Chemical Risk Management Protocol

Safe Methods of Use (SMOU)

Reactions in Sealed Pressure Vessels

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1 Purpose

This Safe Method of Use (SMOU) applies to principal investigators (PIs), laboratory managers, designated laboratory person (DLPs), and all staff and students who direct or participate in the use of chemical reactions conducted in a sealed pressure-rated vessel, at the University of Auckland.

2 Disclaimer

This SMOU should be used as guidance to inform a risk assessment that considers all aspects and potential hazards related to the use of the chemical. **Please read this SMOU in conjunction with the Chemical Risk Management Guidelines.**

Note: 'Shall' denotes a mandatory requirement and 'should' denotes a recommendation.

3 General Guidelines for reactions conducted in a sealed vessel

1. Reactions carried out in a sealed vessel have the potential to explode if the vessel fails under pressure.
2. Risk is higher with increasing temperatures and therefore internal pressure. Reaction vessels must only be manipulated or opened after cooling to rt.
3. Ensure there are no unnecessary flammable/reactive solvents/materials in the fume cupboard when carrying out a reaction in a sealed vessel.
4. Unattended experiments must be clearly labelled to identify possible hazards and steps to take in case of an incident.
5. Protective barriers shall be used:

- Blast shields can be moved into the fume cupboard for the duration of the experiment. Refer to Figure 1 for an example of correct blast shield set up.
- Fume hood sashes are designed to be lowered to provide a physical barrier between reaction in the fume hood and laboratory personnel. They must be

lowered to the fullest extent possible while sealed tube reactions are being carried out.

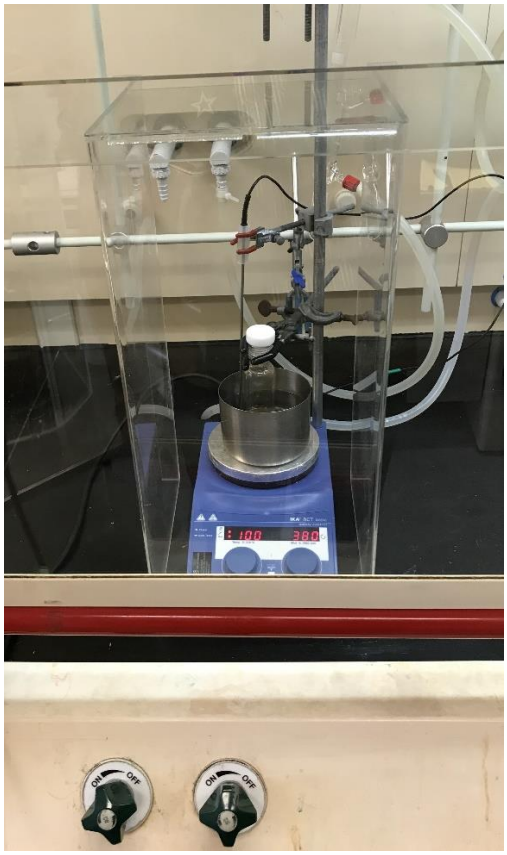

Figure 1: Ideal use and set up of a blast shield. Note that the combination of fully lowered fume hood sash and blast shield assist in containing any potential explosion.

4 Sealed Pressure Vessels

The risk in using a sealed pressure vessels is that pressure cannot be safely released. Therefore, any weak points in the vessel are liable to break under pressure.

- Inspect glassware for any damage prior to use, and discard any damaged vessels.
- The caps should not be overtightened as this will put pressure on the glass.
- The reaction vessel should only be filled to 50% of capacity; ideally ¼ to ⅓ full.

- Blast shields should be used whenever sealed reaction vessels are used, and must be used whenever sealed reaction vessels are heated.

Note that vessels with a screw-top seal as pictured in Figure 2 must not be used as sealed pressure reactors. There is a weak point where the glass narrows below the seal, which is liable to explode under pressure. These vessels should only be used as storage vessels or in low- or room- temperature inert chemistry applications. Example pressure vessels that can be used are shown in Figure 3; ensure you follow the manufacturer's instructions.

Figure 2: Example of a sealed reaction vessel that is NOT suitable for pressurised reactions.

Figure 3: Example of sealed reaction vessels suitable for pressurised reactions.

5 PPE

- Laboratory workers (Student/Staff) shall wear and have access to full face shields when;
  - blast shields have to be removed to manipulate glassware that has not cooled to room temperature
  - the Lab worker's face may be exposed to an explosion from a sealed reaction vessel even with a blast shield in place.
- If a full face mask is used, safety glasses shall be worn as well.

6 Incident response

If a pressurised reaction vessel fails, leading to an explosion:

1. Evacuate the laboratory
2. If anyone has been exposed to chemicals or hurt, decontaminate and provide aid/seek medical attention as required first.
3. Before entering the lab, don PPE including safety glasses, gloves, laboratory coat, and a chemical respirator.
4. Turn off laboratory equipment and make safe any services or items in the location/fume cupboard.
5. Inform your line manager, then the Hazards and Containment Manager or a Health, Safety and Wellbeing Manager ASAP, before cleaning up the lab.
6. Consult the SDS for chemicals that might have escaped the fumehood, to plan how to approach clean up.

Please note that any explosion of a pressure-rated vessel may require reporting to WorkSafe ASAP. Please notify the Hazards and Containment Manager or a Health, Safety and Wellbeing Manager ASAP, who will do the reporting.