



**REPORT**

# International Cyanide Management Code Recertification Audit

*Hebei Chengxin Co Ltd – Production Facility ICMC Recertification Audit –  
Summary Audit Report*

Submitted to:

**International Cyanide  
Management Institute (ICMI)**  
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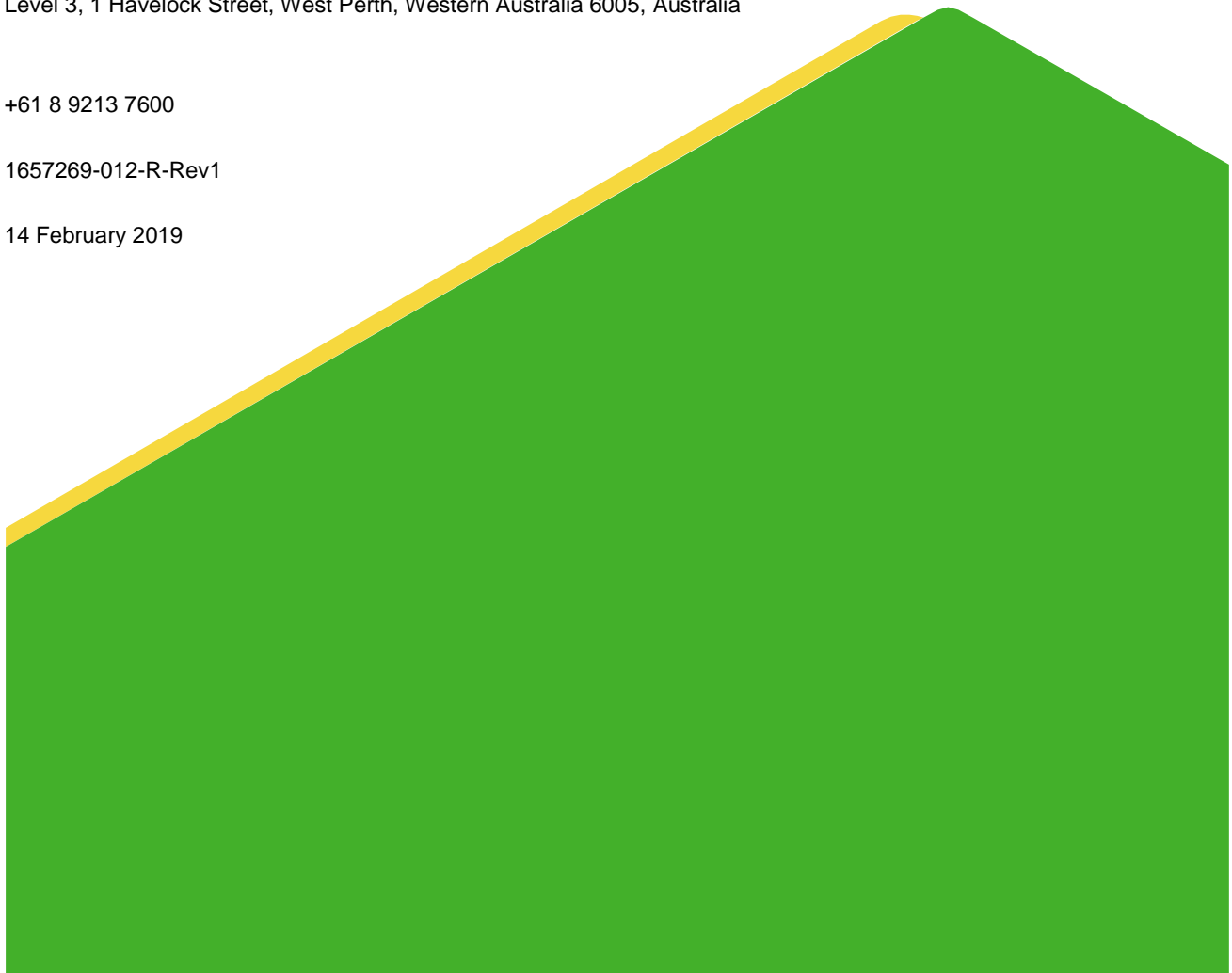
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### **APPENDIX A** Important Information

## 1.0 INTRODUCTION

### 1.1 Operational Information

<b>Name of Production Facility:</b>	Hebei Chengxin Co Ltd
<b>Name of Facility Owner:</b>	Hebei Chengxin Co Ltd
<b>Name of Facility Operator:</b>	Hebei Chengxin Co Ltd
<b>Name of Responsible Manager:</b>	Zhi Qunshen, Hebei Chengxin Co Ltd
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<b>State/Province:</b>	Hebei Province
<b>Country:</b>	China
<b>Email:</b>	chengxin@hebeichengxin.com

### 1.2 Hebei Chengxin Co Ltd Description of Operations

Hebei Chengxin Co Ltd (Hebei Chengxin) was established in 1990. It is a joint-stock enterprise with 4,000 employees. It is one of the largest production bases of cyanide and its derivatives in China. The company has been approved by the quality management system, occupational health and safety management system and environmental management system. The company has the right for import and export. The products are sold to many countries and regions, including South America, North America, Europe, Asia, Australia, South Africa.

Hebei Chengxin Co Ltd is located at Yuan Zhao Road, to the east of Yuanshi County railway station, 2 km west of Beijing/Guangzhou railway and No.107 Stated Road, 3.6 km east of Beijing/Zhuhai speedway, 30 km south of the province capital Shijiazhuang City. To the north is Yuan Zhao Road (400 m), to the west is Jinyuan Road (400 m), and to the east and south is farmland.

The site is used to manufacture a large number of chemicals using liquid sodium cyanide as a basic feed-stock. The part of the site used to manufacture liquid sodium cyanide and then convert the liquid sodium cyanide into solid sodium cyanide is referred to in this report as 'the cyanide facility'. The term 'the site' is used in this report to refer to the entire Hebei Chengxin Co Ltd facility and includes a large number of manufacturing plants which use liquid sodium cyanide as feedstock; these manufacturing plants are not subject to this report.

The cyanide facility is connected to the site's utilities including stormwater drains and the site wastewater treatment plant. The cyanide facility does not have its own wastewater treatment plant.

