



**SUMMARY AUDIT REPORT**

# International Cyanide Management Code Recertification Audit

*Anhui Anqing Shuguang Chemical Co., Ltd –  
Production Facility ICMC Recertification Audit*

Submitted to:

**International Cyanide  
Management Institute (ICMI)**

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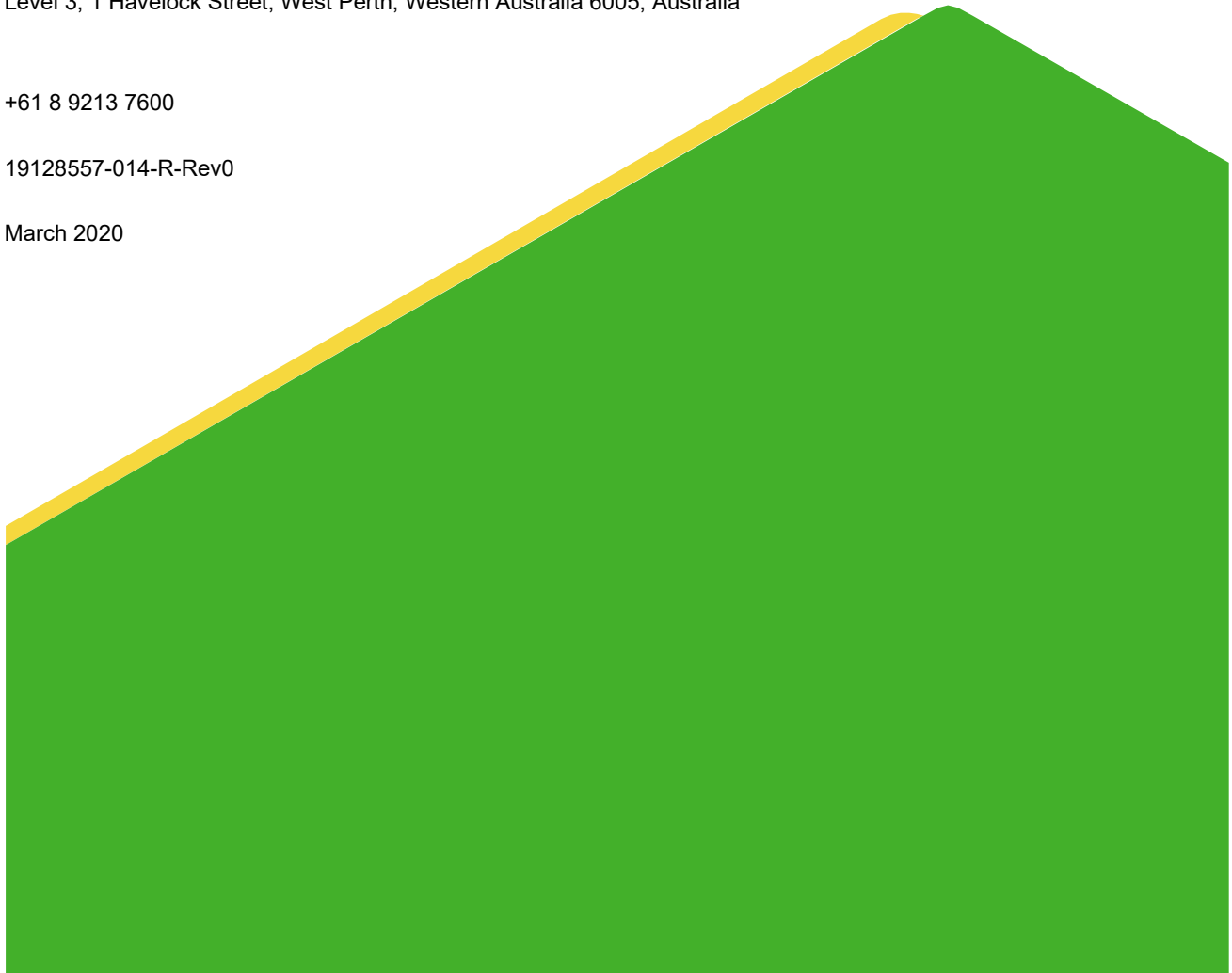
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19128557-014-R-Rev0

