



SCOPE

This information sheet provides guidance on how to manage risks during the storage, handling and use of cyanides. It includes guidance on recognising symptoms of cyanide poisoning and responding to cyanide exposure in the workplace, and should be used to develop and implement safe working procedures for staff, students, contractors and visitors who are required to work with or around cyanide.

Introduction

Inorganic cyanides are substances containing the cyanide anion, (CN). Cyanides include solid metal compounds (such as sodium cyanide and potassium cyanide), Cyanide solutions and hydrogen cyanide gas, HCN. Cyanide compounds are extremely toxic and exposure by inhalation or ingestion can be rapidly fatal.

Cyanide compounds prevent the transfer of oxygen from the blood to the body tissues as a result of selective inhibition of respiratory enzymes. The heart and nervous system are particularly prone to rapid damage.

Cyanide salts are odourless when dry; however, when damp they may have a slight odour of hydrogen Cyanide, HCN, which has a bitter almond smell. A person's sense of smell must not be relied on as a warning signal to detect its presence as the sense of smell fatigues easily and not everybody can smell it. All staff and students where Cyanide or Cyanide compounds are used should be trained in its use, in the management of first aid and have appropriate emergency procedures in place.

HAZARD SUMMARY

A solution of Cyanide greater than 0.1% is regarded as hazardous (X_n harmful) according to the Safe Work Australia criteria. More concentrated solutions of Cyanide are progressively more hazardous, with >1% being very Toxic (T) and > 7% extremely toxic (T+).

Poison: Cyanide is a schedule 7 poison. A permit for purchase and use of Cyanide in laboratories is required by the Department of Health (WA).

Dangerous goods: Cyanide is classified as a dangerous good by the criteria of the ADG code as a DG class 6.1 (toxic substance), packing group 1.

Associated risk phrases:

R26/27/28: very toxic by inhalation, in contact with skin and if swallowed.

R32: contact with acids liberates very toxic gas.

Workplace exposure standard for cyanides

	TWA / ppm	TWA / mg/m ³
Cyanides (as CN)	-	5
Hydrogen cyanide	10 peak limitation	11 peak limitation

HEALTH HAZARDS AND SYMPTOMS OF EXPOSURE

The primary route of exposure to cyanides in the workplace is through inhalation of a gas or dust. This results in fast absorption and circulation around the body. Exposure to cyanides through ingestion is less common and cyanide poisoning can result from absorption through eye or skin contact.

The onset of symptoms following Cyanide exposure depends on:

- the form of the Cyanide;
- the mode of entry into the body; and
- the dose.

Staff and students handling, storing, using or generating cyanides should be trained to recognise the following symptoms of cyanide poisoning:

Mild Acute Cyanide Poisoning	Severe Acute Cyanide Poisoning
Irritation of nose, mouth (metallic taste) & throat	Gasping for breath, cyanosis
Anxiety, headache, giddiness, nausea	Loss of consciousness
Shortness of breath, sense of suffocation	Seizures, cardiac arrest
General weakness, heaviness of limbs, falling blood pressure	Death

Chronic Cyanide poisoning symptoms are similar to those of mild Cyanide poisoning. Repeated skin contact to low concentrations of Cyanide may lead to "Cyanide rash". Individuals with pre-existing kidney, respiratory, skin or thyroid diseases are at a greater risk of developing toxic Cyanide effects.

Skin	Highly toxic – irritant. Contact may result in irritation, redness, itching, pain and rash. Prolonged or repeated contact may result in burns. Potentially fatal via rapid skin absorption.
Eye	Corrosive - irritant. Contact may result in irritation, lacrimation, pain, redness, corneal burns and possible permanent damage. Cyanide can also be absorbed into the body through the eyes.
Inhalation	Highly toxic – potentially fatal. Exposure can result in all of the above symptoms.
Ingestion	Severe exposure may lead to breathing difficulties, muscle spasms, convulsions, nausea, vomiting and death.

RISK MANAGEMENT

All work with Cyanide requires the approval of the Head of School/ Manager of the Area. The Occupational Health and Safety Regulations 1996 require that a current Safety Data Sheet (SDS) be obtained and that all staff and students complete and document a full chemical risk assessment in consultation with their supervisors. Safe Working Procedures and Emergency Plans must be developed prior to work commencing.

Hierarchy of Control

There are a number of ways to control the risks associated with the use of cyanides. Some control measures are more effective than others. Control measures can be ranked from the highest level of protection and reliability to the lowest. This ranking is known as the hierarchy of control.

A combination of control measures may be needed to effectively eliminate or minimise risk.

Examples of the application of the hierarchy of controls for cyanide storage, handling and use are:

Hierarchy Steps	Examples
ELIMINATION	<ul style="list-style-type: none"> Where possible, eliminating the use of cyanides in the work process.
SUBSTITUTION	<ul style="list-style-type: none"> Where practicable, substituting the use of cyanides in a work process with a less toxic chemical - for example replacing copper cyanide with copper pyrophosphate in electroplating.
ISOLATION	<ul style="list-style-type: none"> Isolating cyanides from incompatible substances to avoid dangerous reactions that could generate hydrogen cyanide or other hazardous gases, for example storing cyanides away from acids, oxidising agents and other incompatible substances. Enclosing processes involving cyanides to eliminate potential exposure.