The cyanide facility was constructed in 2007 and replaced earlier cyanide production facilities. There have not been any major modifications to the cyanide facility since 2007. The changes since the ICMC Certification Audit in 2015 comprised:

- The replacement of cooling towers on the 810 workshop area for enclosed systems to meet environmental regulations and reduction in the number of tanks in the 810 work area tank farm from 23 to 16.

The feedstocks to the cyanide facility are light oil and ammonia (stored on site as liquid ammonia). The feedstocks are preheated and evaporated to produce a gaseous reaction mixture. This mixture is passed to an electric arc reactor furnace where the oil fumes are heated to approximately 1,200-1,400°C and passed over a platinum catalyst. This reduces the oil fumes to methane and coke (carbon particles). These intermediate reactants react with the ammonia in an endothermic reversible partial reduction reaction producing a raw gas which is a mixture of hydrogen cyanide and hydrogen with small quantities of methane, oil fumes, coke particles and ammonia.

The coke particles in the product gas are removed in cyclones and recycled. The gas is then cooled in a heat recovery heat exchanger to less than 100°C and passed through a bag filter. This filtered hydrogen cyanide gas is passed through a sodium hydroxide absorber, which generates sodium cyanide liquor, which is transferred via overhead pipelines to bulk storage tanks.

The liquid sodium cyanide liquor then passes through overhead pipelines to the solid sodium cyanide plant where it is concentrated by evaporation in evaporation vessels under vacuum and then crystallised in crystallisation vessels to produce sodium cyanide crystals. The sodium cyanide crystals are then passed through a centrifuge to remove moisture, then through a drier to remove more moisture and passed via a cyclone to the pelletising unit. The vapour from the evaporation unit is passed through a condenser to form condensate, which is stored in bulk above ground storage tanks at the liquid sodium cyanide tank farms prior to reuse in the absorption process.

The sodium cyanide crystals are pressed into pellets which are loaded into plastic bags in either 50 kg iron drums or 1,000 kg timber boxes. The packaged cyanide is stored in the warehouse at the cyanide facility prior to despatch from site. The operation also provides liquid sodium cyanide to the domestic market which is transported in isocontainers.

The infrastructure at the cyanide facility comprises:

- Underground light oil storage tanks.
- Liquid ammonia storage tanks, located within an open concrete lined pit.
- Sodium hydroxide tank farm.
- Two cracking plants – each containing two cracking units with eight absorption tanks.
- Two liquid sodium cyanide tank farms – North Tank Farm and South Tank Farm
- Two solid sodium cyanide production buildings, each containing a full solid sodium cyanide production facility.
- A products warehouse for storage of packaged solid sodium cyanide.
- Liquid cyanide loading facilities (platform and fill lines).

The facility is paved with concrete. The vessels and tanks containing liquid sodium cyanide, such as the absorption tanks, liquid sodium cyanide tanks and condensate tanks are located within concrete bunded areas. The solid sodium cyanide production buildings are both self-bunded with concrete floors, concrete walls and bunds at each doorway. The cyanide facility does not generate any wastewater. The first flush stormwater is piped to a first flush system comprising two open concrete pits at the wastewater treatment plant which services the entire site (i.e. all the other chemical manufacturing plants of Hebei Chengxin Co Ltd).

The facility operates on 12-hour shifts, 24 hours per day, seven days per week, with three production teams. There were no cyanide exposure incidents notes as occurring during the audit period.

### 1.3 Use of Dye

The ICMI has introduced the requirement for dye to be added to liquid cyanide at greater than 15% strength prior to transport and also for dye to be added to solid cyanide at the time of mixing with effect from 1 July 2019. Hebei Chengxin is exploring how to comply with this new requirement as the addition of dye is not acceptable to its non-mining customers, which are a significant and important part of its business. Addition of dye products for some customers and not others provides additional complexity to production and logistical challenges in the supply chain. Hebei Chengxin is exploring options to balance the needs of its customers and compliance with the intent of the Code to have a visual indicator of a cyanide leak.

### 1.4 Auditors Findings and Attestation

in full compliance with

**Hebei Chengxin**

**The International**

**Facility is:**

in substantial compliance with

**Cyanide Management**

**Code**

not in compliance with

**Audit Company:**

Golder Associates Pty Ltd

**Audit Team Leader:**

Mike Woods Exemplar Global (113792)

**Email:**

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There were no Cyanide exposure incidents or releases to the environment noted as occurring during the audit period.

#### Name and Signatures of Auditors:

Name	Position	Signature	Date
Mike Woods	Lead Auditor and Technical Specialist		14 February 2019

### 1.5 Dates of Audit

The warehouse (production) audit and reporting was undertaken between August and October 2018. The field component of the audit was undertaken 13-15 August 2018.

I attest that I meet the criteria for knowledge, experience and conflict of interest for Code Verification Audit Team Leader, established by the International Cyanide Management Institute and that all members of the audit team meet the applicable criteria established by the International Cyanide Management Institute for Code Verification Auditors.

I attest that this Summary Audit Report accurately describes the findings of the verification audit. I further attest that the verification audit was conducted in a professional manner in accordance with the International Cyanide Management Code Verification Protocol for Cyanide Production Operations and using standard and accepted practices for health, safety and environmental audits.

Hebei Chengxin Co Ltd  
Name of Facility

  
Signature of Lead Auditor

14 February 2019  
Date

## 2.0 PRINCIPLES

### 2.1 Principle 1 – Operations

**Design, construct and operate cyanide production facilities to prevent release of cyanide.**

#### 2.1.1 Production Practice 1.1

*Design and construct cyanide production facilities consistent with sound, accepted engineering practices and quality control/quality assurance procedures.*

**in full compliance with**

The operation is

in substantial compliance with

**Production Practice 1.1**

not in compliance with

**Summarise the basis for this Finding/Deficiencies Identified:**

The Facility is in FULL COMPLIANCE with Production Practice 1.1 requiring cyanide production facilities to be designed, constructed and operated to prevent releases of cyanide.

The facility implemented quality control and quality assurance programs during construction of the cyanide production and storage facilities in 2007. Records have been retained of the quality control and quality assurance programs.

