Transport Management Plan for Sodium Cyanide Product

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TABLE OF CONTENTS

INTRODUCTION

1.1 BACKGROUND

Australian Gold Reagents Ltd (AGR) is Western Australia's only manufacturer of sodium cyanide. AGR is the management company of the unincorporated joint venture between CSBP Ltd. and Coogee Chemicals Pty. Ltd.

CSBP, part of Wesfarmers Limited, is the major participant in the venture with a 75% shareholding, and acts as both plant operator and sales agent. Coogee Chemicals, with a 25% shareholding, is a local manufacturer and distributor of industrial chemicals and a significant tank farm operator.

The AGR facility, which is located at CSBP's fertiliser and chemicals complex in Kwinana, consists of two, independent, cyanide solution plants, and a solid cyanide production plant, which provide secure and reliable product supply.

The original facility, which produces a 30 per cent solution (by weight) of sodium cyanide, was the first sodium cyanide manufacturing plant to be constructed in Australia. It has won a number of engineering excellence awards and is recognised for its innovative design, efficiency and safety.

The first cyanide plant was commissioned in 1988 to service the growing gold mining industry in Western Australia. Sodium cyanide is an essential ingredient for the metallurgical extraction of gold.

Since this time the plant has been upgraded, and a second, independent plant constructed adjacent to the first, increasing production capability up to approximately 80,000 tonnes per annum.

The commissioning in 2002 of a briquetting plant gave AGR the capacity to produce 20,000 tonnes per annum of solid sodium cyanide for distribution within Australia and overseas.

1.2 AIM AND OBJECTIVES

The aim of this transport management and emergency response plan is to detail the procedures to be adopted to avoid incidents, and actions required during all phases of emergency response management associated with the transport of both sodium cyanide solution and solids from CSBP's site in Kwinana. The transport management plan is designed to provide the following:

- Sufficient instruction to effectively deal with a transportation emergency;
- A plan of action that is acceptable to CSBP and Coogee Chemicals (the AGR joint venture partners), the relevant Western Australian Government Departments, and Government Emergency Response Agencies; and
- Minimisation of risk to the public, environment, contractors, employees, members of Emergency Response Service, property and equipment.

1.3 EMERGENCY CONTACT DETAILS

The ability to respond to an emergency and the effectiveness of that response is dictated by the availability of suitably qualified personnel and a communications network capable of operation in adverse conditions.

CSBP's Emergency Response Team is available 24 hours per day. Team personnel are available for call out to both onsite and offsite emergencies.

CSBP's Emergency Response System is activated by telephoning:

1800 093 333 within Australia,

or

+61 8 9411 8444 outside Australia

These emergency contact numbers are displayed on the cyanide packaging. The communication protocols are described in individual transport procedures.

Each of the companies involved with the loading, rail transport, road transport and shipping of sodium cyanide through to receival of the product are able to respond to differing degrees to ensure a comprehensive response in the event of an emergency.

1.4 APPLICABLE DOCUMENTS

The following documents are referenced in this document and are an integral part of this Transport Management Plan:

- Vehicle Operator's Handbook for Sodium Cyanide (CSBP-GM-09-110-02)
- Sodium Cyanide Solution Isotainer Loading at SCP Kwinana Loading Station (CSBP-OP-KT-000-08)
- Management of Emergencies (CSBP-RM-11-010-02)
- Storage Tanks for 30% Sodium Cyanide Solution (CSBP-ES-14-501-04)
- Sodium Cyanide Solids Container Unloading at Australian Minesites (CSBP-OP-09-040-11)
- Sodium Cyanide Solution Isotainer Unloading at Minesites (CSBP-OP-09-040-10)
- Cyanide Transport Route Review and Risk Assessment (CSBP-DP-09-110-18)
- Solid Sodium Cyanide – Procedure for Delivery and Despatch of Empty and Full Sea Containers (CSBP-DP-09-110-23)
- SCS – Despatch – Receivals and Despatch (CSBP-OP-KC-006-18)

Emergency response plans covering maritime and inland transport to overseas customers are established between CSBP and the relevant transport contractors. These documents also form part of the comprehensive plan for the management of cyanide transport.

1.5 TRANSPORT MANAGEMENT PLAN REVIEW AND AUDIT PROCESS

This Transport Management Plan will be reviewed at least every two years, or when changes to systems or procedures make it necessary. The biennial review will be initiated by CSBP's document control system.

Internal audits of this plan are scheduled, performed and reported in compliance with the CSBP procedures.

Third party audits are arranged and overseen by the Technical Sales Support Representative, at a frequency agreed with the Competent Authority, from time to time.

2. AGR RESPONSIBILITIES

CSBP Ltd (CSBP), in its capacity as the operator of the sodium cyanide plant and sales agent for the AGR Joint Venture, is responsible for providing emergency response in accordance with the relevant statutory authorities and WESTPLAN HAZMAT.

CSBP assumes the responsibility of "consignor" under the Western Australian Dangerous Goods Transport legislation.

2.1 AGR'S PROVEN PERFORMANCE

AGR has been manufacturing and transporting sodium cyanide since 1988. After years of continuous production experience, and transport to over 40 different gold mines throughout Western Australia, Africa, South America and Asia, AGR has developed a proven safety management system.

This has been achieved by implementation of effective transport management policies, incorporating risk minimisation procedures.

2.1.1 Regulation, Legislation and Codes

AGR conforms with all regulations and codes as applicable to the transport, storage and production of sodium cyanide solution and solids. These include:

- Dangerous Goods Safety Act 2004 - https://www.legislation.wa.gov.au/legislation/statutes.nsf/law_a7019.html
    - Dangerous Goods Safety (Storage and Handling of Non-Explosives) Regulations 2007 - https://www.legislation.wa.gov.au/legislation/statutes.nsf/law_s37950.html
    - Dangerous Goods Safety (General) Regulations 2007 - https://www.legislation.wa.gov.au/legislation/statutes.nsf/law_s37439.html
    - Dangerous Goods Safety (Road and Rail Transport of Non-Explosives) Regulations 2007 - https://www.legislation.wa.gov.au/legislation/statutes.nsf/law_s38035.html
- Australian Code for the Transport of Dangerous Goods by Road and Rail (7th Edition) - https://www.ntc.gov.au/Media/Reports/(A890348C-BEE7-3C64-A770-E98CFD8DDEFA).pdf
- International Cyanide Management Code for the Manufacture, Transport and Use of Cyanide in the Production of Gold - http://www.cyanidecode.org/about-cyanide-code/cyanide-code
- PACIA Responsible Care Program - https://chemistryaustralia.org.au/
- Ministerial Statement 700. Sodium Cyanide Plants (Liquid and Solid) at Kwinana and Transport of Sodium Cyanide by Road and Rail from Kwinana.
    - AGR complies with the Australian Dangerous Goods Code as well as approval conditions and proponent commitments in Ministerial Statement 700 – Sodium Cyanide Plants (Liquid and Solid) at Kwinana and Transport of Sodium Cyanide by Road and Rail from Kwinana (MS700).

- The obligations in MS700 are managed within the Legal Register in Cintellate and compliance with conditions and commitments within MS700 are audited annually

- Appropriate State Specific Road Traffic and Transport Acts and subsidiary legislation - https://www.legislation.wa.gov.au/legislation/statutes.nsf/actsif.html

- Appropriate Dangerous Goods Acts, Legislations, Codes and direction for all other States and Territories within Australia as may be required.

2.1.2 Key Commitments

AGR's key commitments in relation to the safe transport of sodium Cyanide are listed below.

a. From Kwinana, road transport is by the route for Dangerous Goods and Heavy Haulage as designated by the Competent Authority, Department of Mines, Industry, Regulation and Safety– Dangerous Goods Safety Branch and Main Roads WA. - http://www.DMIRS.wa.gov.au/Documents/Dangerous-Goods/DGS_GN_RoutesStoppingAndBulkTransfer.pdf

b. Vehicles shall be equipped with means of communicating quickly, efficiently and reliably with an operational base. A procedure will be maintained for communications with the transport operations base as each vehicle travels along a transport route to a mine and until that vehicle logs off.

c. Procedures are in place to ensure conformance to the standards. These include:

1. Loading and unloading of isotainers,
2. Journey by journey inspections of transport equipment and checklists,
3. Biennial detailed isotainer inspections,
4. First order emergency response,
5. Comprehensive emergency response, and
6. Access to technical advice 24hrs per day.

d. In addition to any required audits by a regulatory body, AGR will continue to perform its own audits of the loading, transport and transport management procedures.

e. The proponent will liaise with local government authorities, relevant government departments and counter disaster groups prior to transportation commencing along approved transport routes, to address local and specific issues, including setting up emergency plans and training programs.

f. Isotainers shall be transported on dedicated low bed road trailers or dedicated The Rail Operator wagons and secured by corner twist locks on either mode of transport

g. Rail wagons shall be maintained by The Rail Operator to the "Railways of Australia Codes of Practice and Conditions for the Carriage of Dangerous Goods"

h. Road prime movers and low bed trailers shall be maintained to manufacturers' specifications and be subject to standards agreed during the carrier selection process.

i. Road transport drivers shall have all the necessary licences including dangerous goods driver and vehicle licences from the Department of Mines, Industry, Regulation and Safety – Dangerous Goods Safety Branch, and AGR/CSBP certification for the transport of sodium cyanide solution or solids.

j. Drivers shall be trained and retrained in the handling of sodium cyanide solution and solids, and in emergency procedures for initial (holding) response to transport incident.

k. AGR's operating agent CSBP shall provide a fully equipped emergency response vehicle and trained personnel on a 24 hour basis to respond to any transport incident involving AGR's sodium cyanide. Refer to AGR's Vehicle Operator's Handbook for comprehensive vehicle operator's requirements (CSBP-GM-09-110-02).

l. AGR will only transport its product along routes approved by the Department of Mines, Industry, Regulation and Safety– Dangerous Goods Safety Branch and Main Roads WA.

m. Adequate stocks of neutralising agent (ferrous sulphate) will be maintained at the plant and along the main transport routes at agreed locations for use in emergencies. The stocks are inspected regularly to ensure that they are kept in good order.

3. CONTRACTOR RESPONSIBILITIES

AGR's sodium cyanide transport carriers have a number of responsibilities that they are required to uphold. The following statements are consistent with the conditions of the transport contracts.

3.1 ROAD TRANSPORT

a. The transport operators must comply with all statutory requirements for the transport of dangerous goods, and the terms and conditions of the Transport Contract.

b. For road transport, only drivers licensed for the transport of dangerous goods, instructed in the properties of the specific hazardous materials, trained to deal with leaks and spillage, and certified by AGR shall be involved in the transportation and unloading of solid or solution sodium cyanide.

c. New drivers shall complete a theoretical training course provide by AGR prior to receiving accreditation to carry sodium cyanide product.

d. All drivers shall complete a refresher course on an annual basis. No driver shall transport sodium cyanide product if they have exceeded their accreditation expiry date, unless authorised by AGR.

e. All transport vehicles shall be equipped with effective communication equipment.

f. The transport operators shall maintain effective communications with drivers during transport operations.

g. The transport contractors are responsible for the provision of adequate safety equipment for the protection of their personnel during operations.

h. In the event of an incident the transport contractor shall make available resources as required by CSBP.

i. The transport contractors will take part in training exercises as required.

j. The carrier's performance will be measured by AGR using Key Performance Indicators.

k. Any incident/defect that occurs in transit or at a minesite shall be reported to AGR/CSBP by the driver or their supervisor as soon as practicable. Emergency situations are to be communicated as per the direction in section 8 via the CSBP emergency 1800 number.

3.2 RAIL TRANSPORT

a. The transport operators must comply with all statutory requirements for the transport of dangerous goods, and the terms and conditions of the Transport Contract.

b. Rail wagons shall be maintained by The Rail Operator to the "Railways of Australia Codes of Practice and Conditions for the Carriage of Dangerous Goods".

c. All locomotives shall be equipped with effective communication equipment.

d. The transport operators shall maintain effective communications with drivers during transport operations.

e. In the event of an incident The Rail Operator shall make available resources as required by AGR/CSBP.

f. The Rail Operator will take part in training exercises as required.

g. Any incident that occurs in transit or at a rail siding shall be reported to AGR/CSBP by the driver or their supervisor as soon as practicable. Emergency situations are to be communicated as per the direction in section 8 via the CSBP emergency 1800 number.

4. PRODUCT PROPERTIES

AGR produces and transports two different forms of sodium cyanide, namely solution and solids.

Sodium Cyanide Solution is produced as a 30% clear, colourless to straw-coloured liquid (sometimes with a reddish dye added) and Solid Sodium Cyanide as a >97%, white briquette.

For further information refer to the following Safety Data Sheets openly available on the AGR website at https://www.agrcyanide.com/safety/safety-data-sheets.

5. HEALTH HAZARDS

5.1 MECHANISM OF POISONING

Cyanide in its ionic form readily forms stable complexes with a number of biologically active metal ions. Most important of these reactions appears to be the interaction with the ferric ion in cytochrome oxidase. This enzyme plays a central role in the utilisation of oxygen within cells.