March 2020



## Distribution List

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Important Information

## 1.0 INTRODUCTION

### 1.1 Operational Information

<b>Name of Production Facility:</b>	Anhui Anqing Shuguang Chemical Co., Ltd
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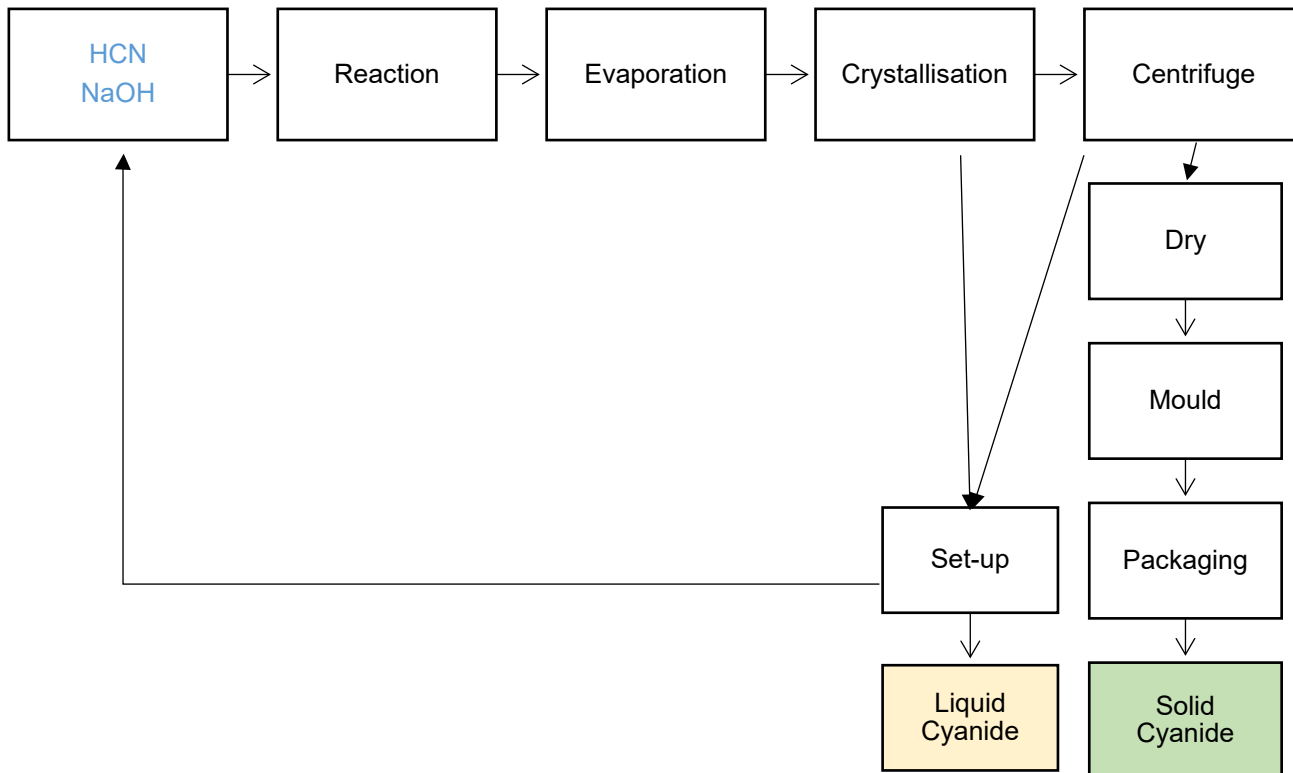
### 1.2 Anhui Anqing Shuguang Chemical Co Ltd – Description of Operations

Anhui Anqing Shuguang Chemical Co., Ltd. (Shuguang) was established in 1994. It is a joint-stock enterprise with 195 employees. The company operates under a Dangerous Chemical Safe Production License issued by the Anhui Province Work Safety Bureau, and valid from April 20, 2017 to April 19, 2020. 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, OHSAS 18001 and ISO 14001 environmental management system. The company has the right for import and export. The products are sold to many countries and regions, including South America, Europe, Asia, Australia, and South Africa.