Materials used for the construction of plant and equipment containing or handling comprise stainless steel or carbon steel. Secondary containment is provided predominantly by concrete bunding and pavement. These materials are recognised as being compatible with cyanide.

The facility is designed to provide full containment within reaction vessels and pipelines in the event of a power outage or equipment failure. Hence, there is no need for inter-locks at the cyanide facility to provide containment in the event of a power outage or equipment failure. The entire plant has been paved with concrete to minimise seepage to the subsurface.

Each cyanide process and storage vessel has been equipped with a level indicator and a high-level alarm. The site has established Workshop Inspection Rules that include inspection of level indicator equipment and secondary containments the vessels are stored in.

Secondary containments for process and storage tanks and containers are constructed of concrete and concrete-rendered brickwork. The secondary containments of the 40% bulk cyanide storage tanks are sized to contain at least 110% of the volume of the largest tanks and are paved with concrete. The tanks are also lined with an outer layer of silica compound insulating material or metal sheeting to minimise the risk of projectile flow beyond the bund boundary in the event of a leak in the upper part of the tank.

The containments are constructed of concrete and were observed to be in reasonable condition. The number of tanks at the 810 workshop area have been reduced from 23 to 16 and the containment size has remained the same. No other changes to the containment system or infrastructure have been undertaken since the previous audit report that certified the containment. Following the audit Chengxin updated the bunding from the second area and photographs of the bunding was reviewed and the bund found to be of a suitable quality.

Spill prevention and containment measures are provided for all cyanide solution pipelines in the form of secondary metal casing or silica compound casing. The ground beneath the pipelines is paved with concrete and drains to the stormwater first-flush system, which provides the final form of secondary containment.



## 2.1.2 Production Practice 1.2

*Develop and implement plans and procedures to operate cyanide production facilities in a manner that prevents accidental releases.*

**in full compliance with**

**The operation is**  in substantial compliance with **Production Practice 1.2**

not in compliance with

### Summarise the basis for this Finding/Deficiencies Identified:

The Facility is in FULL COMPLIANCE with Production Practice 1.2 requiring the development and implementation of plans and procedures to operate cyanide production facilities in a manner that prevents accidental releases.

The facility has an extensive system of procedures, instructions and checklists which support management of the integrity of processing equipment and its operation in a manner intended to avoid cyanide releases and exposures.

The plant is automated and operated via DCS with separate control rooms for the liquid plant and solid plant. Emergency shutdown and interlocks are built into the plant design and managed via the DCS for the liquid plant. As noted previously, the solid cyanide part of the cyanide facility does not have any automatic systems to shut down production systems and prevent releases due to power outages or equipment failure. However, the design of the plant inherently means that in the event of power outage or equipment failure the contents of the vessel, tank or pipe will remain in place until power is reconnected or the equipment re-started.

The facility has procedures for contingencies during upsets in its activities that may result in cyanide exposures or releases. The facility's General Emergency Response Plan and Workshop Site Emergency Response Plan address responses to losses of HCN gas and spills of NaCN liquids.

The facility has a change management process to identify when site operating practices have or will be changed from those on which the initial design and operating practices were predicated. The Management of Change Procedure details what changes require this procedure to be implemented. It details what type of work needs to be reviewed and by who; with process changes requiring review by both the department supervisor and the safety engineer and representative from the environment, health and safety department. A minor deficiency with regards to change management during the 2016 was observed with records for safety evaluation of change of replacing the cooling towers not being retained.

Preventive maintenance programs have been planned and implemented and activities documented for equipment and devices according to manufacturer's recommendations as evidenced by annual maintenance plans and supporting maintenance completion records.

Process parameters are monitored with necessary instrumentation, which is calibrated according to manufacturer's recommendations. The cyanide production facility maintains annual Calibration Lists detailing the instruments on the plant which require calibration during the year.

The instruments include: high pressure gauges, vacuum pressure gauges, numerical temperature displays, flow meters, fixed hydrogen cyanide detector, fixed ammonia gas detector and portable hydrogen cyanide detector. The calibrations are undertaken by an independent external qualified company.

Procedures have been implemented to prevent unauthorised/unregulated discharge to the environment of any cyanide solution or cyanide-contaminated water that is collected in a secondary containment area. Water collected in secondary containment areas is transferred to the site's first flush system for testing for total cyanide before being treated at the site's wastewater treatment plant.

The facility has environmentally sound procedures for disposal of cyanide or cyanide-contaminated solids. Solid cyanide is reprocessed through the production plant. Other contaminated items are decontaminated by washing, followed by incineration.

Cyanide is stored either in liquid form in the tank farms or in solid form in a secure, ventilated warehouse, where public access is prohibited and rainwater ingress is prevented.

Cyanide is packaged for transport in accordance with Chinese regulatory standards for packing of solid cyanide, which were prepared to meet the requirements of the United Nations Recommendation on the Transport of Dangerous Goods – Model Regulations, (2005) and thereby meet the requirements of the political jurisdictions through which the loads will pass.

### 2.1.3 Production Practice 1.3

*Inspect cyanide production facilities to ensure their integrity and prevent accidental releases.*

**The operation is**  **in full compliance with** **Production Practice 1.3**  
 in substantial compliance with  
 not in compliance with

#### **Summarise the basis for this Finding/Deficiencies Identified:**

The Facility is in FULL COMPLIANCE with Production Practice 1.3 requiring the inspection of cyanide production facilities to ensure their integrity and prevent accidental releases.

Inspections of the integrity of pressure vessels, tanks, pumps, pipes, valves and containment bunds (addressing structural and corrosion concerns) are undertaken on a planned basis.

The inspection frequencies are considered sufficient to assure that equipment is functioning within design parameters.

12-hourly inspections are undertaken of the cyanide storage facility, including bunding, pipe work, flanges, pumps, high level alarms and tanks to identify deterioration and leaks.

The cyanide facility undertakes monitoring every six months of the wall thickness for pipes transferring cyanide solutions and undertakes monitoring of the thickness of vessels every 12 months.

Inspections are documented. The documentation identifies specific items to be observed and include the date of the inspection, the name of the inspector and any observed deficiencies. Corrective actions are identified, dated and records kept.

