Cyanide
Information Sheet 03-2011

SCOPE
This Information Sheet provides information and advice for developing and implementing Safe Working Procedures for staff, students, contractors and visitors working at Curtin University who are required to handle 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.
Although Cyanide poisoning is uncommon, all employees where Cyanide is used should be trained in its use, in first aid treatment and have emergency procedures in place.

HAZARD SUMMARY
A solution of Cyanide greater than 0.1% is regarded as hazardous (X n harmful) according to the ASCC 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.

Exposure Standard:
TWA: hydrogen cyanide - 10ppm, peak, skin.
Cyanide salts (as CN) - 5 mg/m3, skin.

HEALTH HAZARDS AND SYMPTOMS OF EXPOSURE
The primary route of occupational exposure is through inhalation, which results in rapid absorption into the systemic circulation. A less common route is via ingestion. Cyanide can be absorbed through the eyes and via 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.
The onset of symptoms following Cyanide exposure is very rapid:

<table>
<thead>
<tr>
<th>Mild or Early Cyanide Poisoning</th>
<th>Severe Early Cyanide Poisoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irritation of nose, mouth (metallic taste) and throat</td>
<td>Gaspings for breath, cyanosis</td>
</tr>
<tr>
<td>Anxiety, headache, giddiness, nausea</td>
<td>Loss of consciousness</td>
</tr>
<tr>
<td>Shortness of breath, sense of suffocation</td>
<td>Seizures, cardiac arrest</td>
</tr>
<tr>
<td>General weakness, heaviness of limbs, falling blood pressure</td>
<td>Death</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Skin</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>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.</td>
</tr>
<tr>
<td>Inhalation</td>
<td>Highly toxic – potentially fatal. Exposure can result in all of the above symptoms.</td>
</tr>
<tr>
<td>Ingestion</td>
<td>Severe exposure may lead to breathing difficulties, muscle spasms, convulsions, nausea, vomiting and death.</td>
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</tbody>
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**RISK MANAGEMENT**

All work with Cyanide requires the approval of the Head of School/Division. The *Occupational Health and Safety (Hazardous Substances) 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 Procedures* must be developed prior to work commencing.

**Hazard Control**

Control measures must be put in place to minimise exposure to Cyanide. A thorough examination of work processes is essential. If in doubt seek expert assistance.

**Elimination**

Elimination of Cyanide operations should be the first element of the hierarchy of controls considered.

**Substitution**

In some cases substitution can be achieved using a less toxic chemical.

**Engineering**

Engineering controls must be in place to ensure that recommended exposure standards are not exceeded.

1. All ventilation systems must be correctly installed, maintained and fit for purpose. All operations with Cyanide must be done in an appropriate fume cupboard.
2. Have a dedicated fume cupboard for Cyanide work.
3. Restrict access to areas where Cyanide is in use.
4. Provide appropriate signage indicating Cyanide is in use.
5. Eyewash stations, emergency showers and hand washing facilities must be available in each work area. Regular maintenance of these facilities is essential.

**Administrative**

1. Ensure that a *Safety Data Sheet (SDS)* from the supplier is obtained.
2. Ensure that personnel are thoroughly trained and familiar with the properties and hazards of Cyanide. Training records must be kept.
3. Conduct a risk assessment for the intended use of Cyanide.
5. Train personnel in *Safe Working Procedures*, engineering controls, use of personal protective equipment (PPE), hygiene, first aid and emergency procedures.
6. Purchase Cyanide in minimum quantities.
7. All Cyanide solutions must be appropriately labelled. Ensure containers and labels are in good condition.
8. 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 (for example supervisor, first aiders, emergency services).
9. Labelled waste containers for the safe disposal of Cyanide solutions must be provided.
10. Systems need to be put in place to manage the area in case of power failure or fume cupboard malfunction.
### Personal Protective Equipment (PPE)

Appropriate personnel protective equipment must be provided and used when working with Cyanide. PPE must be appropriately selected, individually fitted and workers trained in its correct use and maintenance:

<table>
<thead>
<tr>
<th>Face</th>
<th>Eye protection must be worn. Safety glasses in combination with a face shield.</th>
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</thead>
<tbody>
<tr>
<td>Hands</td>
<td>Double gloving is advised. Use of an outer PVC or neoprene/natural rubber blend, together with an inner nitrile surgical/examination glove, is recommended. This combination enables ease of removal and avoids hand contamination. Gloves should be disposed of after use.</td>
</tr>
<tr>
<td>Body</td>
<td>PVC apron complete with sleeve protection where there is a possibility of splashing.</td>
</tr>
<tr>
<td>Feet</td>
<td>Fully enclosed leather or rubber shoes must be worn to protect the feet.</td>
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</tbody>
</table>

**Note:** Contaminated PPE and clothing should be neutralised and disposed of via an approved contractor.

### Storage

The requirements for storage are outlined in AS/NZS 4452:1997, *Storage and handling of toxic substances* and the conditions of the Poisons Permit.