Anhui Anqing Shuguang Chemical Company Co., Ltd. (Shuguang) is located at Jingbei Road, 5 km to the west of Anqing Railway Station, 9 km south of Tianzhushan Airport. To the east boundary is Sinopec Anqing Branch (SAB), to the west and south is the other chemical plants, and to the north is farmland.

The Site is located adjacent to the acrylonitrile unit of Sinopec Anqing Branch. As a by-product of acrylonitrile manufacturing, hydrocyanic acid is delivered to Shuguang by pipelines for manufacture of solid sodium cyanide.

Shuguang sodium cyanide manufacturing processes include:



- Reaction – liquid hydrocyanide acid (above 99.5% in purity) supplied by the adjacent acrylonitrile units of Sinopec Anqing Branch is reacted with 48% sodium hydroxide to generate 40% liquid product
- Evaporation and Crystallisation – saturated sodium cyanide solution is pumped into a vacuum evaporator to remove water and the concentrate is fed to the crystalliser
- Centrifuge- wet crystals are generated by continuous solid-liquid separation of the concentrated crystal pulp
- Drying – the sodium cyanide crystal is heated in the dryer to evaporate the residual water, and crystals are dried into dry powder
- Moulding – Dry sodium cyanide powder is moulded into “pillows” or flakes
- Packaging – sodium cyanide is delivered to the tablet tank through an oscillatory conveyor and then weighted in the weighing and packing machine. Products are tested by random sampling and the qualified products are packed with 50 kg or 380 kg iron drums or 1,000 kg timber boxes with inner polyethylene liners. The packaged cyanide is stored in the warehouse at the cyanide facility prior to despatch from site.

Based on the interview with the site personnel and site observation, there have been no significant changes since the previous ICMC audit in 2016 except replacement of electric furnace of dry process in 2018 as well as auxiliary equipment.

There are three units on Site to manufacture cyanide, and the Site has separated stormwater drains and wastewater pipeline. All the wastewater and first 15 minutes rain flush water will be collected and treated by Site wastewater treatment plant. After that, the treated wastewater will be discharged into Sinopec Anqing Branch wastewater treatment plant.

The infrastructure at the cyanide facility mainly comprises:

- Reaction facilities with three units.
- Liquid cyanide storage tanks, located within an open concrete lined pit.
- Sodium hydroxide tank farm.
- Production facilities with three units.
- A products warehouse for storage of packaged solid sodium cyanide.
- Liquid cyanide loading facilities (platform and fill lines).
- Two administration buildings.
- Control Centre.
- Air emission treatment facilities.
- Wastewater treatment facilities.

The facility is paved with concrete. The vessels and tanks containing liquid sodium cyanide 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 one open concrete pit at the wastewater treatment plant which services the entire site.

The facility operates on eight-hour shifts, 24 hours per day, seven days per week, with four 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. Anhui Anqing Shuguang 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. Anhui Anqing Shuguang 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.


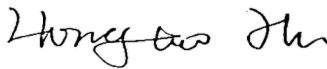
### 1.4 Auditors Findings and Attestation

<b>Shuguang</b>	<input checked="" type="checkbox"/> in full compliance with	<b>The International</b>
<b>Facility is:</b>	<input type="checkbox"/> in substantial compliance with	<b>Cyanide Management</b>
	<input type="checkbox"/> not in compliance with	<b>Code</b>

**Audit Company:** Golder Associates Pty Ltd  
**Audit Team Leader:** Mike Woods Exemplar Global (113792)  
**Email:** mwoods@golder.com.au

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		17 March 2020
Hongtao Hu	Auditor		17 March 2020

## 1.5 Dates of Audit

The field component of the audit was undertaken 24 to 26 September 2019. The audit was undertaken by Mike Woods (Lead Auditor and Technical Specialist) and Hongtao Hu (Auditor and translation).

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.



## 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

Shuguang is

in substantial compliance with

**Production Practice 1.1**

not in compliance with

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

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

Quality control and quality assurance (QA/QC) programs have been implemented during construction of cyanide production facilities and storage facilities, and the QA/QC records have been retained. Appropriate qualified personnel have reviewed facility construction and provided documentation that the facility has been built as proposed and approved.