## 2.2 Principle 2 – Worker Safety

### Protect workers' health and safety from exposure to cyanide

#### 2.2.1 Production Practice 2.1

Develop and implement procedures to protect plant personnel from exposure to cyanide.

in full compliance with

The operation is

in substantial compliance with

**Production Practice 2.1**

not in compliance with

#### Summarise the basis for this Finding/Deficiencies Identified:

The Facility is in FULL COMPLIANCE with Production Practice 2.1 requiring the Facility to develop and implement procedures to protect plant personnel from exposure to cyanide.

The Facility has developed formal procedures to minimise worker exposure during:

- a) Normal plant operations from receipt of raw materials through finished product packaging and shipping
- b) Non-routine and emergency operations
- c) Maintenance related activities.

The *Standard Operational Procedure of Cyanide Production* provides an integrated procedure covering the whole cyanide production and packaging operation. The procedures cover normal and non-routine operations and the production facility is managed via a digital control system (DCS) in two control rooms, one for the liquid plant (801) and one for the solid plant (810).

In addition to the operating procedures there is a permit to work system that covers:

- Working at heights
- Confined space
- Lifting
- Digging
- Machinery maintenance
- On-site road route change
- Flow isolation plate, and
- Hot work.

The procedure discusses the personal protective equipment (PPE) that must be worn and to undertake a field level risk assessment prior to commencing work as well as using a lock out tag out system for working on all cyanide plant. It also requires communication by the maintenance team with the local cyanide department prior to the work commencing and that any unsafe conditions must be reported to the department supervisor.

The safety permit requires a field level risk assessment to be undertaken prior to the work commencing, the use of a buddy system, records of tagging out, checking of PPE, undertaking flammable and toxicity tests. The permit is signed by the employee, the safety manager and department manager.

As discussed in 1.2 the Facility has implemented a formal site change management process.

The management procedures detail the Change Management Procedure (Chapter 36). The change management procedure details what changes require this procedure to be implemented. It details what type of work needs to be reviewed and, by who; with process changes requiring review by both the cyanide department supervisor and the safety engineer. Safety equipment changes require review by the safety management department. Changes involving greater risks must be reviewed by the Vice General Manager. The procedure details conducting the change, inspection and review after the work and training and communication.

The Facility does solicit and considers worker input in developing and evaluating health and safety procedures. Employees have the opportunity to make suggestions regarding the procedures via 'written suggestions' which they can place in suggestion boxes, give to their shift leader who passes it to the supervisor, or they can give it directly to the cyanide department safety manager. Workers interviewed confirmed that have the opportunity to provide input.

A combination of fixed and portable monitors is used at the facility. The fixed monitors are set to alarm at 3 ppm and the portable monitors are set to alarm at 4.7 ppm. Portable monitors are used for task specific activities and the fixed monitors are to provide detection of an issue with the process. When HCN gas levels trigger the 3 ppm alarm level, the site operator shall wear the filter gas mask for short time operation, and the operation time shall not exceed 30 minutes; When HCN gas levels trigger the 4.7 ppm alarm levels., the site operator shall evacuate the site area immediately. The emergency treatment personnel must wear air breathing apparatus and wear heavy protective clothing to the site to find out the leakage source and block the leakage.

The HCN monitoring equipment is maintained, tested and calibrated as directed by the manufacturer. There are fixed detectors within the plant area and portable detector used for task specific activities. Calibration certificates were reviewed for the monitoring equipment.

The Cyanide Production Facility (Workshop 810) General Operations Manual details the areas where the risk of hydrogen cyanide and cyanide dust is considered high and PPE including either a respirator with a filter (appropriate for cyanide) or with oxygen is worn. Ten activities/areas have been identified: cracking area, bag filter replacement, lab analysis workers, cyanide transport (via pipe), cyanide storage tank farms, absorption tank maintenance, evaporation, centrifuge, drying and packaging.

During inspections of the facilities workers were observed to be wearing PPE as outlined in the procedures and signage displayed in the work area.

All operators have radios to communicate with the associated process control room. The facility has a buddy system which requires employees to work in two for each post. All operators have radios to communicate with the associated process control room.

The facility assesses the health of employees to determine their fitness to perform their specified tasks. All workers have a medical examination every year at the local hospital (Yuanshi County). The medical includes of checking blood pressure, lung capacity, electrocardiography (ECG), blood, urine and a liver scan depending upon the working location and duration of the employee. The site has records for each worker detailing the date of the examination and whether they have passed.

The Clothes Exchange and Shower Procedure in the Departmental Level Management Procedures details that all employees and contractors must enter into the exchange room and exchange clothes before work, after the shift they must shower and exchange clothes again.

Every employee working in the cyanide department is provided with six sets of clothes and all employees in the cyanide department have their clothes washed for them on site by the department.

Visitors are supplied with laboratory coats for use while visiting the facility.

Additional PPE is required in the packaging area including the use of coveralls, gloves and full-face respirators. Personnel leaving the packaging facility must head via change room for shower and clothes change.

Warning signs advising workers that cyanide is present and that, if necessary, suitable PPE must be worn, are located around the Facility.

Warning signs were observed to be located on the outside of the warehouse buildings at entrance points and within the warehouse on the outside of the intermediate bulk containers (IBCs). Warning signs were present at the 810 work areas and 801 work areas.

All personnel are prohibited from smoking, eating and drinking, and having open flames in areas where there is the potential for cyanide contamination. All process and storage areas have signs stating no smoking, no eating or drinking and no open flames.

### 2.2.2 Production Practice 2.2

*Develop and implement plans and procedures for rapid and effective response to cyanide exposure.*

in full compliance with

The operation is

in substantial compliance with

**Production Practice 2.2**

not in compliance with

#### Summarise the basis for this Finding/Deficiencies Identified:

The Facility is in FULL COMPLIANCE with Production Practice 2.2 requiring the development and implementation of plans and procedures for rapid and effective response to cyanide exposure.

The Facility has developed specific written emergency response plans for cyanide exposures. The persons interviewed knew to relocate exposed person offsite and remove contaminated clothes, inject exposed person with cyanide resistant injection, rinse the contaminated part with moving water, contact the first-aid clinic and hospital for emergency care.