<p>ENGINEERING CONTROLS</p>	<ul style="list-style-type: none"> • Engineering controls must be in place to ensure that recommended exposure standards are not exceeded. Emergency showers and eye-wash facilities must be available within the immediate work area where cyanide compounds are regularly handled. • Cyanides must not be used in an open laboratory. Work with cyanides must be contained in a fume cupboard with fully functional extraction rate (i.e. fully compliant cupboard). • Using a scrubbing system in conjunction with local exhaust ventilation will further minimise potential exposure to cyanide fumes, mists and gases. • Automating handling and processing operations like transferring of cyanides, for example from storage containers to processing vessels, to minimise potential worker contact. • Installing high efficiency particulate air (HEPA) filters in air handling systems to remove and contain dusts of cyanide salts.
<p>ADMINISTRATIVE CONTROLS</p>	<ul style="list-style-type: none"> • Providing workers with relevant information, training and instructions regarding potential hazards and risks associated with cyanide work, including the safe use, handling and storage of cyanides • The operation and maintenance of engineering control measures, e.g. regular testing of ventilation and emergency systems • The proper use and maintenance of PPE • An effective workplace emergency response guide that is understood and followed in the event of an emergency. • Restricting access to areas where cyanides are being used, processed or stored to authorised personnel only. • Ensure that an SDS from the manufacturer/supplier is obtained • Training records must be kept • Conduct a risk assessment for the intended use of cyanide • Do not work alone or after hours when handling cyanide. Have a buddy system in place. Make sure that all normal assistance services are in place (eg supervisor, security, first aiders). • Solutions of cyanide must be kept caustic. • Waste containers for the safe disposal of cyanide solutions must be provided. • Systems need to be put in place to manage the area in case of power failure of the fume cupboard. • Purchase cyanide in minimum quantities. • Placing a notice of action or emergency response guide in a prominent position where cyanides are handled and stored. • Ensure containers and labels are in good condition.
<p>PERSONAL PROTECTIVE EQUIPMENT</p>	<ul style="list-style-type: none"> • Appropriate personnel protective equipment must be provided and used when working with cyanide. PPE must be appropriately selected, individually fitted and workers trained in correct use and maintenance: • Wear impervious gloves, e.g. PVC, at all times when handling cyanides • Wear a PVC protective apron, rubber boots and face shield whenever there is the possibility of being splashed with a cyanide compound. • Handle gloves and other protective equipment carefully and safely. Wash equipment immediately after use and store clean items well away from cyanides. • Use the appropriate respiratory equipment for the concentration of cyanide dust or gas that may be in the air. This should comply with Australian Standard AS 1716 Respiratory protective devices. • Respiratory equipment should be kept in order and ready for use at all times. Do not store the equipment where cyanides are used or stored.
<p>Storage</p>	
<p>The requirements for storage are outlined in <i>AS/NZS 4452:1997, Storage and handling of toxic substances</i> and the conditions of the <i>Poisons Permit</i>.</p>	
<p>1. Stored in a in a cool, dry, well ventilated area, within a secure (locked) corrosive resistant cabinet with a resistant inner.</p>	

2. Keep cyanides in original containers and keep them securely closed and arrange stock so the oldest material is used first.
3. Check containers regularly for damage or deterioration
4. Cyanide should be stored separately from incompatible materials ensuring cyanide stores do not contain acids or other incompatible substances such as oxidising agents, for example nitrates, nitrites, peroxides and chlorates, which can react to give off hydrogen cyanide and other hazardous gases.
5. Containers should be stored close to ground level in a chemically resistant tray (bund). Retention measures must be in place to contain any spilt cyanide.
6. Take containers to the fume cupboard for opening as there may be accumulated HCN in the container.
7. Make sure that all workers are trained in the safety procedures associated with storing and handling cyanide.
8. Do not eat or drink in a cyanide store or lab and ensure food, drinks, and utensils are not kept in areas where cyanides are stored.
9. Do not store respiratory equipment, clothing or other protective equipment where cyanides are kept.

Disposal

1. Do not over-fill the waste cyanide container
2. Always store and neutralise cyanide waste in the fume hood.
3. To prevent exposure to toxic chlorine gas, always open hypochlorite containers inside the operating fume hood
4. Waste cyanide solution should never be disposed of directly down the sink. 20 L Cyanide Waste carboy must be kept in the fume hood
5. Waste cyanide solutions need to be treated with hypochlorite to destroy the cyanide before disposal.
6. Allow to stand for 24 hours after the last hypochlorite addition to allow slurry to settle
7. Neutralise, filter slurry and dispose in general waste.

Spill Containment

Due to the highly toxic nature of cyanide the greatest caution should be used when dealing with a spill.