The reaction between cyanide ion and cytochrome oxidase is rapid. This prevents the utilisation of oxygen by cells causing a chemically induced suffocation. This process is reversible, with the body able to convert cyanide to thiocyanate and excrete it in the urine.

Symptoms of poisoning will occur when the rate of absorption and binding to cytochrome oxidase exceeds the rate of detoxification. Effective detoxification will occur in two to three hours in most cases.

5.2 ROUTES OF POISONING

Cyanides in all forms have the potential to be extremely poisonous. Cyanides act only when absorbed into the bloodstream where they interfere with the absorption of oxygen by body tissues.

Cyanide can enter the blood stream through three different routes: inhalation, absorption, and ingestion, each of which has similar effects on the body.

5.2.1 Acute Exposure

Health effects of acute exposure to cyanide are dependent upon the quantity and duration of exposure.

Swallowing 50 to 100 mg of sodium cyanide or inhalation of hydrogen cyanide, in excess of 100 ppm, leads to unconsciousness, fits, cessation of breathing, cessation of pulse and death within a short period of time.

For humans the fatal dosage by oral ingestion is in the order of 2 - 6 mg NaCN / kg body weight; depending upon the contents of the stomach. For solid sodium cyanide this is an amount equivalent to the size of a grain of rice. The equivalent quantity of sodium cyanide solution is about the volume of a green pea.

Prolonged exposure to smaller quantities of sodium cyanide (concentrations less than 100 ppm of hydrogen cyanide gas) may lead to symptoms including:

- irritation of the throat with possibly a metallic taste in the mouth
- weakness and heaviness of limbs
- watering of eyes
- dizziness
- difficulty in breathing - rapid respiration
- rapid pulse
- severe headache

- bluish-grey appearance

Severe symptoms include:

- nausea and vomiting
- low blood pressure (shock)
- gasping for breath
- cherry red flush
- coma – unconsciousness

The two principles on which first aid is based are that the cells of the body are being deprived of vital oxygen, and that the body is able to neutralise any cyanide that is present, but requires time to act. Refer to first aid treatment in Section 6.

5.2.2 Chronic Exposure

There is very little information reported on the long-term biological effects of exposure to low levels of sodium cyanide. Over 100 years of usage by industry suggests that effects are minimal.

5.2.3 Inhalation

The fastest route for cyanide to enter the blood stream is through inhalation, since the HCN gas is transferred via the lungs directly into the blood stream.

Not all exposures to HCN are fatal since the effect depends on both the concentration of HCN and the length of the exposure.

5.2.4 Absorption

Cyanide solutions containing caustic soda are corrosive to the skin. Cyanide can also be rapidly absorbed into the body through unbroken skin. The symptoms that result are the same as those caused by inhalation. Repeated contact with cyanide dust or dilute solutions has been reported to cause dermatitis or “cyanide rash”.

5.2.5 Ingestion

Cyanide ingestion is rare in the workplace. If cyanide is ingested it is rapidly absorbed through the stomach lining. Acid in the stomach will break down cyanide compounds and produce HCN gas. The rate of absorption depends on the contents of the stomach. Symptoms are the same as those for inhalation. There is often a pungent, bitter burning taste in the mouth and a slight numbness in the throat and stiffness in the lower jaw.

Sodium Cyanide in the eyes will cause severe chemical burns due to the presence of free sodium hydroxide.

Cyanides are acute poisons with no long-term effects and, provided the body’s detoxification system is not overwhelmed, are rapidly and completely eliminated from the body.

5.3 SOLID SODIUM CYANIDE

Short-term exposure is considered to be potentially toxic. Death may occur if inhaled, swallowed or absorbed through the skin and other tissues in excessive amounts.

Contact with solid material either as granules or dust particles may cause skin irritation and severe burning of the skin. Repeated or prolonged contact may lead to irritation or contact dermatitis, i.e. "cyanide rash", characterised by itching and skin eruptions.

The reaction of solid sodium cyanide with acids, water or very dilute alkali solutions (e.g. less than 0.004% by wt caustic soda) generates hydrogen cyanide gas.

Pure dry sodium cyanide has no odour. However, a slight ammonia and/or hydrogen cyanide odour may be detected if the product is damp.

5.4 SODIUM CYANIDE SOLUTION

Exposure to sodium cyanide solution is usually by swallowing or absorption through the skin.

Decomposition of sodium cyanide solid or solution to hydrogen cyanide gas may result in exposure by inhalation. Exposure by all routes is considered to be potentially toxic. Death may occur if exposure is excessive or prolonged.

However sodium cyanide solution is manufactured as a strongly alkaline product (pH is in excess of 13) which stabilises the sodium cyanide and ensures that hydrogen cyanide is not generated under normal conditions of storage, handling and use.

5.5 HYDROGEN CYANIDE

Generation of hydrogen cyanide may occur in emergency situations involving sodium cyanide. Inhalation of HCN in concentrations greater than 270 ppm is immediately fatal.

Table 1 provides a summary of the health effects to the prolonged exposure of Hydrogen Cyanide vapour at varying ppm.

Table 1 - Health Effects Of Hydrogen Cyanide Vapour

Concentration	Comment Or Effect
2 - 5 ppm	A characteristic smell of "bitter almonds" detectable by some people.
Less than 10 ppm	Probable concentration 50 metres downwind of the core of a sodium cyanide solution spill.
10 ppm	NOHSC peak limitation exposure standard. Employees should not be exposed to concentrations higher than this level at any time.
18 - 36 ppm	Slight symptoms of cyanide poisoning after several hours.
45 - 54 ppm	Tolerated for only half to one hour without effects.
Greater than 100 ppm	Estimated concentration at the core of a sodium cyanide solution spill depending upon air temperature, soil type and condition
110 - 135 ppm	Fatal after half to one hour.
270 ppm and over	Immediately fatal.

6. TREATMENT FOR EXPOSURE TO SODIUM CYANIDE

Cyanides are extremely toxic by all routes and precautions should always be aimed at nil contact. This section deals with the first aid and medical treatment procedures for dealing with victims of cyanide poisoning.

6.1 FIRST AID TREATMENT

6.1.1 Swallowed or inhaled

For all victims that have been exposed to cyanide it is imperative that the victim is removed from the source of exposure and that medical assistance is sought. Rescue personnel must take care to avoid becoming a victim themselves.

- **If the patient is not breathing:**
  - Remove from source of exposure;
  - Ensure airway is clear;
  - Wash face, lips and mouth;
  - Do not give anything by mouth;
  - Commence resuscitation using a mechanical resuscitator (eg, mask and bellows, or Oxy-viva);
  - If equipment is available, oxygen should be administered by a qualified person; and
  - If cardiac arrest occurs, i.e. no pulse present, commence cardiopulmonary resuscitation (CPR).
- **If the patient is unconscious but breathing:**
  - Remove from source of exposure;
  - Do not give anything by mouth;
  - Lay the patient on his side, ensuring that the airway is clear;
  - If equipment is available a qualified person should administer oxygen;
  - A qualified person should administer Amyl Nitrite if available.
- **If the patient is conscious:**
  - Remove from source of exposure;
  - Instruct the patient to rinse and spit mouth with water alternately until burning, tingling or unpleasant taste has ceased. Patient must be told NOT to swallow contents of mouth when washing/spitting procedure is performed
  - Do not give other solids or liquids by mouth

- Do not give Ipecac syrup or other emetics
- Rest and reassure the patient who may become agitated
- If equipment is available a qualified person should administer oxygen;
- A qualified person should administer Amyl Nitrite if available.

Note: Rescue/first aid personnel must take care to prevent cross contamination from the patient by removing all contaminated clothing, footwear and accessories.

6.1.2 Contact with Skin

- Remove contaminated clothing, footwear and accessories.
- Wash skin thoroughly with water. Take care to prevent contaminated wash water entering eyes or mouth
- Treat as per Section 6.1.1

Note: Effects may be delayed, e.g. ½ hour later.

6.1.3 Contact with Eyes

- Immediately wash eye(s) with copious quantities of water for at least 20 minutes. Eyelid(s) should be held open during washing process. If practical take care to prevent contaminated wash water entering mouth (and contacting unaffected skin areas).
- Ensure contaminated clothing has been removed
- Treat as per Section 6.1.1

For all first aid procedures, after commencing first aid, transfer the patient by ambulance URGENTLY to the nearest hospital casualty department accompanied preferably by a first aid person qualified to use the oxygen equipment and with a Cyanide Poisoning Medical Treatment Kit if available. Note that ambulances are not able to accept patients until they have been decontaminated

Note: Ambulances are not able to accept patients until they have been decontaminated

6.2 MEDICAL TREATMENT

6.2.1 Introduction

Cyanide poisoning occurs rapidly after exposure. If the patient is conscious after the usual time (30 minutes) required to reach hospital then exposure to the cyanide source either from inhalation, ingestion or skin contamination is unlikely to have resulted in a significant amount of cyanide being absorbed. In these circumstances the patient should be observed carefully with particular attention being given to the state of consciousness.

6.2.2 Advice to Doctor

- **Treatment should include the following measures:**
  - Immediate attention should be directed towards assisted ventilation, administration of 100 % oxygen, insertion of intravenous lines and institution of cardiac monitoring, if available;
  - Attention should be given to monitoring the level of consciousness;
  - Administer antidote if signs of serious cyanide poisoning are present:
  - Insert indwelling cannula into vein:\
  - Take 5 mL of blood in a plain clotted tube (red top in Western Australia) for later confirmation of diagnosis by measurement of the cyanide level. (Take blood in a heparinised tube and place on ice for immediate transfer to laboratory if direct testing for cyanide levels is available). At the same time take blood for lactic acid level (urgent). An elevated lactic acid level is a useful test to assist in confirmation of the diagnosis.

Note: Cyanide poisoning is a clinical diagnosis and treatment is instigated on clinical grounds.

- **Treatment path**
  - Administer intravenously 5 to 15 grams of hydroxycobalamine over 30 minutes, or faster if necessary. In the Cyanide Emergency Kit these are made up of two 2·5 gram doses that are set to be re-constituted with the saline in the plastic transfer device. An IV giving set is to be inserted into the re-constituted IV hydroxycobalamine bottle. If this has been left in the cardboard packet, it can be hung like an IV bottle through the hole in the top of the box;
  - Also administer sodium thiosulphate 12·5 grams over 10 to 20 minutes with the hydroxycobalamine;

Note: Hydroxycobalamine is the recommended treatment in patients in whom the diagnosis is not clear and where there is a clinical suspicion of cyanide poisoning.

  - If cyanide has been swallowed, whilst gastric lavage, charcoal and cathartics may be used after an antidote therapy, if less than two hours have passed since ingestion, there is little evidence to support a benefit and one should take the advice of an emergency care physicians prior to commencing;
  - Obtain an arterial blood gas measurement immediately, and correct any severe metabolic acidosis (pH below 7·20) with bicarbonate;

Note: The best way to treat metabolic and cardiorespiratory complications of cyanide poisoning is the use of an appropriate antidote

- **Supportive care should include the following measures:**
    - All patients with suspected, or proven, cyanide poisoning should be taken to hospital for evaluation and observation:
    - Follow the patient's progress for at least 24 hours;
    - Watch for the development for pulmonary oedema and aspiration pneumonia in comatose patients
    - Consider more antidote if there is a persistent metabolic acidosis. Bicarbonate can be used cautiously. Correct metabolic acidosis with bicarbonate when blood pH falls below 7·20, and be sure to correct electrolyte imbalance (for example, hyperkalemia, hypercalcemia);
    - Oxygen requirement would be expected to decrease after successful administration of the antidote

7. CYANIDE IN THE ENVIRONMENT

Sodium cyanide is not persistent in the environment – it is readily decomposed by abiotic degradation and hydrolysis to form stable, non-toxic complexes. However, while present in suitable concentrations, cyanide is toxic to flora, fauna and marine life.

Table 2 provides the median effective concentration (EC50) – the concentration at which a certain effect is likely to occur in 50% of the tested organisms under test conditions.

Table 2 – Median Effective Concentration Against Organisms

Organism	EC50
Fish	0.042 mg(CN-)/L over 96 days
Birds	2.5 mg(CN-)/L over 96 days
Terrestrial Plants	22.4 mg(CN-)/L over 32 days
Bacteria	0.6 mg(CN-)/L over 30 min
Soil Organisms	11 mg(CN-)/L over 96 days

8. VESSEL SECURITY AND DESIGN

8.1 VESSEL DESIGN

8.1.1 Sodium Cyanide Solution Isotainers

- **18 Kl Sodium Cyanide Solution Isotainers.**

Sodium Cyanide Solution 18 Kl Isotainers with support frames are of standard ISO dimensions, 6058 mm long, 2438 mm wide and 2591 mm high with a tare weight of 4.2 tonnes.