Showers, low-pressure eye wash stations and non-acidic fire extinguishers are located at strategic locations throughout the Facility. They are maintained and inspected on a regular basis. The Facility has a six-monthly preventative maintenance inspection and servicing programme.

Dry powder fire extinguishers were observed throughout the Facility. No carbon dioxide fire extinguishers were observed.

The Facility has oxygen, a resuscitator, antidote and a means of communication or emergency notification readily available for use in the plant.

An inspection of the facility confirmed that operators have radio communication and antidotes are stored strategically throughout the plant. Oxygen and resuscitator are available in the medical room on the site. Water is available around the plant via safety showers and fire hydrants.

Personnel interviewed knew the location of antidotes and the emergency notification process. Inspection records were samples for the audit period and found to be in order.

The Facility inspects its first aid equipment regularly to assure that it is available when needed. The first aid and emergency response equipment are stored and tested as directed by their manufacturer and replaced on a schedule that assures they will be effective when used.

The antidote produced by China People Army Medicine Science Institute, has instructions that state that it should be stored at room temperature and out of the sun. The antidote was stored appropriately and was in date. The site's first aid clinic doctors inspect the oxygen bottles and resuscitators in the clinic each month.

Fire extinguishers are sent in rotation to an off-site facility Shijiazhuang Changan Jingan fire facility company for servicing and refilling as required by the manufacturer. Fire extinguishers inspected were charged and had servicing dates.

Safety data sheets (SDS) and first aid procedures on cyanide safety are in the language of the workforce (Mandarin) and are available to workers at the site. All the signs and procedures are in Chinese, which is the official language. The SDS has been developed in accordance with global harmonised system (GHS) requirements.

Information boards have been erected at the cyanide areas of the plant that detail hazards, requirements. The drum and IBC external packaging also provides information on cyanide hazards.

All storage and process tanks and piping are labelled to clearly identify the contents. The direction of flow for the pipes is clearly shown.

The facility has a decontamination policy or procedure for employees, contractors and visitors leaving the areas with the potential for skin exposure to cyanide.

Chapter 10 of the Departmental Level Management Procedures reference CXWJ-H10-01 specifies the cloth changing and showering procedures for workers undertaking work in areas where they may be exposed to cyanide. This procedure applies to personnel in the laboratory, packaging, evaporation, maintenance personnel, centrifuge, drying, modelling and cyanide storage areas. They are required to have change clothes and shower when they exit the work area.

Interviews and site inspection confirmed that the decontamination procedure is implemented and followed.

The Facility has its own on-site capability to provide first aid, but not higher level medical assistance to workers exposed to cyanide. The site has its own on-site capability to provide first aid or medical assistance to workers exposed to cyanide. The site has an on-site first-aid clinic which is staffed 24 hours a day by three fully qualified doctors. All the doctors have been certificated by Hygiene Department of Hebei Province. The Facility has developed a procedure to transport exposed workers to locally qualified, off-site medical facilities.

The Safety Workshop Site Emergency Response Plan details the procedure to transport workers to local medical facilities. The site would use either their own cars or in the case of serious injury or exposure they would call the emergency services at the nearest hospitals (Chinese Traditional Hospital in Yuanshi county or Shuanghui Hospital in Yuanshi county) located approximately 15 minutes' drive from the site.

The Facility has alerted local hospitals, clinics, etc. of the potential need to treat patients for cyanide exposure, and the Facility is confident that the medical provider has adequate, qualified staff, equipment and expertise to respond to cyanide exposures.

The facility has toured the hospitals and Dr Yongyao Liu advised that Chinese Traditional Hospital of Yuanshi County is satisfied that the facilities have suitable staff and equipment to respond to cyanide exposures.

Mock emergency drills are conducted periodically to test response procedures for various exposure scenarios. The whole of the Hebei Chengxin Co Ltd site undertakes four emergency response drills each year in accordance with Chinese standards and the facility's Emergency Response Plan. These are discussed further in 5.6.

The 801 and 810 work areas conduct local drills for worker exposure and response actions. Drill reports are developed that outline the drill and the lesson from the drill. Photographs of the exercises are included. Drills are repeated across the work crews to cover all shifts.

Procedures are in place to investigate and evaluate cyanide exposure incidents to determine if the operations programmes and procedures, to protect worker health and safety and to respond to cyanide exposures, are adequate or need to be revised.

The procedure for incident investigation and evaluation is detailed in the Company Management Procedures. It details an accident classification system that determines the type of investigation required; and the accident report process and accident communication process. The most serious accident and exposures require investigation by the government or an outside party. For accidents where no working day is lost the investigation is to be undertaken by the cyanide department along with the safety engineer to determine the root cause of the incident.

The accident and treatment report details the accident, the accident analysis, the prevention measures, the responsible person/s and their monetary punishment decision. It proceeds to a corrective measures section which tabulates the hazard, corrective measure, date for implementation and the responsible person.

There have been no cyanide exposure or cyanide release incidents reported during the audit period.



## 2.3 Principle 3 – Monitoring

**Conduct environmental monitoring to confirm that planned or unplanned releases of cyanide do not result in adverse impacts.**

### 2.3.1 Production Practice 3.1

*Conduct environmental monitoring to confirm that planned or unplanned releases of cyanide do not result in adverse impacts.*

**The operation is**  **in full compliance with** **Production Practice 3.1**  
 in substantial compliance with  
 not in compliance with

#### Summarise the basis for this Finding/Deficiencies Identified:

The Facility is in FULL COMPLIANCE with Production Practice 3.1 requiring environmental monitoring to be conducted to confirm that planned or unplanned releases of cyanide do not result in adverse impacts.

The facility does not have direct discharge to surface water. The facility has been designed, constructed and is operated as a zero discharge facility, with the exception of stormwater and rain water accumulating within secondary containment bunds. The plant facilities are located within curbed concrete containments to prevent cyanide spills and other releases from impacting upon the environment.

Stormwater is discharged indirectly to the environment via the site's wastewater treatment plant and/or the municipal wastewater treatment plant in accordance with regulatory approvals.