The plant was designed and constructed in 1995. The plant was constructed by China National Chemical Engineering Third Construction Co., Ltd., a large construction company in China. In addition, documents have been retained that record the certification of various organisations engaged in the design, fabrication and construction of cyanide facilities. Construction Acceptance Records for Cyanide Production Facility Expansion dated December 2012 were provided for review as well as tank function changes records of sodium hydroxide to sodium cyanide dated February 2013.

No significant changes for the process production from last audit in 2016, except several promotion modifications have been taken as below:

- Replacement of an electric furnace in the production area due to the energy consumption concerns in June 2018.
- Four Gas detectors were added in the reaction area in April 2018.
- 24 hours On-line monitoring system for air emission facilities was installed in August 2018, and it is connected to the Environmental Protection Agency.
- Hazardous waste CCTV monitoring system was installed July 2019, and it is connected to Environmental Protection Agency.
- Procure one ambulance in December 2017 for better emergency response.
- Electric bulletin board was installed was installed in April 2018, which mainly included safety commitment, operation condition, hot work, confined space operation, wastewater online monitoring results.

Records of these changes were provided for review.

The facility was previously assessed as compliant with the Code and Quality control and quality assurance documentation is available for the cyanide facilities. Since the 2016 rectification audit there has been several minor modifications to the plant and records were available for these modifications.

The materials used for construction of cyanide production facilities are compatible with the reagents used and processes employed. No changes to the materials or processes employed have been undertaken during the audit period. The materials used for the cyanide facilities comprises the following:

- Cyanide production facilities and cyanide storage tanks – 304 grade stainless steel
- Pipe work – 304 grade stainless steel.
- HCN pipeline– double-deck SUS316L grade stainless steel
- Compressed air storage tanks – carbon steel
- Wastewater storage tanks – mild carbon steel with polyethylene
- Wastewater pipeline – carbon steel (Q235B)
- Tank unloading hose – high-pressure-rated chemical resistant neoprene rubber.

These materials are recognised as being compatible for use with liquid sodium cyanide.

There are automatic systems and “interlocks” that shut down production systems and prevent releases due to power outages or equipment failures.

Two power supply lines are maintained at the site, therefore in the event of one power line failure, the other power line will be initiated.

In the event of power failure or other upset, causes any of the eight parameters (e.g. temperature, pressure, flow rate, pump, and etc) to migrate outside of normal operating conditions, the Distributed Control System (DCS) will initiate the emergency shutdown system.

In the event of HCN leakage, the HCN detectors will deliver the signal to the Central Control Room, triggering the DCS to initiate the emergency shutdown system to limit the extent of HCN release and to limit the impact of the release by the operation of water sprays.

All the storage tanks are equipped with radar level meters which are connected with the central control room. The tanks are equipped with high-level switches. If the tank exceeds the high level, the central control room will receive a signal from the level meter and the level switch will be automatically initiated to shut down the cyanide supply.

The reactors are equipped with interlock system, which includes a high-pressure alarm, high level alarm, high level gauge and shutoff entry valve connected to DCS system. If the high level is reached, the DCS closes the entry valve and triggers the transfer of solution through to the evaporator to the crystallisation vessel, which in turn can overflow to a buffer tank which can hold the flow for 10 to 20 minutes. These transfers are controlled by the DCS. If the pressure in the reactor reaches a nominated high level, the entry valve is closed, the reaction slows, the cooling water cools the reactor and the pressure reduces. At the same time the product is transferred to the evaporator to further reduce the pressure. Excess reaction materials can also be transferred to one of the other two reactors. The site has never had a situation where it did not have sufficient power to operate the reactors.

The 330 m<sup>3</sup> sodium cyanide storage tank (converted from storage of sodium hydroxide) is fitted with a thermometer, level gauge and transfer pump and is connected to the DCS to enable switching off transfers to sodium cyanide into the tank if the high level point is reached in the tank. The DCS overrides the manual opening of the transfer pump if the high tank level is reached.

The cyanide facility areas are covered with concrete pavement to minimise seepage to the subsurface.