They are designed and constructed of carbon steel to the IMDG Code for IMO Type 1 vessels, and satisfy the requirements of the Australian Code for the Transport of Dangerous Goods by Road and Rail (7th Edition).

They are approved for road transport by the Competent Authority and meet the requirements of the Dangerous Goods Safety (Road and Rail Transport of Non-Explosives) Regulations 2007.

The gross mass of each loaded isotainer is 24.8 tonnes including 20.6 tonnes of sodium cyanide solution at 30% concentration at S.G. of 1.19.

All fittings are located inside a protective coaming on top of the containers. There are no bottom openings in the vessels.

Table 3 – 18Kl Isotainer Coaming Box Fittings and Type

Fitting	Type
Compressed Air Connection (N1)	25 NB flanged valve and blind flange
Discharge Connection (N2)	80 NB flanged valve and blind flange
Pressure Relief Valve (N3)	65 NB relief valve and bursting disc
Fill Connection (N5)	80 NB Kamvalok adapter and screwed cap
Vent Connection (N4)	50 NB flanged valve and blind flange
Spare Nozzle (N6)	65 NB flange with blind flange

- **22Kl Sodium Cyanide Solution Isotainers.**

Sodium Cyanide Solution 22Kl Isotainers with support frames are of standard ISO dimensions, 6058 mm long, 2438 mm wide and 2591 mm high with a tare weight of 3.6 tonnes.

They are designed and constructed of stainless steel to the requirements of T-14 UN Portable tanks and IMDG T14, and satisfy the requirements of the Australian Code for the Transport of Dangerous Goods by Road and Rail (7th Edition).

They are approved for road transport by the Competent Authority and meet the requirements of the Dangerous Goods Safety (Road and Rail Transport of Non-Explosives) Regulations 2007.

The gross mass of each loaded isotainer is up to 27.8 tonnes including 24.2 tonnes of sodium cyanide solution at 30% concentration at S.G. of 1.19.

All fittings are located inside a protective coaming on top of the containers. There are no bottom openings in the vessels.

Table 4 – 22Kl Isotainer Coaming Box Fittings and Type

Fitting	Type
Compressed Air Connection (N1)	25 NB flanged valve and blind flange
Discharge Connection (N2)	80 NB flanged valve and blind flange
Pressure Relief Valve (N3)	65 NB relief valve and bursting disc
Fill Connection (N5)	80 NB Kamvalok adapter and screwed cap
Vent Connection (N4)	50 NB flanged valve and blind flange

8.1.2 Sodium Cyanide Solids to Solution (STS)

The isotainers with support frames are of standard ISO dimensions, 6058 mm long, 2438 mm wide and 2591 mm high.

They are designed and constructed of stainless steel to the IMDG Code for IMO Type 1 vessels, and satisfy the requirements of the Australian Code for the Transport of Dangerous Goods by Road and Rail (7th Edition).

They are approved for road transport by the Competent Authority and meet the requirements of the Dangerous Goods Safety (Road and Rail Transport of Non-Explosives) Regulations 2007.

The gross mass of each loaded isotainer is 22.2 tonnes including 18 tonnes of solid sodium cyanide briquettes at 98% concentration at S.G. of 1.60.

The vessel design conditions are 275 kPa positive pressure to 60 kPa negative pressure.

All fittings are located inside a protective box on the bottom of the container. The box has a lockable hinged lid and contains:

Table 5 – STS Isotainer Fittings and Type

Fitting	Type
Inlet	150 NB male camlock
Outlet	150 NB male camlock

There are two man ways, one at either end of the vessel. One is 600 mm and the other is 400 mm.

8.1.3 Solid Sodium Cyanide

AGR's solid sodium cyanide is packaged in Intermediate Bulk Containers (IBC's) of 1000kg capacity. The briquettes are stored within a woven polypropylene bag, sealed within a PVC plastic liner, within a wooden crate. Packaging complies with International Maritime Dangerous Goods Code for Group 1 hazardous goods, and has been subjected to the relevant tests required by the Code. The Competent Authority has approved this specific design of IBC, which cannot be modified without undergoing the full approval process.

Consignments of stock are transported in standard shipping containers (seatainers), usually containing 20 nett tonnes of product. The majority of seatainers used are hired units which pass through a container depot, where they are inspected for cleanliness and sea-worthiness, before being delivered to CSBP. At CSBP, if any signs of contamination or damage are observed by the despatchers, the seatainers will not be loaded.

The procedure and requirements for sea container inspections is detailed in CSBP-DP-09-110-23 *Solid Sodium Cyanide – Procedure for Delivery and Despatch of Empty and Full Sea Containers* and CSBP-OP-KC-006-18 *SCS – Despatch – Receivals and Despatch*.

8.2 SECURITY

8.2.1 Restraint

- **Rail Transport**

During rail transport the isotainers are secured by twist-locks onto designated flat-top rail wagons.

Each standard gauge wagon will accommodate two isotainers.

The twist-locks are designed to ensure that, in the event of a derailment the container will remain secured to the wagon.

- **Road Transport**

The twist-locks used for securing the isotainers to the rail wagons are the similar to those used for securing the isotainers to road trailers.

8.2.2 Fittings

- **Solution Isotainers**

All sodium cyanide solution isotainer fittings are secured inside a protective coaming on top of the containers. There are no bottom openings in the vessels. The sodium cyanide solution isotainer is accompanied at all times during the loading and unloading processes

- **Solid to Solution Isotainers**

All sodium cyanide solid to solution isotainer fittings are secured inside a protective box at the bottom of the containers. The sodium cyanide solid to solution isotainer is accompanied at all times during the loading and unloading processes.

8.2.3 Seal

The seatainers are padlocked and/or tagged with a security seal for the duration of their transport and storage.

8.2.4 Wharf

At the wharf, containers of sodium cyanide are held in a restricted area of the berth. Approval has been received from Fremantle Port and the Competent Authority to hold the containers in this area for up to five days prior to loading.

Containers of sodium cyanide may also be delivered direct to the wharf, within twelve hours of being loaded onto a ship.

Should there be any form of disruption at the port that threatens the cyanide containers, or any delays that could force the holding time beyond five days, the cyanide containers may be uplifted and returned to the Kwinana site, after consultation with the Competent Authority.

8.3 PLACARDING

The isotainers are dedicated to the transport of sodium cyanide and are marked with the required emergency information panels and placarding, in accordance with the Australian Dangerous Goods Code Edition 7.

Similarly, seatainers used for the transport of solids are placarded with the relevant signage, either on the container itself, or on the trailer.

8.4 TRANSPORT ROUTES

AGR transports cyanide along recognised Dangerous Goods routes, classified by the Competent Authorities.

The specific routes that AGR uses are selected based on their load rating, location and surroundings, where possible, bypassing built up areas.

Where a new customer, or changes to the road or rail system make it necessary or desirable to alter the specified route, AGR will select the new route, based on the criteria listed above, and liaise with the Local Government Authorities and Competent Authority, on the intended change.

Where a change in a transport route crosses into a local government area that has not previously been used for sodium cyanide transport, AGR will notify the local government and establish, with them, what consultative processes, and emergency response planning and training should be undertaken.

8.4.1 Rail

The normal rail routes for the transportation of solid and solution sodium cyanide are provided in the table below.

Table 6 – Rail Routes

1. Kwinana – West Kalgoorlie Rail Yard		
From/To	**To/From**	**Product**
AGR Siding	Kwinana Works	Solid and Solution Cyanide
Kwinana Works	Forrestfield Marshalling Yard	
Forrestfield Marshalling Yard	West Kalgoorlie Rail Yard	
2. Perth – Adelaide Rail Head		
From/To	**To/From**	**Product**
Kewdale Rail Head	Merredin	Solid Cyanide
Merredin	Kalgoorlie/Parkeston	
Kalgoorlie/Parkeston	Cook	
Cook	Spencer Junction	
Spencer Junction	Adelaide Rail Head	

3. Adelaide – Berrimah Rail Head (Darwin)		
From/To	**To/From**	**Product**
Adelaide Rail Head	Port Augusta	Solid Cyanide
Port Augusta	Alice Springs	
Alice Springs	Darwin Port East Arm	

8.4.2 Road

Single semi-trailer, pocket-double, and standard-double road-train configurations are used for the appropriate sections of the road routes.

The normal road routes for the transportation of solid and solution sodium cyanide are provided in the table below.

Table 7 –Road Transport Routes Out of Kwinana

1. Kwinana to Fremantle Port		
From/To	**To/From**	**Product**
Kwinana Beach Rd	Patterson Rd	Solid Sodium Cyanide
Patterson Rd	Rockingham Rd	
Rockingham Rd	Stock Rd	
Stock Rd	Leach Hwy	
Leach Hwy	High St	
High St	Stirling Hwy	
Stirling Hwy	Tydeman Rd **(to Patricks Terminal)**	
Rudderham Dr	Port Beach Rd	
Port Beach Rd	Rudderham Dr	
Rudderham Dr	North Mole Dr	
North Mole Dr	Rous Head Rd	
Rous Head Rd	Birksgate Rd	
Birksgate Rd	Port Beach Rd **(to DP World)**	
2. Kwinana to Kwinana Rail Yard		
From/To	**To/From**	**Product**
Kwinana Beach Rd	Patterson Rd	Solid and Solution Cyanide
Patterson Rd	Beach Rd	
Beach Rd	Mandurah Rd **(to Qube Kwinana)**	
Mandurah Rd	Butcher St **(to Rail Yard)**	
3. Kwinana to the Northern Goldfields		
From/To	**To/From**	**Product**
Kwinana Beach Rd	Patterson Rd	Solid and Solution Cyanide
Patterson Rd	Rockingham Rd	
Rockingham Rd	Thomas Rd	
Thomas Rd	Kwinana Fwy	
Kwinana Fwy	Roe Hwy	
Roe Hwy	Great Northern Hwy	
	Tonkin Hwy Abernathy Rd Kewdale Rd Fenton St **(for Intermodal Transit)**	

Great Northern Hwy	Warrierdar Rd, Minesite Access Rd **(to Minjar)** Mine Access Rd **(to Deflector)**	Solid and Solution Cyanide
	Minesite Access Rd **(to Kirkalocka)**	
	Cue Wondinong Rd, Minesite Access Rd **(to Tuckabianna)**	
	Marble Bar Rd, Minesite Access Rd **(to Nullagine)**	
	Minesite Access Rd **(to Bluebird)**	
	Richardson St, Mt Farmer Rd Minesite Access Rd **(to Dalgaranga)**	
	Hill Fifty Rd, Mount Rd, Palmer Well Rd Minesite Access Rd **(to Mt Magnet)**	
Great Northern Hwy	Ashburton Downs- Meekatharra Rd Minesite Access Rd **(to Fortnum)**	Solid and Solution Cyanide
	Mt Magnet – Sandstone Rd Agnew – Sandstone Rd Goldfields Hwy Minesite Access Rd **(Various Mines)**	
	Lamboo Rd Minesite Access Rd **(to Pantoro)**	
4. Kwinana to the Westonia Return to West Kalgoorlie		
From/To	**To/From**	**Product**
Kwinana works to Kwinana Beach Rd	Patterson Rd	Solid and Solution Cyanide
Patterson Rd	Rockingham Rd	
Rockingham Rd	Thomas Rd	
Thomas Rd	Kwinana Fwy	
Kwinana Fwy	Roe Hwy	
Roe Hwy	Great Eastern Hwy (via Northam Bypass)	
Great Eastern Hwy	Carribin/Westonia Rd Mine Site access Rd (**to Edna May**)	
	West Kalgoorlie Rd **(to West Kalgoorlie Rail Yard)**	
5. Kwinana to the Boddington Gold Mine		
From/To	**To/From**	**Product**
Kwinana works to Kwinana Beach Rd	Patterson Rd	Solid and Solution Cyanide
Patterson Rd	Rockingham Rd	
Rockingham Rd	Thomas Rd	

Thomas Rd	Tonkin Hwy ***Southwest Hwy (if truck is diverted)***	
Tonkin Hwy	Armadale Rd	
Armadale Rd ***Southwest Hwy (if truck is diverted)***	Albany Hwy	
Albany Hwy	Bannister-Marridong Rd	
Bannister-Marridong Rd	Gold Mine Rd	

Table 8 –Road Transport Routes Out of Kalgoorlie

1. West Kalgoorlie Rail Terminal – Qube Bulk (Transit)		
From/To	**To/From**	**Product**
West Kalgoorlie Rd	Anzac Dr	Solid and Solution Cyanide
Anzac Dr	Broadwood Ave	
Broadwood Ave	Percy Rd	
Percy Rd	Epis St	
Epis St	Kybo St	
2. West Kalgoorlie Rail Terminal – South		
From/To	**To/From**	**Product**
West Kalgoorlie Rd	Anzac Dr	Solid and Solution Cyanide
Anzac Dr	Goldfeilds Hwy **(to Jubilee)**	
Goldfields Hwy	Durkin Rd Silverlakes Rd St Ives Rd Minesite Access Rd **(to St Ives)**	
	Coolgardie-Esperance Hwy	
Coolgardie-Esperance Hwy	Minesite Access Rd **(to Higginsville)**	
	Eyre Hwy Minesite Access Rd **(to Central Norseman Gold)**	
3. West Kalgoorlie Rail Terminal – North		
From/To	**To/From**	**Product**
West Kalgoorlie Rd	Anzac Dr	Solid and Solution Cyanide
Anzac Dr	Goldfeilds Hwy	
Goldfeilds Hwy	Leonora - Laverton Rd Red october Rd Old Leonora Laverton Rd Mt Monger Rd Minesite Access Rd **(to Dacian)**	
	Leonora - Laverton Rd Laverton Bypass Great Cerntral Rd Minesite Access Rd **(to Gruyere)**	

