Compressed Gas Safety

Introduction

Few regulations directly apply to the use of gas cylinders, however, there is guidance issued by the Health & Safety Executive (HSE) and the British Compressed Gases Association (BCGA). There are two University policy statement regarding compressed gases, UPS <u>S5/03</u> Safety with gas cylinders and UPS <u>S6/01</u> Acetylene. Mishandling of even small compressed gas cylinders has the potential to cause injury, fire, explosion, or unintended release of substances to the environment. The consequences can be catastrophic.

It is essential that staff and students working with compressed gas cylinders fully understand the hazards and know the appropriate safe practices. In addition, if gas cylinders are to be disposed of, and they have contents or are pressurised (usually both), then they are hazardous waste and need to be managed as such.

Working practices

Identification and Labelling

- All gas cylinders must be clearly labelled.
- Do not accept a compressed gas cylinder for use that does not legibly identify its contents by name.
- Never rely on the colour of the cylinder for identification.
- Gas lines leading from a compressed gas supply must be labelled to identify the gas, the laboratory or area served, and the relevant emergency telephone numbers.
- Signs must be posted in areas where flammable compressed gases are stored, identifying the substances and appropriate precautions.

Engineering Controls / Design Considerations

- Keep hazardous gas cylinders in gas cylinder cabinets or racks, with the exception of cylinders containing a non-toxic, flammable gas, and cylinders used in fume hood applications.
- Place a smoke detector adjacent to flammable gas cylinders, connected if possible to the building alarm system. If possible interlock smoke detector activation with the shutdown of hazardous gas flow.
- Connect all ducts used to exhaust hazardous compressed gas cylinders or gas-carrying components to a ventilation alarm.
- Place a safety shower and/or eyewash in areas where corrosive gases are used or stored.
- Make sure that all gas piping is compatible with the gases used and capable of withstanding full cylinder pressure.
- Never lubricate, modify, force, or tamper with a cylinder valve. Use the appropriate regulator on each gas cylinder. Use check valves when there is the possibility of back flow into the cylinder.

Using Cylinders

- Always use safety spectacles with side shields when handling and using compressed gases, especially when connecting and disconnecting compressed gas regulators and lines.
- Never use a cylinder that cannot be identified positively.
- Never use a cylinder of compressed gas without a pressure-reducing regulator attached to the cylinder valve.

- Use regulators and pressure gauges only with gases and pressure ratings for which they are designed and intended.
- Never use oil or grease as a lubricant on valves or attachments to oxygen cylinders.
- Never use oxygen as a substitute for compressed air.
- Never empty a cylinder to a pressure lower than 172 kPa (25 psi). The residual contents may become contaminated if the valve is left open.
- Test cylinders with toxic, corrosive, and pyrophoric gases for possible leaks when receiving, installing, disconnecting or shipping. Always close the cylinder valve before attempting to stop leaks between the cylinder and regulator.
- Damaged or leaking cylinders should be removed from service and tagged as "DAMAGED or DEFECTIVE".

Storing Cylinders

- Keep cylinders in storage upright, secure, and locked into a compact group.
- Cylinders containing the same gas must be stored in a segregated group; empty cylinders must be stored in the same manner.
- Properly secure cylinders with chain, rope or brackets to prevent falling. Valve protection caps must be fully screwed on.
- Protect cylinders stored outside from standing water by providing proper drainage. Where outdoor storage is necessary, an overhead cover is required to avoid overheating in sunlight and rain damage.
- For short-term experiments using hazardous gases, select the smallest cylinder available.
- Return corrosive gas cylinders to the gas supplier within one year, to avoid regulator and cylinder valve problems due to corrosion.
- Some small cylinders, such as lecture bottles and cylinders of highly toxic gases, are not fitted with rupture devices and may explode if exposed to high temperatures.
- Never place cylinders where they may become part of an electric circuit.
- Avoid areas that are damp or subject to other corrosive materials.
- Do not store flammables, toxic gases and oxidisers adjacent to each other. Store cylinders in wellventilated locations.
- Areas containing hazardous gas in storage must have appropriate signage.
- Cylinders in storage must be separated from flammable or combustible liquids and from combustible materials (such as wood, paper, packaging materials, oil, and grease) by at least 12m (40ft) or by a fire resisting partition having at least a one hour rating.
- Empty cylinders must be closed and the valve cap secured. They must be clearly labelled or marked as "EMPTY."

Transporting Cylinders

- Never move a cylinder with a regulator attached.
- Cylinders larger than lecture bottle size should be chained or strapped to a wheeled cart during transport to ensure stability.
- Only trained personnel using approved trucks may transport cylinders.
- Handle only one cylinder at a time.

- Secure cylinders in a basket or similar device when moving them using a mechanical handling device. Do not use slings, ropes, or electromagnets for lifting cylinders. Do not allow cylinders to strike each other.
- Use appropriate personal protective equipment e.g. Steel toe-cap shoes, rigger gloves.

Piping Incompatibilities and Restrictions

- Do not use copper piping for acetylene.
- Do not use plastic piping in any portion of a high-pressure system.
- Do not use cast iron pipe for chlorine.
- Do not conceal distribution lines where a high concentration of a leaking hazardous gas can build up and cause an accident.
- Distribution lines and their outlets must be clearly labelled as to the type of gas contained.
- Piping systems should be inspected for leaks on a regular basis, preferably weekly. Prompt attention should be given to findings.

Emergency Procedures

- Do not remove leaking cylinders from their ventilated enclosures until the leakage has stopped.
- Trip the remote emergency gas shutoff valve/button, if present.
- Close the main cylinder valve when the leak is stopped or slow, hazardous gases are contained in their enclosure, and it is clearly safe to approach.
- Do not extinguish a flame involving a combustible gas until the source of gas has been shut off.

Training

Members of the department that handle or use compressed gases should have the following training:

- Safe handling practices for hazardous substances contained in gas cylinders: corrosive, explosive, toxic, etc.
- Identification and signs.
- Storage and transportation requirements.
- Emergency procedures.

Further details may be found in University Policy statement UPS <u>\$5/03</u> Safety with gas cylinders. Regular training courses are provided by the University Safety Office: <u>https://safety.admin.ox.ac.uk/training-a-z</u>