Monitoring results indicate that the concentrations of total cyanide in releases from the site's combined discharge of treated wastewater and stormwater have been less than 0.022 mg/L free cyanide.

The facility monitors groundwater at four locations to the north-west, south-west and south-east as well as adjacent to the cyanide solution tank farm. The concentration of cyanide in the groundwater has been less than the local regulatory limit of 0.05 mg/L total cyanide and less than the Code limit of 0.022 mg/L free cyanide.

No seepage or associated impacts upon groundwater has been detected from the facility.

The facility limits atmospheric emissions of hydrogen cyanide gas via an enclosed process and continuous monitoring, with alarm limits set to 3 ppm below the regulatory standard of 5 ppm.

There are no surface water bodies in close proximity to the cyanide facility which require monitoring. The nearest river is approximately 9 km from the cyanide facility.

Monitoring is conducted at frequencies adequate to characterise the medium being monitored and to identify changes in a timely manner. The frequency of monitoring undertaken at the cyanide facility is:

- Wastewater discharges – weekly monitoring
- Stormwater discharges – combined in wastewater discharge and on an event basis
- Groundwater quality – quarterly
- Air quality – quarterly and continuously.

These frequencies are considered adequate in the operating circumstances to meet Code requirements.



## 2.4 Principle 4 – Training

**Train workers and emergency response personnel to manage cyanide in a safe and environmentally protective manner.**

### 2.4.1 Production Practice 4.1

*Train employees to operate the plant in a manner that minimises the potential for cyanide exposures and releases.*

The operation is  in full compliance with **Production Practice 4.1**  
 in substantial compliance with  
 not in compliance with

#### Summarise the basis for this Finding/Deficiencies Identified:

The Facility is in FULL COMPLIANCE with Production Practice 4.1 requiring employees to be trained to operate the plant in a manner that minimises the potential for cyanide exposures and releases.

The operation does train workers to understand the hazards of cyanide and refresher training is periodically conducted. New employees have three levels of training comprising company, departmental and operational level training.

Company level training consists of three days of classroom training. One main booklet called 'Safety Training material' is given to all employees during the training. The books are available after the course in the cyanide department control rooms.

Departmental level training consists of three days training. The training is held both in the meeting room and on site to show the chemical hazards, emergency response and PPE. The new employee is shown the operation of the whole cyanide production plant.

Operational level training consists of three days training on site in the area of the cyanide department that the new employee will be working, each employee is designated an experienced worker who teaches them how to operate the machinery in that area. During the three days they do not operate the machinery by themselves, at the end of the three days they have an exam. In addition, they go through the operating procedures.

Refresher training is provided in the form of monthly training sessions. Each month the safety adviser for the cyanide department gives training that lasts approximately one hour.

All employees also receive general safety knowledge training from the Safety Department of Yuanshi County. This three day course is renewed every year with another three day course.

Interviews with personnel and training records confirmed that workers are trained in cyanide hazards prior to undertaking works and refresher training is provided. The Facility trains workers in the use of personal protective equipment (PPE) and when and where this equipment is required.

PPE training is covered in all three levels of training (company, departmental and operational) and there are specific management and departmental procedures regarding PPE storage, maintenance and which type of PPE is required in the different operations within the cyanide department. Interviews with employees confirmed that training on how and when to use PPE is provided.

The Facility trains workers to perform their normal production tasks with minimum risk to worker health and safety and in a manner that prevents unplanned cyanide releases.

The General Operations Manual includes the requirements for safely undertaking specific tasks, including donning PPE prior to undertaking certain tasks. New employees are partnered with an experience person to learn the job and this is overseen by the supervisor for the area.

The training elements necessary for each job are identified in training materials. Training elements include the physical and chemical characteristics of cyanide, fire prevention, personal protection equipment, etc., and also specific training materials regarding each post.

The Facility has 46 personnel with safety management certificate. Training is provided by these qualified personnel to all employees.

Employees are trained prior to allowing them to work with cyanide. Worker must complete the corporate and area training before being allowed to perform work. New employees are teamed with an experienced operator and are not permitted to work unsupervised until the shift supervisor is satisfied that the person can completed the necessary tasks safely in accordance with procedures.

The Facility evaluates the effectiveness of cyanide training by testing. There are questionnaires that are used for the tiered induction training and these are retained. New employees are teamed with an experience person who demonstrates and observers the worker perform their tasks.

#### 2.4.2 Production Practice 4.2

*Train employees to respond to cyanide exposures and releases.*

**The operation is**  **in full compliance with** **Production Practice 4.2**  
 in substantial compliance with  
 not in compliance with

#### **Summarise the basis for this Finding/Deficiencies Identified:**

The Facility is in FULL COMPLIANCE with Production Practice 4.2 requiring employees to be trained to respond to cyanide exposures and releases.

The Facility does train workers in the procedures to be followed if a cyanide release is discovered.

Workers are trained in procedures to be followed if a cyanide release is discovered during company, departmental and operational training and well as monthly and weekly training. The Facility has 46 designated safety management personnel with qualifications.

Workers interviewed could describe the response processes including evacuation to an upwind location, use of safety showers, reporting the incident and use of antidote. In addition to the processing workers the operation also has dedicated emergency responders that are trained in higher level response actions.

The Facility does train workers to respond to worker exposure to cyanide and are routine drills used to test and improve their response skills.

Mock drills have been conducted with workers to train them and test their response skills. The facility has conducted worker exposure scenarios for the 810 workshop area and the 801 workshop area. The drills are recorded and reports assess the performance of the exercise and improvements needed.

Emergency drills are evaluated from a training aspect to determine if personnel have the knowledge and skills required for effective response. The drills are recorded and reports assess the performance of the exercise and improvements needed. The mock drill reports identified minor improvements to be made and these were addressed through a repeat of the exercise.

Training records are retained throughout an individual's employment, documenting the training they have received and including the names of the employee and the trainer, the date of training, the topics covered, and how the employee demonstrated an understanding of the training materials.

Training files for members of the Workshop 801 and 810 were reviewed and contained evidence of training including course content, assessments and certificates.

All workers received trainings on personal protective equipment and emergency response procedures during a spill or exposure at daily, weekly, monthly and annually trainings.