Goldfeilds Hwy	Leonora - Laverton Rd Laverton Bypass Mt Weld Rd Minesite Access Rd **(to Granny Smith)** Minesite Access Rd **(to Sunrise Dam)**	Solid and Solution Cyanide
	Agnew–Leinster Rd Agnew–Vivien Rd Agnew-Lake Miranda Rd Minesite Access Rd **(to Agnew)**	
	Wotton St Wells St Wongonal Rd Minesite Access Rd **(to Matilda)**	
	Research Station Rd Jundee Rd Minesite Access Rd **(to Jundee)**	
	Minesite Access Rd **(to Gidgi)** Minesite Access Rd **(to Paddington)** Minesite Access Rd **(to Thunderbox)**	
	Cane Grass Rd Davyhurst-Ora Banda Rd Minesite Access Rd **(to Davyhurst)**	
4. West Kalgoorlie Rail Terminal – West		
From/To	**To/From**	**Product**
West Kalgoorlie Rd	Gt Eastern Hwy	Solid and Solution Cyanide
Gt Eastern Hwy	Kandana Rd Minesite Access Rd **(to Mungari)**	
	Cairns Rd N Coolgardie Rd Minesite Accss Rd **(to Beacon)**	
	Lady Loch Rd Napean Rd Minesite Access Rd **(to Burbanks)**	
	Minesite Access Rd **(to Greenfields)**	
	Southern Cross-Marvel Loch Rd Minesite Access Rd **(to Marvel Loch)**	
5. West Kalgoorlie Rail Terminal – East		
From/To	**To/From**	**Product**
West Kalgoorlie Rd	Anzac Dr	Solid and Solution Cyanide
Anzac Dr	Goldfeilds Hwy	
Goldfeilds Hwy	Mt Monger Rd Minesite AccessRd **(to Lakewoods)** Minesite Access Rd **(to Randalls)**	
Goldfeilds Hwy	Boorara Rd	
Boorara Rd	Black St **(to Fimiston)**	
Black St	Yarri Rd	
Yarri Rd	Minesite Access Rd **(to Kanowna Belle)**	
	Minesite Access Rd **(to Carosue Dam)**	
	Kurnalpi-Pionjin Rd Minesite Access Rd **(to Tropicana)**	

Table 9 –Road Transport Routes Out of Adelaide

1. Adelaide Rail Terminal – Toll Intermodal Depot		
To/From	**To/From**	**Product**
Pedder Cres	Toll Intermodal Depot Adelaide	Solid Sodium Cyanide
2. Toll Intermodal Depot Adelaide – North East South Australia		
To/From	**To/From**	**Product**
Pedder Cres	Regency Rd	Solid Sodium Cyanide
Regency Rd	Port Express Way	
Port Express Way	Port Wakefield Rd	
Port Wakefield Rd	Northern Expressway	
Northern Expressway	National Hwy M20	
National Hwy M20	National HWY A20	
National HWY A20	Barrier HWY A3 Minesite Access Rd **(to White Dam)**	
3. Toll Intermodal Depot Adelaide – New South Wales		
To/From	**To/From**	**Product**
Pedder Cres	Regency Rd	Solid Sodium Cyanide
Regency Rd	Port Express Way	
Port Express Way	Port Wakefield Rd	
Port Wakefield Rd	Northern Expressway	
Northern Expressway	National Hwy M20	
National Hwy M20	National HWY A20	
National HWY A20	Cobb Hwy	
Cobb Hwy	Mid-Western Hwy	
Mid-Western Hwy	Ungarie Rd	
Ungarie Rd	West Wyalong-Condobolin Rd	
West Wyalong-Condobolin Rd	Bathurst St	
Bathurst St	Melrose St	
Melrose St	Henry Parkes Way	
Henry Parkes Way	Albert Rd	
Albert Rd	Mineral Hill Rd Minesite Access Rd **(to Mineral Hill)**	
4. Toll Intermodal Depot Adelaide – Victoria		
To/From	**To/From**	**Product**
Pedder Cres	Regency Rd	Solid Sodium Cyanide
Regency Rd	Churchill Rd	
Churchill Rd	Torrens Rd	
Torrens Rd	City Ring Rte/	
City Ring Rte/	Princess Hwy	
Princess Hwy	National Highway M1	
National Highway M1	National Highway A1	
National Highway A1	National Highway A8	
National Highway A8	Seaby St Scallan St Stawell-Avoca Rd London Rd Patrick St Oregan St	

	Albion Rd Leviathan Rd Mine Site Access Rd **(to Stawell)**	
National Highway A8	Wimmera Hwy	
Wimmera Hwy	Sunraysia Hwy	
Sunraysia Hwy	Wimmera Hwy	
Wimmera Hwy	Calder Alternative Hwy	
Calder Alternative Hwy	Calder Hwy	
Calder Hwy	Allies Rd	
Allies Rd	Loddon Valley Hwy	
Loddon Valley	Victoria St	
Hwy	Averys Rd	
Victoria St	Howard St	
Averys Rd	Taylor St	
Howard St	Epsom-Barnadown	
Taylor St	Axedale-Goornong Rd	
Epsom-Barnadown	Epsom-Fosterville Rd	
Epsom-Fosterville Rd	Minesite Access Rd **(to Fosterville)**	

Table 10 –Road Transport Routes Out of Darwin

1. Toll NQX Depot Darwin – South		
To/From	**To/From**	**Product**
O'Sullivan Circuit	Export Dr	Solid Sodium Cyanide
Export Dr	Berrimah Rd	
Berrimah Rd	Wishart Rd	
Wishart Rd	Tiger Brennan Dr	
Tiger Brennan Dr	Stuart Hwy (National Hwy 1)	
Stuart Hwy (National Hwy 1)	Minesite Access Rd **(to Union Reef)**	

8.5 TRANSPORT TIMES AND CURFEWS

Solution cyanide leaving Kwinana by road must depart the CSBP site at times that will allow the driver to clear the metropolitan area without encountering significant traffic build-ups. CSBP regulates these departure times during day-time hours to between **1000hrs and 1400hrs** and evening hours between **1800 hrs and 0500 hrs**.

An extension to day-time departures may be authorised by AGR/CSBP under extraordinary circumstances and only after a risk assessment is conducted. Departures outside the prescribed timings are to be recorded and risk assessments kept on file in the event of an incident.

Departure times from West Kalgoorlie are not subject to the same curfew times as the Kwinana Depot (apart from the standard quiet time period of 0000hrs – 0400hrs).

All vehicles transporting sodium cyanide on behalf of AGR are to cease transport operations between the hours of 0000 hrs – 0400 hrs where it is safe and practicable to do so. This period is to be used for fatigue management and rest during this hazardous period.

Exemptions to this control may be authorised by AGR in extraordinary circumstances.

There are no time restrictions on the departure times for transport of solid cyanide for export via Fremantle Port.

Table 11 – Transport Times

AGR Departure Time	Comment
0500 h - 1000 h	Not permitted for normal delivery activity* (Kwinana Only)
1000 h – 1400 h	Permitted
1400 h – 1800 h	Not permitted for normal delivery activity* (Kwinana Only)
1800 h – 0500 h	Permitted
0000 h – 0400 h	No Vehicle Movement – quiet time (all sites)
** Extension may be authorised by CSBP under extraordinary circumstances.*	

8.6 VEHICLE TRACKING

Vehicles transporting sodium cyanide through sensitive or remote areas must be fitted with a satellite tracking system. These systems allow the position of the vehicle to be monitored, and will raise an alarm if the following conditions arise:

a. Stopping for more than ten minutes in a built up area, or without logging off.

b. Vehicle in motion without logging on.

c. Departing from the designated transport route by greater than 250 m.

d. Driver activated duress.

The driver must:

a. Log on to the system when leaving Kwinana, or the West Kalgoorlie.

b. Log off and on for rest breaks.

c. Log off when arriving and log on when leaving a minesite.

d. Log off when arrived back at Kwinana or West Kalgoorlie.

Vehicles transporting containers of solid sodium cyanide are not required to have satellite tracking when transporting the product within a 50km radius of CSBP Kwinana works. The driver however must report to their transport base on departure from Kwinana and arrival at their destination, and the transport base must have a system for flagging over-due trucks. These destinations currently would be either:

- the Fremantle Port – Patrick's and P&O container terminals, or
- Kewdale for delivery to the Interstate rail yard.

8.7 TRANSPORT ROUTE REVIEW AND RISK ASSESSMENT

The process for the review of transport routes and updating of the transport risk assessment is described in procedure Cyanide Transport Route Review and Risk Assessment (CSBP-DP-09-110-18).

A full route review and update of the risk assessment must be carried out at least every three years. In the interim, minor reviews may be triggered by small changes to transport routes, emergency response capabilities or sensitive facilities along a route. If any of these changes are determined to be sufficiently significant, a full review and risk assessment will be initiated.

9. EMERGENCY RESPONSE

AGR, through CSBP's emergency response team, provides offsite support in the event of an incident involving its sodium cyanide product. A coordinated response effort involves the appropriate combat authorities including Police, Fire and Rescue Service, transport carriers and minesite personnel if appropriate. The following section outlines the alerting and communication systems used in the event of an incident and the appropriate spill site actions.

9.1 THE ALERTING SYSTEM

9.1.1 The Rail System

The Rail Operator, the train operator, has the task of delivering containerised sodium cyanide to West Kalgoorlie from the AGR, rail serviced production plant at Kwinana. Both locations are on the standard gauge railway between Kwinana and Kalgoorlie and on the main west-east rail corridor.

All The Rail Operator locomotives used for transport of sodium cyanide are equipped with communication systems. All standard gauge trains are in constant contact with Train Control Centres enroute (Perth/Northam/Merredin/Kalgoorlie).

In addition to radio communication, all railway signals enroute are equipped with Arc Infrastructure (Track Operator) telephones connected to the nearest Train Control Centre. The set scheduling and controlling system operated by Arc Infrastructure is also in itself an alerting system. This system operates in the following way:

a. For standard gauge lines between Kwinana and Kalgoorlie, train positions are shown on a panel at the train control office and controllers operate a switch to allow trains to pass from one section to the next. Red indicator lights show the passage of a train through a section.

Note: Non-arrival of a train at the end of a section at the scheduled time alerts train control that a problem has occurred. The time to traverse a section is between fifteen and thirty minutes for standard gauge lines.

9.1.2 Road System

The road vehicle prime movers are equipped for satellite and mobile phone communication with either the transport operator's central or local base. This ensures that contact can always be established in case of emergency.

The vehicle tracking system described in Section 8.6, will raise an alarm if the driver is incapacitated.

In the event of a road closure, vehicles may only be diverted along alternative routes with the consent of the Competent Authority.

9.2 ALARM COMMUNICATIONS

9.2.1 Raising of Alarm

In an emergency involving rail transport, the communication would likely be made by an The Rail Operator locomotive operator via the locomotives communication systems or by a member of the public dialling the emergency number or supplier's contact number on the EIP.

In a road vehicle emergency, the communication would most likely be by telephone to the emergency number or supplier's contact number on the EIP, or by a police patrol vehicle.

When the emergency number is called, the telephone operator will ask 14 basic questions:

- Caller's name?
- Caller's phone number?
- Is this an exercise?
- What is the emergency?
- What assistance is required?
- What is the chemical or material involved?
- What is the U.N. number?
- What is the address or location of the emergency?
- What is the name of the transport company involved?
- Is anyone injured?
- Is a fire involved?
- Is the container leaking liquid?
- Can the public be affected?
- Have emergency services been notified?

The telephone operator (CSBP Security Officer) will repeat the answers back to the caller, and then proceed to activate the CSBP Emergency Response System.

The vehicle operator's responsibility in the event of an emergency is primarily to control the situation until the authorities arrive.

9.2.2 Communication to Participating Organisations

Upon inspecting the site, the Incident Controller (the senior fire officer or in some cases the senior police officer) would assess the need for support and the extent required from the participating organisations. CSBP are to be involved immediately in any incident.

On-site information on response would be obtained from:

a. the EIP on the lower right-hand corner of the isotainer (Refer to AGR Vehicle Operators Handbook);

b. Dangerous Goods – Initial Emergency Response Guide (SAA/SNZ HB76:2010);

c. the pocket card carried by police and fire personnel, which interprets the HAZCHEM code on the EIP, providing direction on the correct immediate action to be taken.