The two Cyanide Tank Farm bunds are also lined with concrete and epoxy coating. The capacity of the tanks is 75 m<sup>3</sup> and in a tank farm that has a bund capacity of the tank farm is approximately 132 m<sup>3</sup>. This capacity provides more than 110% of the capacity of the largest tank (75 m<sup>3</sup> in volume). The other sodium cyanide storage tank has a volume of 330 m<sup>3</sup>. This tank is located in a bund with a capacity of 510.23 m<sup>3</sup>, i.e. in excess of 110% of the tank volume.

There is no storage of HCN at the facility. The HCN is supplied through a double-deck stainless steel pipeline from Sinopec Anqing Branch that is routed in an elevated pipe bridge to the reactors. The ground surface along the route of the pipeline is surfaced with concrete to provide containment in the event of a leak.

The packaging workshop and cyanide products warehouse are also constructed with concrete floors and were observed to be in good condition.

The facility does employ methods to prevent the overfilling of cyanide process and storage vessels, including level indicators and high-level alarms. All the signals indicated on the DCS.

The methods applicable to each vessel are as follows:

- Reaction tanks: monitoring the parameters of temperature, liquid level, pressure, flow rate and density of HCN.
- Evaporators: monitoring the parameters of temperature, liquid level, pressure and vacuum degree.
- Crystalliser: monitoring the parameter of temperature.
- Centrifuge: monitoring the parameter of electric current.
- Adjust tanks: monitoring the parameters of temperature and liquid level.
- Liquid cyanide storage tanks: monitoring the parameters of temperature and liquid level.

When the liquid level reaches the 90% of the set value, the alarm will sound and the level switches will be initiated through the DCS system.

Weigh scales and electronic load cells are used on the packing lines to prevent the overfilling of solid cyanide. There are automatic and manual filling lines. When the automatic filling lines run, cyanide can be filled automatically using the electronic load cells, but the drums should be covered manually. While filling manually, the operation is initiated by pushing the "Manual Filling" button and the indicator light comes on when the drum is filled to the required quantity, prompting the operator to push the "Manual Stop" button to finish the filling process. A Metering & Packing Operation Procedure is in place to specifically control the operator's actions during manual filling.

The two 75 m<sup>3</sup> storage tanks for sodium cyanide and one 330 m<sup>3</sup> storage tank for sodium cyanide that are each fitted with high level volume meters (V-602A, V602B and LT1110) connected to the DCS. The DCS alarm activates if the high-volume limit is reached.

Secondary containments for process and storage tanks and containers are constructed of materials that provide a competent barrier to leak and sized to hold a volume greater than that of the largest tank and piping draining back with additional capacity for the design storm event.

The secondary containments for cyanide process and storage tanks and containers comprise two tank farm bunds, two reactor bunds (two reactors in one bund and one reactor in the other bund), the production building and the wastewater collection tank bund.

There have been no changes to the previously certified containment systems and calculations to demonstrate bund capacities were available for review. The Site has an emergency collection tank for liquid cyanide leakage and initial flush stormwater with the capacity of 827 m<sup>3</sup> to enable containment and re-use or testing and treatment prior to discharge if needed.

Spill prevention or containment measures are provided for all cyanide solution pipelines.

The pipelines are located on overhead gantries which pass over concrete paved pedestrian walkways and roadways.

There are no buried cyanide pipelines on the cyanide facility. Valve guards are used on all cyanide solution pipes on aboveground pipelines.

There are no leak alarms on the cyanide pipelines. But HCN leak alarms have been set in the connection flange with warning alarm on Site and in Control room.

Pipelines used to transfer cyanide solutions are constructed of stainless steel (316) which is suitable for such use. The pipes are continuously welded (no flanges) except for some valve and instrument connections.

2-hourly inspections are undertaken of the cyanide storage tank farms and pipelines. The inspections include pipe work, flanges, pumps, high level alarms and tanks to identify leaks. The inspector will submit the inspection results dayshift and night shift after inspection OA system.

In the event of loss from a pipeline within a bunded area, the spill would drain to a sump from where the liquid would be pumped to the Emergency Storage Tank for re-use in the process.