1. Small spills inside a fume cupboard should be managed by a competent and adequately trained person wearing appropriate PPE.
2. Where there is any spill outside of an area where there is adequate ventilation (such as a fume cupboard), evacuate the area and move unprotected personnel out of danger.
3. Prevent further release of cyanide and restrict access to the spill site, dial 000 or 0 000 from an internal phone and advise Curtin Security on 4444 from an internal phone or 9266 4444 from a mobile phone.
4. Only trained personnel (emergency services) with the appropriate PPE are permitted to enter the contaminated area..
5. A comprehensive spill kit should be available in the work area. The contents of the spill kit should be carefully researched so that it is fit for purpose. Workers must be trained in spill management.
6. Prevent spillage from entering any drains or waterways.
7. Complete an incident report via the Curtin Incident reporting system

EMERGENCY MANAGEMENT

Any incident that involves potential exposure to cyanide must be regarded as a medical emergency. Cyanide-specific first aid and emergency response equipment should be readily available where cyanide is stored and used.

All staff and students who work with cyanide must be made aware of Curtin University emergency procedures and any emergency procedures specific to the use of cyanide.

Prior to administering first aid, appropriate PPE must be put on.

Skin Contact

1. Drench with water to wash off all cyanide.
2. Remove contaminated clothing etc as soon as possible. Place in labelled plastic bag for further treatment.
3. Dial 000 or 0 000 from an internal phone and advise Curtin Security on 4444 from an internal phone or 9266 4444 from a mobile phone.
4. Continue to drench affected areas.
5. The SDS should accompany the person involved to the hospital.

Eye Contact
1. Remove contact lenses.
2. Flood eye with gently running water for at least 15 minutes, ensuring that the flow of water does not contaminate the unaffected eye.
3. Dial 000 or 0 000 from an internal phone and advise Curtin Security on 4444 from an internal phone or 9266 4444 from a mobile phone.
4. Continue flushing with water or isotonic saline during transport.
Ingestion
Dial 000 or 0 000 from an internal phone and advise Curtin Security on 4444 from an internal phone or 9266 4444 from a mobile phone
Do not induce vomiting. Vomited material should be regarded as contaminated.
Inhalation
1. Remove affected person to fresh air.
2. Oxygen can be administered by a trained person.
3. Dial 000 or 0 000 from an internal phone and advise Curtin Security on 4444 from an internal phone or 9266 4444 from a mobile phone Do not enter the contaminated area
4. Medical attention must be sought even if there are no symptoms.
First Aid
To be effective, first aid must be prompt. Immediately:
1. Check for danger, put on required PPE and see if the casualty is responsive
2. Dial 000 or 0 000 from an internal phone and advise Curtin Security on 4444 from an internal phone or 9266 4444 from a mobile phone
3. Remove the patient from further exposure, if safe to do so.
4. If trained, administer 100% Oxygen to anyone who is exposed to cyanide, whether conscious or unconscious, breathing or not breathing.
5. If the patient is not breathing, do not use mouth to mouth ventilation due to risk of contamination , use a resuscitation bag and valve mask.
6. If pulse is absent, commence CPR.
7. Remove any contaminated clothing and place in a sealed labelled bag. Wash the patient with copious amounts of fresh water.
8. Accompanying the patient to hospital should be a copy of the Cyanide Information Pack
POWER FAILURE OR FUME HOOD FAILURE
In the event that the there is a malfunction of the fume cupboard it is vitally important to make the workplace safe.
1. Cease all Cyanide operations.
2. Switch off electrical devices.
3. Lower the fume cupboard sash.
4. Exit the laboratory.
5. Evacuate the immediate area.
6. Report the fault to management.
Do not enter an area where Cyanide operations are taking place if there has been a power failure or fume cupboard alarms are operating.
CYANIDE INFORMATION PACK
As part of safe working procedures is it is highly advisable to have an <i>Cyanide Information Pack</i> available for emergency personnel and medical practitioners. It is recommended that the information pack contains:
1. A copy of the <i>Risk Assessment</i> .
2. A copy of the <i>Safety Data Sheet</i> .
3. A copy of the Cyanide Emergency Response Guide.
4. A copy of this Cyanide Information Sheet

CYANIDE CHECKLIST

Below is a checklist to be used prior to starting work with Cyanide.

- Risk assessment completed for the use of Cyanide and safe work procedures.
- Full review of Emergency Procedures prior to commencing work.
- Fume Cupboard for Cyanide work is in full working order. Check:
 - Power
 - Extraction
 - Sash operability
 - Filters are appropriate for cyanide work
- Emergency shower and eye wash are immediately accessible and in full working order.
- Signage is clearly visible to all building occupants, highlighting the use of Cyanide in the laboratory and emergency contacts listed.
- 100% Oxygen is readily available and staff are trained to use it
- Spill Kit is available.
- Full PPE is available for both the operator and buddy. All personnel trained in the use of PPE.
- The Cyanide information pack is complete and available in case of an incident.

References

- [1] [Occupational Health and Safety \(Hazardous Substances\) Regulations 1996](#)
- [2] [AS/NZS 4452:1997, Storage and handling of toxic substances](#)
- [3] [AS 2243 Safety In Laboratories](#)
- [4] [Cyanide Emergency Response Guide](#)