply first aid** and treat contaminated individuals as per the SDS.

If required, summon a First Aid Officer, or ambulance. Isolate affected persons and keep on site. Continually reassess the situation and modify response accordingly. In general the following prompt action should be taken for direct exposure:

- Remove a casualty to fresh air,
- Remove contaminated clothing and shoes immediately,
- In case of contact with chemical, **immediately** flush skin and eyes with running water for at least 15 minutes using eyewash and/or safety shower,
- Use safety shower if necessary,
- Obtain immediate medical assistance,
- Keep casualty warm and quiet.

Note in some cases, effects of exposure (inhalation, ingestion or skin contact) to a substance may be delayed, for example lower concentrations of hydrofluoric acid.

6. **Get further assistance**
   - Alert local contacts (Laboratory Manager, Safety Officer, Supervisor or nearest Fire Warden).
   - Contact Safety Health and Wellbeing (935**1-5555**) if the Emergency Services have been called.

## 5.3 LOCAL SPILL RESPONSE

If a significant spill can be managed locally:

1. **Immediately notify others in the area of the spill**. Corridors and pathways have a lot of foot traffic so it is important to alert passers-by of the spill and ensure the area is kept free of traffic.

2. **Identify the chemical**/s and hazards involved (SDS, label) and use the information on the physical and chemical properties of the material.

3. **Ensure that two trained staff are allocated to clean-up the spill**

A clean-up procedure of a significant spill should never be completed by one person. There must be at least two people, who have been trained in spill response:

- One person to clean up the spill, and
- A second person to observe and assist by handing spill containment material to the person cleaning up. This person should not have direct contact with the spilt chemical.

4. **Wear correct PPE** to respond to the spill. Do not touch any hazardous chemical or surfaces in the spill area without wearing appropriate PPE. Avoid breathing vapours from the spill. If there are vapours emitting from a spill it may be necessary to use a respirator (refer 5.4).

4. **Clean up spilt material.**

    a. Ventilate if gases or fumes are released. Open windows or place the fume cupboard on boost ventilation, if possible. An area may need to be closed off until ventilation is complete.

    b. Absorb liquids. Hazardous chemical pads, booms or wipes, appropriate for the chemical, can be used. Place pads around the perimeter of the spill area first and then work towards the centre to clean up the spill.

    c. Collect solids. A small dust pan and brush could be used for solid material. If dust is generated a single use, disposable P2 face mask should be worn. For very small particles (e.g. nanoparticles) these masks should not be worn as they are ineffective.

5. **Decontaminate** the affected area, equipment and clothing.

    a. **Neutralise** any remaining acids / alkalis when the bulk of material has been absorbed. For large volumes it is not feasible to use a neutralising reagent as large amounts will be required and substantial heat is generated. Dilute neutralising solutions can be useful for decontaminating the area after the spilt material has been removed (see 5.6.2).

6. **Dispose** of contaminated spill material in a sealed and labelled container designated for waste disposal through the University hazardous waste program.

7. **Review the surrounding area** when decontamination is complete. Check walkways, floors, stairs, and equipment for damage. Replenish any items used in the spills kits. Report the incident using Riskware.

Very small spills on a bench, balance or in a fume cupboard etc, must be cleaned up promptly and thoroughly to prevent contamination.

### 5.3.1 Flammable or toxic vapour

If flammable material is involved, ensure there are no ignition sources in the possible hazard zone of the vapour. In general, flammable vapour will have greater density than air and be concentrated around the floor or spill area.

If an item or material has been contaminated with a volatile flammable liquid, it is advisable to place the item in a fume cupboard, until the liquid has evaporated.

If toxic vapour is present the area must be vacated until concentrations are below exposure standards. Refer to the safety data sheet.

### 5.3.2 Unknown hazards

If you are uncertain of the origin or identity of the chemical spill, approach with care-:

- Never assume the chemical is harmless,
- Many harmful chemicals are colourless and/or odourless,
- Do not touch or walk through a spill area,
- Do not touch damaged containers, packages or spilled material unless wearing appropriate PPE.

## 5.4 PERSONAL PROTECTIVE EQUIPMENT

In general the PPE required for spill response is the same as that for laboratory work involving hazardous chemicals:

- Eye and face protection – Safety Glasses, Goggles or Face shield
- Gloves – nitrile, neoprene (or as appropriate for the spilt chemical)
- Fully enclosed, chemical resistant footwear – plastic vinyl booties may also be useful
- Labcoat
- Dust mask P1 ( only for solid material) else use P2 or appropriate respirator

Additional protection from fumes and vapours may be provided by an appropriate respirator. The need for a respirator will depend on the chemical hazard and volume of spilt material. Respirators should be full-face and have a universal cartridge that will protect from corrosive gas, toxic gas, organic solvents, chlorinated solvents, dusts, mists and fumes. Respirator must fit well (i.e be fit-tested to the user) to be effective.

Cartridges for respirators generally have a limited shelf life from the date of manufacture, if stored undamaged in original packaging. When respirators are removed from their packaging, the life span is reduced to six months. Always place a date on a respirator cartridge when the package is opened. Checking the use-by date of respirator cartridges should be part of a regular laboratory maintenance or workplace inspection program.

Self-contained breathing apparatus (SCBA) are used by the emergency services where hazardous atmospheres may be present. These apparatus should only be used by trained and competent personnel.

## 5.5 DECONTAMINATION AND DISPOSAL

Dispose of clean-up materials in appropriate waste bags or plastic buckets. These containers must be compatible with the spilled chemical. Contaminated equipment and clothing must be de-contaminated where possible. Items that cannot be decontaminated should be disposed of as hazardous waste.

Label the spills waste container with a hazardous waste label, seal and store in a suitable place and organise for disposal on the next chemical waste collection day. For further information refer to the Hazardous Waste Program.

### 5.6 HAZARD AND INCIDENT REPORTING

All spills which are hazardous with the potential to cause injury or have caused an injury must be reported on Riskware.

## 6 REVIEW AND EVALUATION

Performance standards and the associated procedures and guidelines will be reviewed by Safety Health & Wellbeing at least once every two years to identify and implement opportunities for improvement.

## 7 REFERENCES

1. AS/NZS 2243.2:2006 Safety in laboratories - Chemical aspects
2. SAA/SNZ HB76:2010 Dangerous Goods -Initial Emergency Response Guide

## 8 DOCUMENT CONTROL

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|---|---|
| **Acknowledgements** | . |
| **Related Documents** | WHS_CHE_STD_1_Chemical Safety Standards<br>University of Sydney Hazardous Waste Program<br>University of Sydney Emergency Management Procedures |

| Version Control | Date released | Author/s | Custodian | Approved by | Amendment |
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## APPENDIX A – CHEMICAL SPILL WARNING PLACARD