The cyanide facility undertakes monitoring of the pipe wall thicknesses every month via ultrasonic inspection. The inspection records note the integrity of the pipe and support structures. And a biannual X-ray detection for the cyanide pipelines has been conducted by the qualified authority (General Administration of Quality Supervision, Inspection and Quarantine). In the event that a leak of cyanide solution from a pipeline is not trapped by the silica-based insulating compound or the stainless-steel casing, the leak would discharge onto concrete paving leading to the facility's emergency tanks of stormwater.

## 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

**Shuguang is**  in substantial compliance with **Production Practice 1.2**

not in compliance with

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

Shuguang 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 procedures that describe the standard practices necessary for its safe and environmentally sound operation.

Shuguang operates under an integrated Management System Manual, which addresses ISO9001, ISO14001 and OSHA18001 (as GB/T 28001-2001, the Chinese standard). The System has been certified by third party certifiers.

Facility documentation is controlled through the document management system by designated personnel. Site workers access hard copies of the procedures at their work area.

The *Operating Procedure of Sodium Cyanide Production Process* address safety for each process across the whole of the operation, including warehousing, hot work, working at height, fire safety, confined space and management of personal protective equipment.

The *Safety Technology Code for Cyanide Facility* identifies key safety characteristics of hydrogen cyanide and sodium cyanide and specific safety requirements for each part of the production process, such as the reactors, evaporators, crystallisation, centrifuge, dryers and packaging. For the reactors, evaporators and crystallisers, it states that when the two reagents are being mixed, the composition of the mixture must be managed to avoid excessive generation of HCN. The concentration of sodium hydroxide in the reaction mixture is required to be kept between 1.0 and 1.5%. Hourly manual monitoring is undertaken of the hydroxide concentration to guide the supply settings of the reagents.

The *Process Operation Procedures for Cyanide Production and Safety Technology Code for Cyanide Facility* provide work instructions addressing the following:

- General safety requirements including:
  - Operation safety requirements for unloading of cyanide solutions.
  - Safety requirements for cleaning of cyanide pipes.
  - Safety requirements for cleaning of cyanide equipment.
- Start-up and shut-down of the production facility standard operating requirements.
- Standard operation requirements – e.g. evaporation, crystallisation, centrifuge, drying, pressing, packaging.
- Standard operation requirements for the operation of the wastewater treatment plant and cooling towers.

The Process Operation Procedures for Cyanide Production and Safety Technology Code for Cyanide Facility show detailed operational steps for each job.

The *Cyanide Facility Operation Rules* notes that before any operation, the operators must check that the instrument air is functioning, pressure is stable, exhaust system and valves work well; functioning of the weight scale; and that the power and instrumentation are reliable. In case of any failure of the packing line, the operation will be stopped until the problem has been solved.

The Maintenance Procedures for Critical Equipment also specify the maintenance requirements for critical equipment, including:

- Reactors
- Evaporator
- Crystalliser
- Centrifuge
- Vacuum Filter
- Pumps
- Dryer
- Shaping Machine
- Weight Scale
- Capper
- Heating and Decomposition Tank
- Cooling water pumps in production building.

Three safety assessments are undertaken: Job Safety Assessments, Hazardous Chemicals Production Process Safety Impact Assessment (required every three years under Chinese Law) and Significant Hazards Risk Assessment (required annually under Chinese Law).

The Job Safety Assessments are undertaken by Shuguang. The Significant Hazards Risk Assessment and the Process Safety Impact Assessment is undertaken by expert third parties.

The Facility has developed formal procedures for contingencies during upsets in its activities that may result in cyanide exposures or releases.

The Emergency Response Scenarios for the Cyanide Plant and Process Operation Procedures for Cyanide Production include detailed emergency practices for abnormal conditions, including:

- Power Failure
- Steam Failure
- Instrument Air Failure
- Pipe Rupture of Circulating Water
- Instrument Failure for the Reaction System

- HCN leakage
- Pressure Raise in the Reactors
- Leakage in the Liquid Cyanide Storage Tanks
- Solid Cyanide Spill.