In addition, advice would be obtained from:

a. relevant sections of this contingency plan;

b. the supplier CSBP (number given on the EIP – twenty-four hours **1800 093 333**);

c. the DFES chemical information centre (twenty-four hours **(08) 9323 9333**);

d. The Rail Operator Train Management Emergency number (twenty-four hours **(08) 9454 0421 or 9454 0400**).

DFES is the Combat Authority in an emergency and is able to provide detailed information on First Strike Action (the immediate response action to be taken by the emergency services), protective clothing, safety, danger area dimensions, first aid, safety, pollution control, manufacturer identification and telephone contact numbers, and other related information for responding emergency services.

After the site had been assessed and advice had been obtained as necessary from participating organisations, the Incident Controller would determine the on-site assistance required and communicate this to participating organisations.

9.3 ASSEMBLY OF RESPONSE ORGANISATIONS

The Control Authority, usually DFES, is responsible for initiation of alerts, and for the call-out of participating organisations. CSBP will always be called in an emergency situation.

The Rail Operator and the appropriate road transport operator must also have representatives present for incidents involving rail transport or road transport.

9.4 SPILL SITE ACTIONS

9.4.1 Management

The Combat Authority, responsible for all actions involving fire, leak or spillage, is the Department of Fire and Emergency Services (DFES). The senior fire officer on site would be responsible for all spill combat actions.

9.4.2 Public/Personnel Evacuation

Evacuation of the public should only be necessary if hydrogen cyanide is being evolved in a manner that poses public risk.

Risks from hydrogen cyanide in the close vicinity of a spill should only arise if:

a. the sodium cyanide comes into contact with an acid;

b. a solid spill is exposed to moist air or water;

c. a solution spill occurs during high temperature conditions or the solution spills onto hot ground;

d. a spill occurs in a relatively contained area with poor ventilation.

DFES, Health Department, Department of Environment, AGR and CSBP are equipped with gas monitoring equipment and can determine whether there is a risk of hydrogen cyanide evolution. In addition, many gold mines have this equipment and personnel trained in its use.

If hydrogen cyanide evolution is a concern, the immediate area must be evacuated until declared safe.

9.4.3 Notification of Water Resource Consumers

If a spill occurs near a water resource and there is a possibility of contamination of the water resource, the Incident Controller should notify the Water Corporation on **131375** who will advise all potential water resource consumers that the resource should not be used until the Water Corporation has completed tests and issued clearance.

A water resource in this context includes any such resource used for either domestic or stock use, and may include catchment dams and borefields.

9.4.4 Definition of Control Area

A control area should be defined by the Incident Controller in accordance with WESTPLAN HAZMAT procedures (https://www.oem.wa.gov.au/resources/legislation-and-policy-framework/plan/westplans). The control area should include the combat area defined by the Combat Authority and specialist advisers.

9.5 CSBP OFFSITE EMERGENCY RESPONSE

CSBP maintains an emergency response arrangement to manage off-site incidents involving our products that are produced and/or marketed within Western Australia. These arrangements are designed to assist local response authorities with advice, and practical assistance in the containment and recovery of our products following unforeseen incidents.

CSBP offers an incident reporting and technical advice service for over-seas incidents involving exported solid sodium cyanide.

Emergency response equipment and safe handling training has been given to the over-seas transporters of cyanide.

9.5.1 Concept of Operations

An off-site incident is usually reported to CSBP by the use of the **1800 093 333** telephone number. This number links the person reporting the incident with the Kwinana Gatehouse. The Security Officer records the details and transmits the information to CSBP's Incident Management Team (IMT) via an SMS message to the team members' mobile phones.

Where the emergency notification is not via the 1800 number, for instance a direct call to a country depot or Kwinana works, the person taking the call will then make a 1800 call to the Kwinana Gatehouse.

9.5.2 Offsite Response Procedure

In the event of an offsite incident the following procedure is adopted.

a. The incident is reported to the IMT member via SMS.

b. The Duty Incident Controller (IC) acknowledges the message and the IMT members report to the Emergency Control Centre (ECC).

c. The IC or Shift Supervisor contacts and confirms the current status of the incident with the person who originally reported the incident.

d. The IC briefs the Crisis Management Team Coordinator on the incident.

e. The IC may stand-down part or all of the IMT at this time, dependent upon the need.

f. Dependent upon the circumstances, CSBP's Emergency Response Team (ERT) or part thereof is dispatched to the incident site. Travel to the incident site may involve the use of chartered aircraft or movement by CSBP ER vehicles or both.

g. On arrival at the incident site the On Scene Commander (OSC) will liaise directly with local authorities and support agencies. The OSC will keep the IMT fully informed of development at the incident site.

h. At the site the OSC will provide advice and support to the local authorities as appropriate and required.

i. The OSC will direct the ERT to resolve the incident, in co-operation with Emergency Responders.

j. At the completion of the incident the OSC will advise the IC and arrange a debrief with the ERT upon return to Kwinana.

k. A post incident analysis (PIA) will be conducted at a convenient time following the incident.

Where the incident involves exported sodium cyanide, the AGR representative will establish contact with the relevant customer and/or transporter, and establish what level of assistance is required from them.

9.5.3 Emergency Response Team Composition

The ERT consist of two teams (team alpha and team bravo) recruited from regular day-employees from the various business units within CSBP. The ERT is capable of a rapid response together with specialist equipment to any incident site. The following personnel may also be involved:

- Senior Manager,
- Specific Technical Advisor,
- Chemical Sales/Technical Representative.

9.5.4 Emergency Response Team Role and Responsibility

The ERTs are concerned with transport routes serviced by The Rail Operator and transport contractors, and the customers' premises.

The role of the ERT at the incident site is to advise and assist the attending emergency service providers in the implementation of appropriate emergency response action to contain the situation.

9.5.5 Training

Cyanide emergency exercises are conducted bi-annually, involving transport contractors and State Emergency Services.

ERT training is conducted fortnightly for each team.

Training is organised by CSBP's Emergency Services Support Officer who develops the strategies and training outcomes.

9.5.6 Audits

CSBP's Emergency Response Procedures are to be audited periodically in line with CSBP Management of Emergency Procedure (MoE) CSBP-RM-11-110-02.

An audit of the CSBP Management of Emergencies Procedure and associated documents will be audited every 24 months. Scheduling of the audit is to be 12 moths from the last document review.

9.5.7 Equipment

CSBP has specific ERT equipment to enable them to respond to an incident, without depleting the Works' equipment resources. The major ERT equipment is listed below:

- Six Tonne Prime mover (used primarily for off site response),
- Three Tonne Prime mover,
- 4 x 4 Toyota Landcruiser,
- Ammonia pumping Trailer (used primarily for offsite response).

The contents of the six tonne truck are detailed in Emergency Response Vehicle 6T. Equipment List. (CSBP-SF-11-010-17)

9.6 ISOLATION DISTANCE FOR SPILLS OF CYANIDE

Work performed by the WA Chemistry Centre of the Department of Mines in 1989/90 showed that at 50 metres from the perimeter of a spill of solution cyanide, the concentration of hydrogen cyanide is at safe levels, provided the spill has not contacted acids.

The DFES standard isolation distance is a minimum of 70 metres upwind.

One can gauge if the isolation distance from a cyanide solution spill is insufficient if one can detect the odour of ammonia (AGR's 30% sodium cyanide solution contains about 0.3% by weight of ammonia).

If ammonia is detectable, the isolation distance needs to be increased until the odour can no longer be detected.

Irrespective, a minimum distance of 50 metres must be maintained from the perimeter of the spillage. Personnel working within the 50 metre zone must be fully protected.

If significant amounts (several hundred kilograms to several tonnes) of strong acid (e.g. sulphuric, hydrochloric acids) mix with the cyanide spillage, the isolation distance would need to be increased 10 times or more, depending on the quantity of acid involved and the weather conditions. The mixing of acid and cyanide is a very unlikely scenario.

Hydrogen cyanide present above a spill of solid sodium cyanide will vary greatly depending on the conditions in the spill environment. A minimum distance of 50 metres must be maintained from the spill to ensure safety, in case the condition if the spill deteriorates through contact with water or acid.

9.7 ROAD TRANSPORT INCIDENT

Provided the vehicle operator is not injured, he plays an important role until the emergency authorities (DFES and Police) arrive. The driver, by law, must carry the Emergency Procedure Guide for sodium cyanide, or Dangerous Goods – Initial Emergency Response Guide (SAA/SNZ HB76:2010) in the driver's door pocket.

9.7.1 Sodium Cyanide Solution Incident

A scenario demonstrating the role of the vehicle operator and, later, that of AGR/CSBP's off-site emergency team in assisting the lead combat authority is as follows:

a. **The vehicle operator secures the area**

1. Enlisting bystanders as required to keep people and vehicles at least 50 metres away the driver arranges for warning triangles and Danger signs to be placed at the perimeter.

2. With a solution incident, if ammonia can be detected at the 50 metre perimeter, the vehicle operator increases the radius of the secured area until ammonia cannot be detect

b. **Next, he communicates**

1. If the radio/telephone is working and is safely accessible he contacts the DFES on **000**. Depending on the extent and nature of the incident DFES may activate the WESTPLAN HAZMAT immediately or wait until further information becomes available.

2. WESTPLAN HAZMAT can call upon expertise and resources from the multitude of government and private bodies such as: the Water Corporation, Western Australian Government Departments and the manufacturer of the dangerous goods involved.

3. The vehicle operator then contacts CSBP on the 24 hour emergency contact number, **1800 093 333**. The operator will ask for the following information:

4. The telephone operator (CSBP Security Officer) will repeat the information given back to the caller, and then proceed to activate the CSBP Emergency Response System.

    a. The vehicle operator's responsibility in the event of an emergency is primarily to control the situation until the authorities arrive

    b. If he can only communicate via his base, the base radio operator alerts DFES and CSBP.

c. If his radio/telephone is inoperative or inaccessible, the vehicle operator writes responses to the above questions on a sheet of paper, gives it to a bystander and sends him/her off to alert the DFES and CSBP.

5. The IC or the Shift Supervisor acknowledges the SMS message and directs the CSBP On-Scene Commander and off-site team to respond.

6. From the Vehicle Operator's description of his location, or from the transport contractor's satellite tracking system, CSBP's IC identifies any special concerns (e.g. Water bodies) that may be at risk and formulates a plan for addressing the situation.

c. **Contain the Spill**

1. Provided the vehicle operator can retain full control at the scene and avoid endangering himself or others, he can attempt to contain the spill, particularly to prevent it entering waterways. If this can be safely attempted, he puts on his protective equipment:

a. PVC jacket and trousers, or PVC suit,

b. Chemical resistant boots,

c. Full face respirator and filter, and

d. Full length PVC gloves

d. **Remain at the scene:**

1. The driver must stay at the scene and remain in charge until relieved by the authorities

e. Finally the driver must:

1. Provide technical advice until relieved by CSBP/AGR

9.7.2 DFES

DFES is the lead combat authority of dangerous goods emergencies.

a. On arrival the senior fire officer assesses the extent of the emergency and what additional resources he may need. He confers with the vehicle operator, confirming the identity of the chemical and assumes control. The fire officer ensures a good supply of water is readily available or is brought to the site

Note: The vehicle operator remains at the scene to provide technical advice.

b. DFES officers don their protective gear, rescue any injured, and contain the spill to prevent spread and possible entry into drains and waterbodies.

c. The police serve as emergency co-ordinators and take on the duties of securing the area, traffic control and assisting the DFES with communication. The police can also call for assistance from the State Emergency Service, if required.

d. If the incident has the potential to escalate, the senior fire officer activates the WESTPLAN HAZMAT.

e. AGR/CSBP's emergency response team can be called out at this point or earlier if required. This team, (which is on 24 hour alert) usually responds directly to a call received on the 1800 093 333 specialist advice number. It can also be called out by the DFES, Police or under WESTPLAN HAZMAT.

9.7.3 CSBP Emergency Response Team

CSBP's Emergency Response Team is trained to handle incidents associated with cyanide, acids (sulphuric, hydrochloric, nitric), caustic soda, and ammonia.

a. On arrival, the CSBP OSC reports to the senior fire officer.

b. Under the fire officer's direction the CSBP team assists with containing the spill, stops the leak, neutralises and cleans up the spill.

Note: The CSBP crew wear similar protective equipment as used by the DFES personnel.

c. Once the level of hydrogen cyanide gas above the spill is sufficiently low (as determined by the Combat Authority), a full face respirator can be used instead of the self-contained breathing apparatus.

d. Containment of the spill itself can be effected using sand, dirt, limestone, lime or any other non-acidic, solid, insoluble material.

e. The crew then stops the leak

f. Once the spill is prevented from spreading any further, CSBP's OSC communicates with CSBP's Incident Controller and a decision is made to either recover as much of the spillage as possible before neutralising and recovering the residue, or neutralising all the spillage before recovery and removal.

g. In either case AGR/CSBP use ferrous sulphate powder to neutralise sodium cyanide. It will be necessary to spray water on the mixture to ensure adequate mixing. There are stockpiles of ferrous sulphate located strategically along AGR's cyanide solution transport routes.

h. After neutralisation, the mixture is recovered with shovels and/or front-end loaders and trucked to a gold mine for safe disposal.

i. The remaining contents of the isotainer may be transferred to another isotainer, unless the original isotainer can be safely transported under escort.

j. At the end of the clean-up, thorough testing ensures that residual cyanide meets the levels required by the Department of the Environment, which may vary depending on the situation.

k. Finally, DFES personnel and the CSBP team wash down their protective equipment and place it in the containers provided for this purpose.

