

May 2018

Ammonia refrigeration

This technical bulletin is aimed at persons conducting a business or undertaking (PCBU's) who design, install, commission, own, operate or maintain ammonia refrigeration plant.

Purpose

It is designed to help PCBUs understand their responsibilities under the Health and Safety at Work Act 2015 ('HSWA'), the Health and Safety at Work (Hazardous Substances) Regulations 2017 ('the Regulations') and the Health and Safety in Employment (Pressure Equipment, Cranes, and Passenger Ropeways) Regulations 1999 ('PECPR'). It also provides advice on what PCBUs using ammonia can do to fulfil their duties.

Background

The uncontrolled release of ammonia from refrigeration plant is a critical work health and safety risk. It has the potential to cause death, a severe permanent disability or life shortening illnesses. Critical risks must be managed effectively to minimise the risk of harm to workers, emergency services and the public.

In the last year, approximately 20 ammonia releases were notified to Work Safe New Zealand. Some workers were taken to hospital, some treated at the scene, and others were at risk but unharmed.

At a recent incident, a pressure safety valve opened (and failed to close) causing three workers to be seriously harmed. The workers required decontamination and medical treatment.

These incidents highlight the importance of risk assessments and implementing appropriate control measures including training, and having a written preventive maintenance plan and a compliant emergency response plan.

What is anhydrous ammonia?

Anhydrous ammonia is a toxic and corrosive substance that is supplied in cylinders as a liquefied gas. The gas is pungent, and very irritating to the eyes, nose, and respiratory system. It is flammable in high concentrations. On release to the atmosphere, one litre of liquid expands to 850 litres of gas, which therefore makes the release of the anhydrous ammonia liquid a much greater risk than a release of the gas. Low level exposure through inhalation can cause coughing and breathing difficulties, where high level exposure through inhalation can cause lung damage, leading to death. Contact of liquid with the body must be prevented.

Symptoms to look for when exposure to ammonia is a risk:

- difficulty breathing
- irritation of the eyes, nose or throat, and
- burns or blisters.

What are the causes of ammonia release?

The two main causes of ammonia releases are:

EQUIPMENT FAILURE	HUMAN FACTORS
<ul style="list-style-type: none">- Corroded pipework- Leaks from rotating shafts (and valve glands)- Failure of high level and pressure cut out switches, and safety valves.	<ul style="list-style-type: none">- Failing to establish and follow a written preventive maintenance programme- Missing procedures: Failing to establish or follow safety processes or procedures- Not identifying hazards correctly- Missing critical control measures (such as those identified in recognised New Zealand Standards)- Ineffectively managing change and safety critical control measures- Not having an effective emergency response plan- The PCBU and refrigeration contractor not consulting with each other to manage their overlapping duties.

Primary duty of care

Under the Health and Safety at Work Act PCBUs with ammonia-based refrigeration systems at their workplaces have a duty to ensure, so far as is reasonably practicable, that the health and safety of their workers, and others (e.g. members of the public) is not put at risk from the release of ammonia. Risks must be eliminated so far as is reasonably practicable. If a risk from an uncontrolled release of ammonia can't be eliminated, it must be minimised so far as is reasonably practicable. Some of the steps workplaces can take to manage the risks from ammonia release are:

- regular maintenance of plant, with emphasis on safety-critical devices
- ensure all warning and ventilation systems are fully operational
- review of control measures to ensure they are in line with industry standards
- provide workers with personal protective equipment (PPE) such as respiratory, eye and skin protection **to minimise exposure.**
- high-risk tasks (such as adding or removing ammonia or compressor oil) should have a written operating procedure.

Good communication between the service provider PCBU (that services or maintains the plant) and the owner/operator PCBU (with management or control of the workplace and/or plant) can help manage the risk of an uncontrolled ammonia release.

Should any escape, leakage or spillage of ammonia occur, PCBUs are required to notify WorkSafe as such leaks are notifiable events.

Hazardous substance controls

There are a number of controls that workplaces must follow under the Health and Safety at Work (Hazardous Substances) Regulations. PCBUs must:

- Establish and maintain an inventory, which includes a safety data sheet (SDS), or a condensed version of the SDS, for each substance.
- Ensure the ammonia is secured from access by unauthorised persons.
- For 100 kg or more of ammonia contained within the plant, the PCBU with management or control of the workplace must have an emergency response plan (ERP). The plan must:
 - address all reasonably foreseeable emergencies that could happen if controls fail or are breached
 - state any special training needed to deal with an emergency involving ammonia
 - include the inventory and a site plan showing where the ammonia is located in the workplace.
- In addition, the PCBU has duties to ensure the plan, and the equipment, facilities, and people described in it, are available, including to emergency service providers. The PCBU must also ensure that the emergency response plan is tested every 12 months to demonstrate whether it is workable and effective, and is implemented in the event of an emergency.

PECPR controls

The Health and Safety in Employment (Pressure Equipment, Cranes and Passenger Ropeways) Regulations also contain controls that apply.

These regulations establish controls on pressure equipment, including inspection and certification by third party equipment inspectors. Requirements include the need to ensure equipment is safe, is operated safely, is operated within design limits, and is maintained in safe condition. All such equipment requires a current certificate of inspection.

Effect of other legislation

We accept that most facilities that utilise ammonia in refrigeration systems are beneath the thresholds for designation under the Health and Safety at Work (Major Hazard Facilities (MHF) Regulations. However, the information, process requirements and processes used by MHF's contain good guidance that could be utilised in many installations that have such systems.

Resources

Industry Standards

AS/NZS 5149.1-2016 Refrigerating systems and heat pumps – Safety and environmental requirements – Definitions, classification and selection criteria
<https://shop.standards.govt.nz/catalog/5149.1%3A2016%28AS%7CNZS%29/view>

AS/NZS 5149.2-2016 Refrigerating systems and heat pumps – Safety and environmental requirements – Design, construction, testing, marking and documentation
<https://shop.standards.govt.nz/catalog/5149.2%3A2016%28AS%7CNZS%29/view>

AS/NZS 5149.3-2016 Refrigerating systems and heat pumps – Safety and environmental requirements – Installation site
<https://shop.standards.govt.nz/catalog/5149.3%3A2016%28AS%7CNZS%29/view>

AS/NZS 5149.4-2016 Refrigerating systems and heat pumps – Safety and environmental requirements – Operation, maintenance, repair and recovery
<https://shop.standards.govt.nz/catalog/5149.4%3A2016%28AS%7CNZS%29/view>

AS 3788:2006 – Pressure Equipment – In-service Inspection
<https://infostore.saiglobal.com/en-au/standards/as-nzs-3788-2006-r2017--374650>

Our website worksafe.govt.nz has further guidance on overlapping duties, risk management and major hazard facilities.

The [Hazardous Substances Toolbox](#) has information on how to comply with the key controls under the Regulations. The [hazardous substances calculator](#) can also help you work out which key controls you need in your workplace for the amount of ammonia you hold.

Approved Code of Practice for Pressure Equipment (excluding boilers) 2001
worksafe.govt.nz

Victorian Code of Practice – Ammonia Refrigeration
AIRAH 2010 www.airah.org.au

Ammonia in Refrigeration Systems
WorkSafe BC 2018 www.worksafefbc.com

Safe Operation of Cold Storage Facilities
WorkSafe Victoria 2017 www.worksafe.vic.gov.au