## 2.5 Principle 5 – Emergency Response

Protect communities and the environment through the development of emergency response strategies and capabilities.

### 2.5.1 Production Practice 5.1

Prepare detailed emergency response plans for potential cyanide releases.

The operation is  in full compliance with **Production Practice 5.1**  
 in substantial compliance with  
 not in compliance with

#### Summarise the basis for this Finding/Deficiencies Identified:

The Facility is in FULL COMPLIANCE with Production Practice 5.1 requiring a detailed emergency response plan for potential cyanide releases.

The Facility has developed emergency procedures for the management of emergencies associated with the storage of chemicals including cyanide. The facility has the following emergency response plans:

- Safety production incident comprehensive contingency plan and Emergent environmental incident hazard special contingency plan which provide high level guidance for the preparation of the following subordinate plans.
- Sodium Cyanide (Potassium) major incident hazard special contingency plan (CXWJ-AQ-02-03) details the emergency response for potential releases of cyanide.
- Emergency response action measures of 810 workshop (CXWJ-H10-03) describes safety associated response procedures and actions in the event of cyanide spills.

Procedure of CXWJ-AQ-02-01, 02,04, 05 details the emergency response for potential releases of liquid ammonia, light oil, liquid chlorine and Benzyl cyanide

The procedure of CXWJ-HB-02 details what to do in the event of a large leak including preventing its access to the site drainage, use of bunds, use of plastic to prevent penetration to the underground soils, use of sand or plastic cover to reduce risk of hydrogen cyanide gas, pump all liquid into containers, never use copper or aluminium equipment, collect all contaminated soils into suitable container.

The procedure of CXWJ-HB-02 states what to do in the event of an incident during loading and dissolution and details the need to select suitable equipment to stop the leak, if possible, and then to follow the same procedures as above.

The procedure of CXWJ-AQ-02-03 (Section 4.2-1) details what to do in the event of a release and also the emergency response for fire or explosion.

The procedure of CXWJ-H10-03 (Section 4.2-3) details emergency actions to be taken in the event of rupture to pipes, tanks or valves.

Power outages and equipment failures are dealt with in the Departmental Level Management Procedures which details what to do in the event of power outages. The Systems Document contains a 'Power off emergency response procedure' that details that the facility is supplied with electricity by two separate power circuits. In the event of a failure of one supply the other power supply is able to meet plant requirements.

Overtopping of ponds, tanks and waste treatment facilities. This is not applicable as the only open ponds are emergency ponds that are pumped to in the case of an emergency.

The Sodium Cyanide Major Incident Hazard Special Contingency Plan (CXWJ-AQ-02-03) details the emergency response for potential releases of cyanide. Other sections of the plan deal with specific process areas at the site/cyanide facility including the raw material storage areas, cracking furnace, finished product area, vacuum pump area and maintenance.

The procedure contains specific response actions including: control of any release at source; evacuation of workers and potentially affected communities; use of first aid measure and antidotes; and containment, assessment, mitigation and future prevention of releases.

## 2.5.2 Production Practice 5.2

*Involve site personnel and stakeholders in the planning process.*

in full compliance with

**The operation is**

in substantial compliance with

**Production Practice 5.2**

not in compliance with

### **Summarise the basis for this Finding/Deficiencies Identified:**

The Facility is in FULL COMPLIANCE with Production Practice 5.2 requiring the Facility to involving site personnel and stakeholders in the planning process.

The Facility has involved its workforce and stakeholders in the emergency response planning process.

The emergency response procedures were issued to all departments and each department had specific training days where employees were disseminated information from the procedure and had the ability to comment on the procedure. The responsibilities of all departments have been stated in the procedure.

The site communicates with the local communities through inviting a selection of people from the 20 surrounding villages within a 1 km radius of the site. The villagers have a tour of the facility and are able to discuss the production and storage of cyanide. The procedure CXWJ-AQ-01 was discussed during the visit and meeting records was provided for review. Relevant government authorities and neighbouring industrial facilities were included as below:

- Shijiazhuang Municipal Environmental Assessment Organization
- Hebei Provincial Chemical Industrial Research Institute
- Yuanshi County Environmental Protection Bureau
- Huaiyang Town Community Government
- GongZhuan Town Community Government
- Hebei Provincial Petroleum Institute.

The site communicates with the local communities through inviting a selection of people from the 20 surrounding villages in a 1 km radius from the site. The villagers tour the facility and are able to discuss the production and storage of cyanide. The Site is open for surrounding villages to visit.

The emergency response procedures (ERPs) were issued to all departments and each department had specific training days where employees were disseminated information from the ERPs and had the ability to comment on the ERPs.

During the revision and upgrade of the emergency response plans during 2018, the cyanide facility liaised with, and provided copies of the plans to, relevant government authorities and neighbouring industrial facilities, including:

- Shijiazhuang Municipal Environmental Assessment Organization
- Hebei Provincial Chemical Industrial Research Institute
- Yuanshi County Environmental Protection Bureau
- Huaiyang Town Community Government.

The only external responder which may come to site to assist in the event of an emergency would be the local fire department.

### 2.5.3 Production Practice 5.3

*Designate appropriate personnel and commit necessary equipment and resources for emergency response.*

in full compliance with

**The operation is**

in substantial compliance with

**Production Practice 5.3**

not in compliance with

#### **Summarise the basis for this Finding/Deficiencies Identified:**

The Facility is in FULL COMPLIANCE with Production Practice 5.3 requiring designated appropriate personnel and committed equipment and resources for emergency response.

The ERPs' details the following emergency response teams: director, on-site director, departmental control team, medical team, security team and the support team. The cyanide department control team comprises of four control teams that cover every shift plus an additional day time team. Each control team has eight members.

The Safety production incident comprehensive contingency plan (CXWJ-AQ-01) Chapter 3.2 and Emergent environmental incident hazard special contingency plan (CXWJ-HB-02) Chapter 4.2, details the following emergency response teams: director, on-site director, departmental control team, medical team, security team and the support team. The cyanide department control team comprises of four control teams that cover every shift plus an additional day time team. Each control team has eight members.