1. Cyanide must be stored in a secure (locked) poisons cabinet in a cool, dry, well ventilated area.
2. Keep Cyanide in well labelled, securely closed, original containers. Check containers regularly for damage or deterioration.
3. 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.
4. Cyanide should be stored separately from acids, acid fumes or water to avoid production of HCN.
5. Dangerous goods segregation rules should be strictly observed. Separate Cyanide from oxidising agents, alkalis, acids, metals, silica, ceramics, organic materials, heat sources and food stuffs.
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.

### Spill Containment

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

1. Where there is any spill outside of an area where there is adequate ventilation (such as a fume cabinet), evacuate the area. Prevent others from entering the area. Dial 5 to report the spill. Only trained personnel (emergency services) with the appropriate PPE are permitted to enter the contaminated area.
2. A small spill inside a fume cabinet should be managed by a competent trained person wearing appropriate PPE.
3. 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.
4. Prevent spillage from entering any drains or waterways.

### EMERGENCY MANAGEMENT

All workers with Cyanide must be made aware of Curtin University emergency procedures. (Dial 000 from mobiles or 0000 from internal phones). Any incident that involves contact with Cyanide must be regarded as a medical emergency. No first aid should be administered if there is the possibility of contamination. Prevent further contamination of injured person or rescuer. Wear the appropriate PPE.

### Skin Contact

Seek urgent medical attention. Prompt decontamination is essential.

1. Remove contaminated clothing etc as soon as possible. Place in labelled plastic bag for further treatment.
2. Drench with water to wash off all Cyanide. Continue to drench affected areas until advised.

### Eye Contact

Seek urgent medical attention. Consult an eye specialist.
1. Flood eyes with gently running water for at least 15 minutes.
2. Continue flushing with water or isotonic saline during transport.

**Ingestion**

Seek urgent medical attention.

1. Urgent hospital treatment is likely to be required.

**Inhalation**

Do not enter the contaminated area.

1. Rescuers should wear respiratory apparatus.
2. Remove affected person to fresh air.
3. Oxygen can only be administered by a trained person.
4. Seek urgent medical assistance.

**First Aid**

In all the above instances, to be effective, first aid must be prompt. Therefore immediately:

1. Safely remove the patient from further exposure. Whether Cyanide solution or HCN is involved first aid will need to be performed by a trained rescuer complete with appropriate respiratory equipment and PPE.
2. Oxygen (100%) is considered the most useful treatment for early Cyanide poisoning and should be administered by a trained person to anyone who is exposed to Cyanide, whether conscious or unconscious, breathing or not breathing.
3. If the patient is not breathing, do not use mouth to mouth ventilation due to risk of contamination.
4. If pulse is absent, commence external cardiac massage.
5. Remove any contaminated clothing and place in a sealed labelled bag. Wash the patient with copious amounts of fresh water.
6. Arrange for urgent transfer to hospital. The patient should be accompanied by a person trained in CPR and able to continue resuscitation. Also accompanying the patient should be a copy of *Cyanide Information Pack*.

**CYANIDE INFORMATION PACK**

As part of safe working procedures is it is highly advisable to have an *Cyanide Information Pack* available for emergency personnel and medical practitioners. It is recommended that the information pack contains:

1. A copy of the *Risk Assessment*.
2. A copy of the *Safety Data Sheet*.

**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. Do not enter an area where Cyanide operations are taking place if there has been a power failure or fume cupboard alarms are operating.

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.
7. Report the fault to management.

**CYANIDE CHECKLIST**

Below is a checklist to be used prior to starting work with Cyanide.
Risk assessment completed for the use of Cyanide and operational 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

- 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.
- Spill Kit is available and personnel trained in its use.
- 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