9.7.4 Sodium Cyanide Solid Incident

In the case of a solid sodium cyanide road transport incident, the same notification process as for solution cyanide applies. Containment of the spill should place a priority on keeping the solids dry, protecting the spill from wind that could disperse cyanide dust, and protecting drains and waterways.

Solid cyanide spills should be shovelled into sealable containers for transport to a minesite. As much of the surrounding dirt should be recovered as is required to leave the site clean. Where solid cyanide has been lost onto wet ground, ferrous sulphate should be used to neutralise the area, as it is for spills of solution cyanide.

Whilst this is a fairly simple scenario, the principles apply irrespective of the magnitude of the loss of containment.

9.8 RAIL TRANSPORT INCIDENT

The principles are very similar except that the train driver raises the alarm by radio. He would strive to secure the area and await the arrival of the emergency authorities. The train driver would not take part in containment or advisory duties.

The Rail Operator operations would:

a. Prevent any other rail traffic entering the area

b. Alert the emergency authorities

c. Alert AGR/CSBP via **1800 093 333.**

The Rail Operator employs an independent “Approved Responder” to control and clean-up product spills in the event of an incident enroute. The Approved Responder is approved by the Department of Mines, Industry Regulation and Safety’s Chief Dangerous Goods Officer based on having exhibited compliance and capability in managing emergency response

The response and clean-up procedure from this point on would involve DFES and the other emergency services supported by the AGR/CSBP off-site team.

In addition The Rail Operator provides storage of a critical neutralising agent, Ferrous Sulphate, along the rail corridor at the following strategic sites enabling ready in-field access for attending to product spills:

a. Leonora,

b. Southern Cross,

c. West Merredin, and

d. Northam.

Procedures are described to assist trained personnel in the containment, reclamation and clean-up of sodium cyanide spills.

10. PLANNING, TRAINING AND EXERCISES

10.1 PLANNING

Planning for a sodium cyanide spill can ensure co-ordination of action in the event of an emergency. This planning is in place through the WESTPLAN HAZMAT report and this document.

According to Lees (1980), emergency planning should aim to:

a. Plan broad areas of responsibility, chains of command and systems of communication. Excessive detail should be avoided to ensure the flexibility to cope with varied situations.

b. Clarify not only what is to be done, but who is to do it.

c. Establish a communication system.

d. Provide suitable equipment (including neutralisation agents) and ensure compatibility of equipment.

e. Establish training awareness programs.

f. Establish handling and transport procedures.

10.2 TRAINING

All personnel likely to participate in a cyanide spill need to be thoroughly trained in emergency procedures and should act only within the extent of their training and capability. Different levels of training are required for the various participating organisations:

a. Control Authority personnel in the transport route areas require proficiency in the management of emergencies involving hazardous and dangerous goods.

b. The Combat Authority personnel require proficiency in the understanding of the precautions required for a sodium cyanide spill. They should have general awareness training in the clean-up operations.

c. The Rail Operator and the road transport operator are to be trained in:

1. The recognition and classification of dangerous goods – in particular, sodium cyanide solution;

2. Transfer operations such as shunting, marshalling and trans-shipping of isotainers - The Rail Operator;

3. Trans-shipping of isotainers and solution discharge procedures (transport operator);

4. Specific transport procedures and precautions; and

5. Emergency procedures in the event of a spill.

d. Other participating organisations may require specific training in aspects they may become involved in.

10.3 EMERGENCY EXERCISES

The prime role of emergency exercises is to familiarise personnel with their functions and to test communication paths, response times and proficiency of the group.

Periodic exercises may be held for the following types of emergencies:

a. spills involving rail wagons

b. spills involving road vehicles

c. solids spills during transport

d. solids spills at Fremantle Port

e. straight-forward spill scenarios

f. complex spill scenarios

11. HANDLING HAZARDS AND PRECAUTIONS

The hazards associated with handling sodium cyanide are discussed in some detail in Section 5. The highly toxic nature of sodium cyanide, and of the hydrogen cyanide gas potentially released, demands extreme care in any clean-up operation.

The handling hazards and precautions that should be taken during clean-up are summarised as follows.

11.1 SUMMARY OF HANDLING HAZARDS

The following handling hazards arise during any clean-up operation involving sodium cyanide:

a. Sodium cyanide is a highly potent poison, whether taken internally or absorbed through intact skin.

b. Sodium cyanide solution contains minimum 0.3% sodium hydroxide, which is corrosive to skin tissues and mucous membranes, and extremely harmful to the eyes.

c. In an enclosed space, lethal concentrations of hydrogen cyanide gas may form above sodium cyanide solution.

d. Sodium cyanide solid and solution liberate hydrogen cyanide on contact with acids.

e. Solid sodium cyanide will liberate hydrogen cyanide on contact with water or moist air.

f. The rate of release of hydrogen cyanide is increased by temperature; thus, extreme caution is necessary for a spill during high ambient temperatures or onto hot ground.

g. Hydrogen cyanide is not detectable by smell by many people. It is unsafe to rely on detection of hydrogen cyanide by smell.

11.2 PRECAUTIONS

The following precautions should be observed in any clean-up operation involving sodium cyanide solid or solution:

a. The clean-up operation must only be conducted by trained personnel wearing the appropriate protective equipment.

b. Food or drink must not be permitted or consumed in the combat area.

c. In the event of skin contact, immediate and thorough washing with water is required.

d. Smoking must not be permitted in the combat area.

e. Acid or acidic material must not be allowed to come into contact with sodium cyanide.

f. Water should not be added to sodium cyanide without awareness that hydrogen cyanide gas will evolve.

g. As much of the material as possible should be recovered from the spill.

h. Spillages may be neutralised by addition of agents such as ferrous sulphate or sodium hypochlorite or calcium hypochlorite.

i. The use of absorbent agents on sodium cyanide solution will restrict the evolution of hydrogen cyanide and the migration of liquid.

j. Untreated cyanide solution must not be pumped to sewers without approval by the Water Corporation.

11.2.1 Ventilation

Sodium cyanide solid and solution must only be handled in areas with adequate ventilation. Supplied air breathing apparatus must be worn for entry into unventilated spaces (e.g. storage tanks or isotainers) until the space has been thoroughly cleaned and ventilated and gas tests indicate the atmosphere is safe for unaided breathing.

It is recommended that personnel do not enter a confined space area with >10ppm HCN levels, in case of equipment failure.

11.2.2 Personal Protection

The objective of personal protection is to avoid all contact with either solid sodium cyanide or sodium cyanide solution or inhalation of hydrogen cyanide gas.

In an emergency situation reliance must be placed on protective equipment, knowledge, procedures and personal hygiene to avoid exposure.

In emergency situations in the field where there is no air movement, dilution ventilation of the scene may be achieved by the use of a high volume air fan, if available. The use of such a fan should be assessed on a case by case basis depending upon the emergency.

PVC, or other waterproof material, is preferred for full protection against contamination by contact with sodium cyanide.

The minimum protective clothing required for working with or around sodium cyanide will vary depending on the situation and the risk. As a guide, cyanide delivery drivers making and breaking hose connections are required to wear:

a. work or chemical resistant boots;

b. long trousers outside boots and long sleeved shirt or approved long sleeved, body covering overalls;

c. elbow length PVC (or other waterproof) gloves;

d. safety helmet with face shield down; and

e. safety goggles (not glasses)

Jacket sleeves and trouser legs should be secured (cuffed) so they are effectively sealed to prevent entry of liquid or solids.

Protective gloves should be elbow length. Recommended materials for gloves are natural rubber, polyvinyl chloride (PVC), neoprene or nitrile.

Rubber boots should be worn and trouser legs adjusted to prevent entry of particles of solid sodium cyanide or sodium cyanide solution into footwear.

11.2.3 Respiratory Protection

If the degree of inhalation risk is known, e.g. atmospheric concentration of hydrogen cyanide, wear an approved full face air purifying respirator or an approved air supplied positive pressure full face mask meeting the requirement of Australian Standards AS1715 and AS1716.

It is recommended that a combination of gas filter with a particulate filter be fitted to an air-purifying respirator to capture solid particles and remove hydrogen cyanide vapours.

For emergency conditions i.e. where the concentration of cyanide in the atmosphere is unknown or there is uncertainty about the known concentration, wear an approved positive pressure, supplied air breathing apparatus.

11.3 SAFE HANDLING INFORMATION

11.3.1 Storage and Transport

a. Store solution in an outside area away from acids and oxidising materials.

b. Storage tanks are to be bunded to contain spillage or leakage.

c. Store solids in a dry, ventilated area.

d. Strict safety precautions must be observed and protective clothing and equipment used as required by the task, when handling the material.

e. Water hoses, eyewash stations, safety showers, fire-fighting equipment and first aid facilities to be readily available.

11.3.2 Spills and Disposal

Evacuate all unprotected persons to an up wind location.

Contain, collect and return cyanide spillage to the plant or mine process where possible, otherwise neutralise and dispose using ferrous sulphate, followed by sodium or calcium hypochlorite solution. Toxic gas can evolve during neutralisation. Waste cyanide solutions must be neutralised and not allowed to be discharged directly into sewers, drains or water courses.

11.3.3 Fire/Explosion Hazard

Non-combustible, but contact with heat, acids, acid salts and carbon dioxide liberates hydrogen cyanide gas, which is highly toxic and flammable.

Wear complete protective equipment and self-contained breathing apparatus.

⚠ WARNING

CO_2 extinguishers should not be used.

11.3.4 Other Information

Good personal hygiene and work practices are essential and all personnel involved in emergency response should be trained and instructed in response procedures.

12. CONTAINMENT

12.1 PRESENCE OF HYDROGEN CYANIDE

Before undertaking any work on containment and clean-up, it must be established that hydrogen cyanide levels in the area are safe. The spill area should only be entered by the Combat Authority or trained personnel wearing self-contained respiratory protection until hydrogen cyanide levels have been measured and determined to be safe.

12.2 CONTAINMENT ACTION

The priority action in the event of a sodium cyanide spill is to contain the escape of material into the environment. In particular, escape to stormwater drains, watercourses or catchment dams should be prevented if possible. This may be done by placement of physical barriers to prevent runoff (for example, using soil or absorbent material).

Sodium cyanide in either the solid or solution form should not be diluted or flushed away with water, as this would serve to further evolve hydrogen cyanide and disperse the sodium cyanide into the environment. In addition, untreated sodium cyanide must not be disposed of to sewers without approval of the WA Water Corporation.

Where spills are contained and there is a risk of rain diluting and dispersing the material, the area should be covered with plastic or a tarpaulin.

13. RECOVERY AND TREATMENT OF SPILLS

Recovery and treatment of spilt sodium cyanide may include:

a. recovery of solid or solution

b. neutralisation or the removal of soil

c. neutralisation

d. treatment and/or disposal of excavated soil

e. treatment and/or disposal of recovered cyanide.

13.1 RECOVERY OF SOLUTION

If pools of spilt solution are present at the spill site, the primary aim after containment is to recover as much of the solution as possible. Recovered solution can then be transported away from the spill site and treated in properly controlled conditions. In situ neutralisation would normally be considered only after as much solution as possible was recovered. Circumstances under which it could be decided not to recover pools of spilt solution and to neutralise in situ only include:

a. when access for recovery equipment is poor;

b. when only a small amount of solution has been spilt;

c. when there is a danger of loss of containment before full recovery of solution, such as when it is raining;

AGR/CSBP and the Combat Authority have the necessary equipment (pumps, flexible hoses, etc.) to facilitate recovery of spilt solution. The solution may be pumped to a suitable mobile tank for transport away from the spill site.

After recovery of as much solution as possible, soil removal should be considered.

13.2 RECOVERY OF SOLIDS

Spillage of sodium cyanide solid onto land is likely to be localised and may be cleaned up by collecting the solids from the contaminated area. In wet weather sodium cyanide pellets should be covered with a tarpaulin to prevent dissolution and where necessary a trench should be dug around the area to prevent entry and contamination of rainwater. Natural drainage channels require protection.

In the event that a container of solid cyanide is dropped into the port, Fremantle Port would arrange for the area to be blocked off so that the container could be manoeuvred into a position that would permit its retrieval. Divers will be used to attach chains to the container to allow it to be lifted out by the berth crane or a barge crane, if necessary.