Company level and departmental level training in Emergent environmental incident hazard special contingency plan (CXWJ-HB-02) Chapter 12 and The Safety production incident comprehensive contingency plan (CXWJ-AQ-01) Chapter 9 is undertaken. The emergency response team have training in responsibilities, fire information and use extinguisher, on site emergency procedure training, emergency equipment, including use of SCBAs, administering antidote, hazard identification, different emergency response training, major hazardous sources, management procedure training, hazardous operations training and mock drill training.

The Safety production incident comprehensive contingency plan (CXWJ-AQ-01) Appendix 1 and Emergent environmental incident hazard special contingency plan (CXWJ-HB-02) Appendix 11-1 details cell phone contact information for company leaders and team members are called by radio.

The Safety production incident comprehensive contingency plan (CXWJ-AQ-01) Chapter3 and Emergent environmental incident hazard special contingency plan (CXWJ-HB-02) Chapter 4.1 details the organisational framework for the company level and responsibilities, it details the responsibilities for the director, the on-site director, the departmental control team, the medical, security team, and support teams.

The Safety production incident comprehensive contingency plan (CXWJ-AQ-01) Appendix 2 and Emergent environmental incident hazard special contingency plan (CXWJ-HB-02) Appendix 12 details all emergency equipment. It includes fire extinguishers (dry power and foam), fire hoses, eye wash bottles, shower and eye wash stations, fire hydrants, fire pumps, high temperature emergency clothing, SCBAs, chemical coveralls, gloves, light oil, HCN and ammonia detectors, emergency lighting, masks, chemical resistant gloves, sand, sand drum, shovel, and cyanide antidote.

Inspections of fire extinguishers, cyanide antidote, eye wash bottles, fire hydrants, SCBAs, PPE, gloves, fixed and portable monitors, emergency lighting and masks, are undertaken as part of monthly inspections.

The ERP details the hospital responsibilities and the fire department's responsibilities and the government safety department who provide advice on emergency response.

The facility has confirmed that outside entities included in the ERP are aware of their involvement and are included as necessary in mock drills or implementation exercises.

The site has given the ERP to the Yuanshi County fire department and the two hospitals used by the site who have passed it on to their own ambulance services.

The Yuanshi County local fire department attended the mock drill that was undertaken in June 2018 which simulated a fire in the light oil storage area within the cyanide department. The fire department sent two fire engines and enacted a fire scenario.

Outside entities included in the ERPs have received a copy of the plan and the local fire department has taken part in one of the mock drills at the facility.

#### 2.5.4 Production Practice 5.4

*Develop procedures for internal and external emergency notification and reporting.*

in full compliance with

**The operation is**

in substantial compliance with

**Production Practice 5.4**

not in compliance with

#### **Summarise the basis for this Finding/Deficiencies Identified:**

The Facility is in FULL COMPLIANCE with Production Practice 5.4 requiring development of procedures for internal and external emergency notification and reporting.

The ERPs includes procedures and contact information for notifying management, regulatory agencies, outside responders and medical facilities and includes appropriate telephone numbers.

The ERPs include procedures and contact information for notifying potentially affected communities of the incident and/or response measures and for communication with the media.

The System Document details that only the office manager is to communicate with the media.

### 2.5.5 Production Practice 5.5

*Incorporate into response plans and remediation measures monitoring elements that account for the additional hazards of using cyanide treatment chemicals.*

**The operation is**  **in full compliance with** **Production Practice 5.5**  
 in substantial compliance with  
 not in compliance with

#### **Summarise the basis for this Finding/Deficiencies Identified:**

The Facility is in FULL COMPLIANCE with Production Practice 5.5 requiring the Facility to incorporate monitoring elements that account for the additional hazards of using cyanide treatment chemicals into response plans and remediation measures.

The ERPs describes specific, appropriate remediation measures, such as recovery or neutralization of solutions or solids, decontamination of soils or other contaminated media and management and/or disposal of spill clean-up debris, and provision of an alternate drinking water supply, as appropriate.

The Environmental Accident and Emergency Response Plan details that remedial measures will include digging out contaminated soil, then decontaminating the soil using hydrogen peroxide in a concrete contained area.

In the event of requirement for drinking water the site would purchase bottled water. They already have a contract with a supplier.

### 2.5.6 Production Practice 5.6

*Periodically evaluate response procedures and capabilities and revise them as needed.*

**The operation is**  **in full compliance with** **Production Practice 5.6**  
 in substantial compliance with  
 not in compliance with

#### **Summarise the basis for this Finding/Deficiencies Identified:**

The Facility is in FULL COMPLIANCE with Production Practice 5.6 requiring the Facility to periodically evaluate response procedures and capabilities and revise them as needed.

The ERPs includes provisions for annually reviewing and evaluating its adequacy. The evaluation is undertaken by the vice president, managers, safety engineers, departmental managers and emergency response team members.

Mock emergency drills are conducted periodically to test response procedures for various exposure scenarios, and the lessons learned from the drills are incorporated into emergency response planning.

The whole of the Hebei Chengxin Co Ltd site undertakes four emergency response drills each year in accordance with Chinese standards and the facility's Emergency Response Plan.

The cyanide manufacturing facility (Workshop 810) also undertakes another emergency response drill once per month.



Examples of the drill reports for the following scenarios over the last three years were reviewed.

- Practice emergency evacuation due to HCN gas release
- Fire response
- Fire extinguisher training
- Cyanide poisoning response
- Light oil spill and fire
- Ammonia liquid spills.

For each drill the following is recorded:

- Description of emergency scenario
- Record of training attendance and assessment
- Photographs of the event.

Independent Emergency Drill Reports is prepared to identify the deficiencies of the ERP. And an updated version to address the deficiencies is prepared after the drill as required.

Mock drills are undertaken by the ERT team and also the operations team to test response actions. The facility has provision to evaluate the ERPs after any emergency that required its implementation, and for revising it as necessary.

The ERPs details that it should be evaluated both after an emergency and is evaluated every year.

### 3.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled – “Important Information Relating to this Report”, which is included in Appendix A of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

## Signature Page

**Golder Associates Pty Ltd**



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**APPENDIX A**

# Important Information

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

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