PRINCIPLES FOR THE SAFE HANDLING AND DISTRIBUTION OF HIGHLY TOXIC GASES AND MIXTURES

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Asia Industrial Gases Association

298 Tiong Bahru Road #20-01 Central Plaza Singapore 168730
Tel : +65 6276 0160 Fax : +65 6274 9379
Internet : http://www.asiaiga.org

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PREPARED BY :

Jean-Paul Barbier	AIR LIQUIDE
Giorgio Bissolotti	SIAD
Simon Christian	AIR PRODUCTS
Kevin Cleaver	BOC
Dieter Heller	LINDE
Joseph Merckaert	AIR LIQUIDE
Bruno Reimann	AIR LIQUIDE
Werner Weterings	SCOTT SPECIALITY GASES
Herman Puype	EIGA

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ASIA INDUSTRIAL GASES ASSOCIATION
298 Tiong Bahru Road #20-01 Central Plaza Singapore 168730
Tel: +65 62760160 Fax: +65 62749379
Internet: http://www.asiaiga.org

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1 Introduction

Scope

The purpose of this document is to set out basic principles for the safe handling and distribution of highly toxic gases and mixtures. These principles are in addition to those, which are normally applied to the handling of gases and containers.

It is recommended that these principles should apply to all highly toxic gases especially those that are considered to have inadequate odour warning at dangerous concentrations in air. Appendix A gives examples of such gases.

In addition, it is recommended, as far as it is reasonably practicable, to extend the application of the principles set out in this document to all toxic gases.

Whilst this document is primarily aimed at gas suppliers and distributors, it is recommended that gas users also observe the principles.

2 Principles

2.1 Principle 1 – Training

Principle 1- All personnel handling highly toxic gases shall be trained. It is important to ensure that all personnel are trained to a level which is commensurate with their involvement with highly toxic gases. The minimum requirements is that all personnel (including vehicle drivers) handling highly toxic gases must be able to recognise the gases they are handling, be aware of the appropriate properties and hazards and the action to take in the event of an emergency. Such personnel should be provided with appropriate safety equipment and training in its use.

2.2 Principle 2 – Supplier and user responsibilities

Principle 2- Suppliers shall take reasonable steps to ensure that highly toxic gases are only supplied to competent users. Users must be aware of the hazardous properties of the gases they are handling and should have trained personnel and adequate facilities and procedures for safe handling and dealing with emergency situations. Users should be provided with appropriate gas data and safety information and it is recommended that they are asked to confirm that they have the necessary facilities and procedures in place before they are supplied with highly toxic gases.

2.3 Principle 3 – Storage and use considerations

Principle 3- All areas where higly toxic gases are filled into containers, used or stored, shall be well ventilated. It is important to ensure that the ventilation is adequate. Ventilation requirements will be determined by the operation, for example:

- Storage of highly toxic gas containers in the open air or where this is not possible, with forced ventilation of at least 10 air changes per hour.

- Filling and use of highly toxic gas containers normally requires additional localised extraction, such as that provided by a fume cubicle, gas cabinet or ventilation hood.

The specification and design of ventilation systems should be undertaken by competent personnel who take into account the toxicity and physical / chemical properties of the gas and the potential risks and possible magnitude of any gas leakage.

2.4 Principle 4 – Valve protection

Principle 4- Highly toxic gas containers shall be checked to be free of leaks, shall have their valve outlets fitted with a gas tight cap nut or plug and shall have their valves protected against mechanical

damage. The fitment of a gas tight cap nut or plug to the gas container valve outlet significantly reduces the risk of leakage. Such a device should be fitted at all times unless the gas container is in use. Any gasket materials used must be compatible with the gas and suitable for the service pressure.

It is recommended that for additional safety, the nut or plug should be provided with a bleed hole (or other suitable arrangement) that allows gas discharge (of gas accumulated in the valve outlet) before complete removal of the cap nut or plug. The provision of bleed holes etc. must not affect the ability of the cap nut or plug to provide a leak – free seal on the valve outlet when correctly fitted and tightened.

It is also recommended that such devices are made “captive” by securing to the container valve with a chain. This ensures that the device is not lost whilst the container is in use and is immediately available for refitting when the container is disconnected from the equipment after use.

Highly toxic gas container valves should be protected against mechanical damage at all times. When gas containers are in use, they should be properly secured to prevent them falling. A valve protection device such as a valve cover or guard should be fitted at all other times. (Note: where it is not practicable, e.g. for lecture bottles, an adequate ventilated packaging for the gas container must be provided).

Note: The fitment of a flow limiting device in the valve outlet may be considered as means of providing additional safety, however such devices are unsuitable for certain applications (e.g. corrosive gases).

2.5 Principle 5 – Security highly toxic gases

Principle 5 – Highly toxic gases must be stored securely in locked cages, compounds or stores. In addition to ensuring ventilation requirements are adequate for the storage of highly toxic gases, it is important that access to the store is restricted to authorised and competent personnel only. This will necessitate provision of lockable storage areas to minimise the risk of unauthorised persons gaining access.

2.6 Principle 6 – Transportation

Principle 6 – Highly toxic gases shall only be transported on well ventilated vehicles. Good ventilation at all times is of paramount importance when handling highly toxic gas containers. Such containers shall only be transported on suitable vehicles where the load space is well ventilated and separated from the vehicle’s compartment. Open vehicles are recommended, however, where closed vehicles must be used, the load area must be provided with adequate forced ventilation and there must be a safe procedure for entering the load area (e.g. additional ventilation before load area doors opened). Highly toxic gases must never be transported in closed vans, private cars, etc. where the vehicle load area communicates with the driver’s compartment. Security of the cylinder must be considered during transport.

2.7 Principle 7 – Inventory requirements

Principle 7 – An inventory of all highly toxic gases shall be kept. Any losses in storage or transport shall be immediately identified and investigated. It is important to closely monitor the storage and movement of highly toxic gases to ensure that they do not get into the wrong hands (e.g. through theft, mistaken delivery, falling off vehicle in transit, etc.)

The system for controlling the storage and movement of highly toxic gases shall be audited periodically to ensure its correct operation.

Appendix A - Example list of Highly toxic gases that have inadequate odour warning

Examples of Highly toxic gases which are considered to have inadequate odour warning at dangerous concentrations in air

Arsine – AsH_3
Chlorine Trifluoride ClF_3
Cyanogen – $(CN)_2$
Cyanogen Chloride CNCl
Diborane B_2H_6 Germane – GeH_4
Hydrogen Cyanide – HCN
Hydrogen Selenide – H_2Se
Nickel Tetracarbonyl – $Ni(CO)_4$
Phosgene $COCl_2$Phosphine – PH_3
Tungsten Hexafluoride – WF_6