Containment of Minor Leak	
Description	Minor hole, split or weld failure in vessel shell
Equipment	• Personal protection equipment, • water, • 25 kg neutralising agent, • 25 kg absorbent.
Response	• Don personal protection equipment. • Use absorbent material and soil to build bund around spill. • Collect contaminated fluid. Stabilise or neutralise remnant liquid on tank and ground through cyanide testing of the soil to agreed standards using absorbent or neutralising agent. • CSBP ERT also has patches that can be used to stop leaks.
Containment of Major Leak	
Description	Major hole, split or weld failure in vessel shell, failure of pipe fittings.
Equipment	• Rubber pads, • putty, • strapping, • tools, • 30t lifting equipment, • personal protection equipment, • water, • neutralising agent, • absorbent.
Response	• Don personal protection equipment. • Isolate site and provide containment to prevent loss of liquid to water course etc. • Fit pad, putty and straps, and secure in place • Using lifting equipment, and considering potential for further vessel damage, rotate vessel to locate hole upper most if possible. • Collect contaminated fluid. Stabilise or neutralise remnant liquid on tank and ground through cyanide testing of the soil to agreed standards using absorbent or neutralising agent. • Wash down vessel with water • Collect contaminated fluid. • Stabilise or neutralise remnant liquid on tank and ground to agreed standard through cyanide testing. • CSBP ERT also has patches that can be used to stop leaks.

Ground Containment	
Description	Liquid flowing over impervious surface
Equipment	• Sand or earth, • shovels, • personal protection equipment, • neutralising agent, • sheet plastic lining, • gas detection equipment.
Response	• Don personal protection equipment. • Contain liquid to minimum area and prevent spreading • Prevent liquid from entering any drainage system • Soak liquid into clean earth and retain. • Use sheet plastic to collect and contain as much liquid as possible. • Use gas detection equipment to monitor for HCN at the site. • Neutralise contaminated soil as required. • Check final contamination using cyanide test kit.
Reclamation of Sodium Cyanide Solution Contained on the Ground	
Description	Cyanide liquors in shallow pools contained by earth mound or plastic sheeting.
Equipment	• Diesel powered, diaphragm recovery pump with extendable suction hose and delivery hose capable of drawing liquid slurry from shallow pool and transferring to storage vessel at some height above pump. • Receival vessel, • water tanker, • hoses, • portable generator.
Response	• Don personal protection equipment. • Transfer as much contaminated liquor to receival vessel for treatment/disposal away from the incident site. • Check final contamination using cyanide test kit. • Finally treat/ neutralise contaminated soil and test that final concentration meets standards.

Reclamation of Tanker Liquid	
Description	Remnant liquid in isotainer, isotainer not in ideal position, leakage has occurred from isotainer, spillage has occurred over isotainer surface, access could be restricted. Vessel position is unable to be improved
Equipment	• Diesel powered, diaphragm recovery pump suitable for nominal suction head and delivery head to receival vessel, • 50 mm flexible reinforced suction hose. • Receival vessel, • water tanker, • hoses, • portable generator, • general hand tools, • magnetic base drill with 50 mm boring bit, • nitrogen cylinder and lead, • rubber pads, • 60 mm backing plug, • straps
Response	• Don protective equipment, including air-breathing apparatus. • Assess the situation, and carry out emergency response actions aimed at recovering the cyanide in the tank. • Purge with nitrogen if any drilling or cutting is to be attempted. • Flush shell with ferrous sulphate solution.
Reclamation of Sodium Cyanide Solids	
Description	Sea-container damaged and IBC of solid cyanide broken open, spilling briquettes onto the ground.
Equipment	• Full-face respirator or supplied air, • breathing apparatus, • protective clothing, • sealable plastic drum, • brooms, • shovels, • ferrous sulphate solution.
Response	• Determine HCN level above and around the spill to determine the requirement for breathing apparatus. • Sweep and shovel dry material into sealable drums. • Treat any remaining powder with the ferrous sulphate solution, and soak up with absorbent granules. • Using a short mast fork-lift and ramp, remove the remaining, undamaged IBCs from the damaged sea-container and re-pack them in an empty container for return to site

13.3 SODIUM CYANIDE FIRE

Sodium cyanide is not flammable, although hydrogen cyanide gas is at certain concentrations. An Emergency Response Guide for Fire details what precautions to take and what response is recommended in the event of a fire involving sodium cyanide.

As for solution cyanide, solid sodium cyanide does not burn. However, the hydrogen cyanide liberated by the heat can be ignited at certain concentrations.

A summary is presented in the Table below.

Fire (SOLUTION)	
Description	Fire at incident site affecting isotainer, causing vapour pressure above liquid to increase and release hydrogen cyanide vapour. Isotainer relief valve is set at 240kPa.
Equipment	• Normal fire-fighting equipment for chemical fire and toxic gas. • Basic equipment supplied by DFES. • Self-contained breathing apparatus.
Response	• Reduce temperature of isotainer by water spray to vessel and attack the fire source • Hydrogen cyanide gas evolved is unlikely to reach explosive limits • Fire-fighting water is to be collected and treated as a contaminated liquid until proven otherwise. • Carbon dioxide extinguishers are not to be used.
Fire (SOLIDS)	
Description	Fire at incident site causing solid cyanide temperature to become elevated
Equipment	• Normal fire-fighting equipment for chemical fire and toxic gas. • Basic equipment supplied by DFES. • Self-contained breathing apparatus.
Response	• If cyanide has not been spilt, spray the container with water to reduce its temperature. • Fire-fighting water is to be collected and treated as a contaminated liquid until proven otherwise. • If cyanide has been spilt at the incident site, do not spray the cyanide with water or carbon dioxide extinguishers. • Use a dry powder extinguisher to suppress the fire around the cyanide

13.4 NEUTRALISATION OR THE REMOVAL OF SOIL

In most spills, it is likely that much of the solution would soak into the soil at the spill site. Effected soil could be either neutralised in situ or excavated and removed to a suitable site for treatment and/or disposal.

Equally, solid briquettes that may have turned to powder during the spill, can mix with the surrounding environment, which could require a small amount of the surface to be removed.

In some instances, it may be decided not to excavate and remove soil, this could occur if:

a. the soil were of low permeability, such as clay

b. solution had spilt onto rock that was difficult to excavate

c. access for excavating equipment was poor

d. the groundwater was not potable

e. only a small quantity of solution had been spilt.

Sodium cyanide is not a persistent pollutant and is naturally degraded in time by aerobic and anaerobic micro-organisms in soil. Complete removal of affected soil and all traces of cyanide need not be considered as essential. Neutralisation can be achieved in-situ.

13.5 TREATMENT AND/OR DISPOSAL OF EXCAVATED SOIL

There may be several options available for treatment and disposal of excavated soil, depending upon the quantity of soil excavated, the availability of treatment sites and equipment, and the proximity of disposal sites.

The principal options are:

a. direct disposal to an approved waste disposal site or to tailings dams at gold treatment plants, which are designed to accept cyanide-bearing wastes;

b. removal to a contained hardstand or suitable facility for treatment with neutralising agent. After treatment, the soil could be returned to the excavation site, or disposed of to landfill or a tailings dam.

13.6 TREATMENT AND/OR DISPOSAL OF RECOVERED SOLUTION

There may be several options available for treatment and/or disposal of recovered solution, depending upon the quantity of solution recovered, the location of the spill site, and other factors.

The principal options are:

a. return of recovered solution to the manufacturer,

b. acceptance by a gold mine for use in gold recovery,

c. delivery to an approved liquid waste treatment plant, and

d. neutralisation.

Transport of Contaminated Materials	
Description	Removal of contaminated liquid or solid material from the incident site. Secondary containment vessel is to be free of leaks and capable of containing material under transport conditions.
Equipment	• Secondary containment vessels and transport vehicles to Dangerous Goods (Transport)(Road and Rail) Regulations. •
Response	• Emergency authorities to be advised in accordance with the regulations for the Transport of Dangerous Goods, of the intent to move the contaminated material away from the incident spill site and on public roads or rail.

13.7 NEUTRALISATION

Description: Recovery and treatment of an extensive sodium cyanide spill may include:

- Recovery of sodium cyanide material.
- Neutralisation and/or disposal of excavated soil.
- Neutralisation and/or disposal or recovered solution.
- Neutralisation of soil and/or water in situ.
- Recovery and treatment of ground water.

Note: Response to an extensive spill will require the development of a detailed plan to meet the specific circumstances.

14. WATER RESOURCE TREATMENT

14.1 NOTIFICATION TO RESOURCE USERS

Water resource treatment may be necessary if sodium cyanide has entered any watercourse, catchment dam or groundwater. If a spill occurs near a water resource and there is a possibility of contamination of the water resource, the Control Authority should notify the Water Corporation identifying that potential consumers are at risk and that the resource should not be used until tested and cleared.

The National Health and Medical Research Council (NHMRC)/Australian Water Resources Council (AWRC) guideline health-related level for cyanide is 0.1 mg/L (NHMRC/AWRC 1987).

14.2 SURFACE WATER TREATMENT AND MONITORING

If surface water resources are suspected of being contaminated, sampling should be undertaken along the watercourses and dams, etc. suspected of contamination. These samples would be analysed for total cyanide to ascertain whether levels were within the NHMRC/AWRC guidelines.

The sampling and analysis would be undertaken by the Water Corporation, **or** the Chemistry Centre of WA.

If cyanide levels in excess of the NHMRC/AWRC guideline were found, the water resource would be treated according to the circumstances and need. While some unique situations may exist where it is acceptable to add neutralising agents to water sources (effective system exists for mixing reagent into water body, neutralisation proceeds efficiently at water body pH, and real threat to human life overrides inevitable impact on environment).

Note: Generally, hypochlorite, ferrous sulphate and hydrogen peroxide MUST NOT be allowed to enter any natural body of surface or ground water.

Use of the water resource should not be resumed until clearance is given by the Water Corporation.

14.3 UNDERGROUND WATER TREATMENT AND MONITORING

If underground water resources are suspected of being contaminated a monitoring program may be implemented to assess if contamination has occurred and the extent of contamination, both vertically and horizontally. A monitoring program could involve the drilling of one or more bores in or near the spill site, depending upon the known hydrogeology of the area.

The decision on whether to implement a monitoring program is the responsibility of the Water Corporation, and would take account of factors such as:

a. the vulnerability of the groundwater resources to contamination;

b. the potability of the groundwater;

c. the quantity of solution spilt and the efficiency of recovery, removal and neutralisation.

The monitoring program would be undertaken by the Water Corporation, with other sampling and analysis by the Chemistry Centre of WA.

If cyanide levels in the groundwater were found to be in excess of the NHMRC/AWRC guideline, groundwater pumping and treatment would need to be considered. However, pumping and treatment may not always be necessary in such instances - for example, if:

a. the groundwater in the affected site is found to be not potable;

b. the contamination is minor and it is considered that the natural degradation of cyanide will be adequate for clean-up;

c. groundwater plume modelling indicates that by the time the plume reaches a production bore, cyanide levels will be within the NHMRC/AWRC guideline.

The possible options for clean-up of contaminated groundwater resources include:

a. sinking of a bore (or bores) in or near the spill area and pumping out the affected water for neutralisation;

b. injection of air or oxygen into the soil to maintain aerobic conditions and assist in the breakdown of the cyanide.

Use of the water resource should not be resumed until clearance is given by the Water Corporation.

15. NEUTRALISATION

15.1 SUITABLE NEUTRALISING AGENTS

Neutralisation of cyanide can be carried out using any of the following reagents:

a. Hydrated ferrous sulphate crystals or solution.

b. Sodium or calcium hypochlorite solution.

Sodium hypochlorite oxidises cyanide to form sodium cyanate and sodium chloride, where as ferrous sulphate complexes the cyanide into a low toxicity iron salt. Sodium hypochlorite solution is a strong oxidant and has to be handled with care. Ferrous sulphate is safe to handle. Both reagents degrade with time.

Note: While some unique situations may exist where it is acceptable to add neutralising agents to water sources, generally, hypochlorite and ferrous sulphate **MUST NOT** be allowed to enter any natural body of surface or ground water.

15.1.1 Ferrous Sulphate Monohydrate

The most suitable neutralisation agent is ferrous sulphate monohydrate (sulphate of iron) which is a light grey/brown free-flowing powder. Ferrous sulphate reacts passively with a cyanide solution to form the 'Prussian Blue' iron salt precipitate. The precipitate is moderately toxic by ingestion, and is slightly acidic. Some hydrogen cyanide and ammonia is evolved when mixing ferrous sulphate and sodium cyanide, but this can be minimised by using a mixture of ferrous sulphate and an alkali such as sodium carbonate or sodium hydroxide.

As a guide, 7 tonnes of ferrous sulphate neutralises the contents of one 18 cubic metres isotainer:

- 1kg neutralises 2.5 litres of 30% sodium cyanide solution, or
- about 1 kg of ferrous sulphate per 0.9 kg of dry cyanide.

Colour change can also be used to determine if sufficient material has been used to neutralise the cyanide. On neutralisation, the mixture may turn green or blue depending on the aeration of the mixture. If sufficient oxidation occurs (ferrous to ferric) the mixture will change from green to blue, the latter indicating the formation of Prussian Blue.

Stockpiles of ferrous sulphate monohydrate are stored along AGR's cyanide solution transport routes. Most of it is stored in 20-ft sea-containers, in 25-kg bags that are shrink-wrapped onto pallets. Each stockpile holds a minimum of 16 tonnes of ferrous sulphate – enough to neutralise the entire contents of two cyanide solution isotainers.

Table 12 - Location of Ferrous Sulphate Stocks

TOWN	LOCATION	QTY	CONTACT NUMBER FOR KEY TO SEACONTAINER
Agnew	Leinster Goldfields - Agnew Gold Operation	20T	9088 3810
Armadale	Lot 2 Purves Rd - Armadale Removals	20T	9399 6311
Bindoon	Great Northern Hwy - behind Shire Offices	20T	9576 4600 emts@chittering.wa.gov.au
Boddington	Boddington Gold Mine – Gold Mine Rd	20T	0427473929
Bluebird	Great Northern Hwy - Meekatharra	20T	9980 2136
Fremantle Ports	North Mole, Fremantle - Patrick's Terminal	20T	9432 0319 frelandside@patrick.com.au
Higginsville	Avoca Resources Limited Mine Site	20T	9039 6030
Kalgoorlie	The Rail Operator West Kalgoorlie - Container Terminal	20T	9022 0638
Kalgoorlie	Epis Street – Qube Bulk Transport Yard	20T	0429 502 238
Kwinana	CSBP Works – Chemicals East	50T	1800 093 333 9411 8444
Laverton	Granny Smith Gold Mine	20T	0408 754 925 9088 2240
Leonora	The Rail Operator siding 500m past Shell Depot	20T	0439 739 172
Merredin	Great Eastern Hwy - The Rail Operator Siding	20T	0438 455 643
Mt Magnet	Shire Yard	20T	9963 3000 works@mtmagnet.wa.gov.au
New Norcia	Mackie Hay – 7km north of New Norcia. 500m along Yerecoin Rd	20T	9654 8023 nnoffice@gilmac.com.au
Northam	The Rail Operator Siding - Avon Locomotive Yard	20T	0438 455 643
Nullagine	Marble Bar Rd – Millennium Minerals	20T	
Tropicana	Tropicana Gold Mine	20T	9265 2614

A side lifter can pick up the sea-container and transport it to the spill site or a forklift can be used to lift the pallets onto a flat top truck, which then drives to the site.

As a last resort, the 25kg bags can be extracted from the shrink-wrapping and man-handled directly onto a truck.

All stock shall be inspected (by CSBP) regularly for stock level, chemical and physical state, access and general housekeeping. Inspection records are kept on file. Any deficiency in the quantity, condition or accessibility of the stock is reported and remedial actions are tracked by the Technical Support Manager.

Access to neutralising agent stored at CSBP works or the mine sites is gained via the works management.

Neutralising depots at rail terminals are accessed via The Rail Operator area staff.

Neutralising chemicals at towns on route (road) i.e. Mt. Magnet and Bindoon are stored at either the local fire station or Shire yard. Access is via the DFES or Shire office.

⚠ WARNING

Full protective clothing, including respiratory protection, must be worn when spreading ferrous sulphate onto cyanide spills as a small amount of hydrogen cyanide gas will be initially liberated.

15.1.2 Method of Application - Ferrous Sulphate Monohydrate

a. Split bag with shovel or cut open with knife,

b. Use shovel to spread evenly over spill (if spill is on a sealed surface, cover area with sand first),

c. Water in well with spray,

d. Mix well with shovels to ensure intimate contact with the spillag,

e. Allow 30 minutes for complete penetration and reaction,

f. Dig out the residue and shovel into front end loader bucket,

g. Test soil beneath for free cyanide,

h. If free cyanide less than the Department of Environment standard (to be determined in consultation) then the site may be declared safe,

i. If free cyanide is above the standard then repeat exercise until level falls below the required level,

j. Place fresh soil in the cavity left by the removal of contaminated soil. Take latter to a gold mining site for safe disposal.

15.1.3 Sodium Hypochlorite or Calcium Hypochlorite

These may only be used on diluted cyanide spills, namely those below 1% sodium cyanide strength. Sodium hypochlorite can react with strong concentrations of cyanide solution to generate toxic cyanogen chloride gas.

Sodium hypochlorite (also called "pool chlorine") is most effective in neutralising low concentration contamination wash water, and contaminated PPE and tools.

Chlorine gas can also be used to treat very dilute solutions of cyanide (less than 0.5%).

15.2 NEUTRALISATION PROCEDURES

The general principles for neutralisation of contaminated soil involve containing the spill, treatment with ferrous sulphate or sodium hypochlorite, assessment of the effectiveness of the treatment, and continuation of treatment until cyanide has been neutralised.

Contaminated liquids would be either neutralised at the spill site and disposed of as treated effluent or transported to a near-by mine site for mixing with process liquid or use as a reagent. Contaminated liquid may, in some circumstances, be returned to Kwinana works for treatment. Transport must be approved by the relevant Competent Authorities.

Particular neutralisation control methods to be adopted are to be agreed at the spillage site.

15.3 SUMMARY OF CHEMISTRY CENTRE OF WA FINDINGS

The Chemistry Centre of WA carried out in 1988/89 investigations into the neutralisation of sodium cyanide solution. These findings are summarised as:

a. The most significant factor affecting HCN gas evolution from cyanide solution is the pH (normally stabilised at pH 13). A decrease in pH increases HCN evolution.

b. HCN gas emission from contaminated soil is increased by wind over the soil.

c. Gas concentration close to the unconfined soil surface can be many times greater than that above a solution, in an enclosed space, at the same temperature.

d. The evolution of HCN from liquid surfaces (such as puddles) is less than that from soil.

e. Raising the temperature of the soil increases the rate of HCN evolution.

f. Evolution from an impervious surface e.g. a bitumen road, appears no worse than from contaminated soil.

15.4 NEUTRALISATION SCENARIOS

Full protective clothing, including respiratory protection, must be worn when neutralising cyanide spills as a small amount of hydrogen cyanide or other toxic gases could be liberated. Refer to Section **12** for handling, hazards and precautions.

15.4.1 Stabilisation and Removal of Soil

a. Define the affected area and secure from unauthorised entry.

b. Determine the HCN level 1 m downwind, 1 m above the soil and take appropriate precautions to protect all persons.

c. Remove excess cyanide liquids or solids from area.

d. Cover the spill area with an alkaline material (e.g. slaked lime, hydrated lime or cement) to nominal depth of 25 mm.

e. Wet the surface with excess water.

f. Using small earth moving equipment dig out the affected area to depth of 150 mm, taking care not to further spread the contaminated material.

g. Load out all the contaminated material and take to the pre-determined disposal site for treatment.

h. Clean and wash any earth moving equipment collecting all solid and liquid material for further neutralisation.

i. Carry out neutralisation of the area as described in Section – Neutralisation of Top Soil In-situ.

15.4.2 Neutralisation of Top Soil In-situ

a. Define the affected area and secure from unauthorised entry.

b. Determine the HCN level 1 m downwind and, 1 m above the affected area and take appropriate precautions to protect all persons.

c. Remove the excess cyanide liquids or solids from the area.

d. Cover the area with ferrous sulphate crystals to nominal depth of 10 mm and ensure that no spillage remains exposed.

e. Spray the neutralising agent with water to wet the surface, rake to help complete reaction and leave for 1-2 hours.

f. Monitor for HCN above ground and on downwind edge of the spill.

g. If the level rises apply 10 mm of solid, alkaline material (eg. slaked lime) and water.

h. Repeat raking and HCN monitoring until situation is stable and monitored level is below 10 ppm.

i. Remove to a contained safe area the reacted neutralising agent and stabilised top soil to depth of 50 mm by hand shovel.

j. Remeasure HCN level and if above 10 ppm spread additional ferrous sulphate and alkaline solid on the surface. Repeat as before.

k. If below 10 ppm, test the cyanide level in the soil. If soil contamination is above Department of Environment standard, repeat neutralisation.

l. If contamination is below Department of Environment standard, fill the excavated area with clean soil and declare the spill area safe.

m. After 24 hours, test the level of cyanide in the neutralised material. If the cyanide level is above Department of Environment standard, mix in more ferrous sulphate and wait another 24 hour period.

n. When the cyanide level in the neutralised mixture is below Department of Environment standard, declare the area safe.

15.4.3 Neutralisation of Removed Contaminated Liquid

a. Contain the liquid in leak free container and secure the immediate area from unauthorised entry.

b. Circulate the liquid for short period to establish uniformity.

c. Determine the cyanide level.

d. Determine the HCN level 1 m downwind and at 1 m height and take appropriate precautions to protect all persons.

e. Estimate the amount of cyanide in the contained solution.

f. Determine the quantity of 10% concentration sodium hypochlorite for excess neutralisation on the basis of 18 L of 10% hypo to 1 kg sodium cyanide (100%).

g. Slowly add sodium hypochlorite into the pump suction on the basis of 1 : 10 of liquid mass.

h. If the reaction has any indication of being violent, cease addition of sodium hypochlorite and circulate for 30 minutes.

i. Circulate for 1-2 hours.

j. Re-assess cyanide level.

k. If the cyanide level is greater than 1 ppm, repeat the neutralisation.

l. Circulate for a further 1-2 hours.

m. Monitor the cyanide in the liquid to be below detectable level and the HCN above liquid to be less than 5 ppm.

n. Declare liquid to be safe for disposal via an approved neutral liquid and land fill site.

15.4.4 Neutralisation of Removed Contaminated Soil

a. Contain soil in a plastic lined earth pond. Pond is to be approximately twice the volume of the material to be treated.

b. Estimate the amount of cyanide in the contaminated soil.

c. Determine the quantity of 10% concentration sodium hypochlorite for excess neutralisation on the basis of 18 L of 10% hypo to 1 kg sodium cyanide (100%).

d. Fill the pond with water to about the 25% level.

e. Determine the HCN level 1 m downwind and, 1 m above the soil heap and take appropriate precautions to protect all personnel.

f. Set up a low head sprinkler to wash over soil in the pond.

g. Slowly add 10% concentration sodium hypochlorite to the pump suction in the basis of approximately 1:10 of liquid to solid mass.

h. If the reaction has any indication of being violent, cease addition of sodium hypochlorite and circulate for further 30 minutes.

i. Circulate for 1-2 hours.

j. Re-assess the cyanide level and determine the quantity of neutralisation agent for excess neutralisation.

k. Continue to monitor HCN level in the atmosphere above the liquid.

l. Add further neutralisation agent to the pump suction.

m. Circulate for a further 1-2 hours.

n. Monitor the cyanide level in the soil and liquid to below detectable level and HCN above liquid to be 5 ppm.

o. Declare liquid and solid to be safe for disposal via an approved neutral liquid and land fill site.

15.4.5 Control of Contaminated Pond or Dam Water

a. Assess the extent of the spillage, quantity of contaminated water and use of dammed water.

b. Define the affected area and secure from unauthorised entry.

c. Carry out soil neutralisation on any drainage channels.

d. Determine the HCN level 1 m downwind and 1 m above water surface and take appropriate precautions to protect persons and animals.

e. Assess the cyanide level in the dam water.

f. Determine risks to people and animals to determine if neutralisation is necessary

g. Consider circulating dam water to promote cyanide decomposition.

h. Monitor cyanide level periodically until safe to release control of dam.

15.4.6 Control of Major Storage Water

a. As quickly as possible assess the extent of spillage, water in-flow rates, water out-flow rates and use of dammed water.

b. Discuss with the Water Corporation and local authority the impact of the spill incident.

c. Develop response actions which may include:

1. Monitoring of main water body

2. Restriction of use of water from dam

d. Become aware of the consequence and time frame of any spill damage.

e. Carry out a damage control program as necessary.

15.4.7 Control of Flowing Surface Water

a. As quickly as possible assess the extent of spillage, water flow rate and downstream use of water

b. Alert any downstream users within a distance of two days flow from the spill site.

c. Set up a monitoring program in conjunction with the Water Corporation and local authorities.

d. Carry out a damage control program as necessary.

15.4.8 Control of Sub-Surface Flow Water

a. Establish the impact of the spill incident on ground water by discussion with Water Corporation and local Government authority.

b. Develop response actions which may include:

1. Shut down any bores which draw contaminated water.

2. Increase flow on bores located close to the spill area creating an artificial drawdown.

3. Establish monitor bores.

c. Set up an extended monitoring program.

d. Become aware of the consequences and time frame of any spill damage.

e. Carry out a damage control program as necessary.

16. REPORTING AND INVESTIGATION

All Incidents and near-misses during the transport and unloading of sodium cyanide are to be reported by the transport contractor. This will allow for the investigation of events and causes, and for tracking any follow-up actions that arise.

All transport incidents are to be reported to the relevant Competent Authorities as required.

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