Other abnormal conditions are specific to the kinds of processing upsets and incidental conditions that may arise irregularly during operations, such as machine failures (agitators, pumps) and pipeline blockages.

The facility uses menu displays configured in the DCS to monitor abnormal operating conditions from the control room. Should there be a cyanide exposure or release these are managed via the site's emergency response plan documents that provide details on the response actions.

The facility has a procedure which identifies when site operating practices have or will be changed from those on which the initial design and operating practices were predicted.

The procedure applies to all plant modifications to ensure that they are implemented in a manner which does not present a hazard to safety, health, the environment or physical security. For all the potential modifications, likely risks and appropriate control measures must be identified to manage the health, safety and environment impacts. Modification proposals are reviewed by a suitably qualified person from the Environment, Health & Safety (EHS), Production and Equipment and Maintenance departments.

Before being enacted, the proposed change must be signed off by the General Manager, or delegate.

Based on the sample change applications reviewed, the EHS Manager had participated in the risk assessment process and the changes were all signed off by the General Manager. The records about electric furnace change in 2018 was retained.

The cyanide facility has implemented preventative maintenance programs and documented activities for equipment and devices necessary for cyanide production and operation.

A preventive maintenance program is managed by the maintenance department with three separate teams responsible for mechanical plant, civil structures and instruments. The overall strategy of annual plan development for each department is described in its departmental procedure.

The Maintenance Procedures specifies the type of equipment requiring maintenance and the maintenance frequency. This information is used to prepare an annual maintenance plan.

The Equipment Maintenance Plans list and describes the maintenance requirements of the equipment and for each item. Equipment maintenance plans for cyanide facilities were review for the audit period and correlated with the description of maintenance activities provided by site engineers.

For reactive maintenance the operator verbally reports issues to the maintenance department, then the maintenance department raises a maintenance request in writing for action by the maintenance department.

Process parameters are monitored with necessary instrumentation and the instrumentation is calibrated according to manufacturer's recommendations.

The procedure requires that the calibration should be conducted according to the planned frequency. Following calibration, a calibration notice must be placed on the equipment. The facility maintains annual calibration lists detailing the instruments on the plant that require calibration during the year. The instruments included: fixed and portable hydrogen cyanide detectors, portable flammable gas detector, high pressure gauges, vacuum pressure gauges, numerical temperature displays and flow meters.

The calibrations are undertaken by an independent external qualified company: Anhui Province Anhui Institute of Metrology Items of equipment were sampled at random and the corresponding calibration records were available covering the audit period.

Procedures are in place and are being 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 that collects in the facility's secondary containment areas is considered to be potentially contaminated with cyanide. Accordingly, all secondary containment areas are configured to drain to the Shuguang Wastewater Treatment Plant to enable treatment of the contaminated water before it is discharged under agreement to the Sinopec Anqing Branch treatment plant for further treatment before discharge to the Yangtze River. The cyanide reagent tanker unloading area has also be considered as part of a secondary containment area. The unloading area is drained to the first flush basin which also then forms part of the secondary containment. Arrangements are in place for the first flush basin to be pumped clear to the Wastewater Treatment Plant in the same way as other secondary containments.

There are on-line monitoring instruments and alarms installed on both the discharge point from the Shuguang Wastewater Treatment Plant and from the stormwater pipeline that normally discharges stormwater from plant road surfaces that are expected to be nominally clean of cyanide contamination. If either alarm sounds, the relevant outlet valve is closed immediately, and the potentially contaminated water is collected in the Wastewater Treatment Plant or in the First Flush Basin (in the case when usually clean stormwater has been detected as contaminated). Procedures require these conditions to be reported to the Shift Supervisor. The water quality is then monitored, and if over limit, it will be treated using sodium thiosulfate with close monitoring and the cause will be investigated.

Backing up the procedures for dealing with the discharge of contaminated stormwater, there are also procedures of a more preventive nature that clearly specify steps to be undertaken in the event of leakage of cyanide into the bunds or unloading bay and imposing risk to stormwater. The procedures include the following specific items:

- Leakage during production
  - a. In the event of any leakage during production, check and ascertain the leakage source, shut down the production lines, and then correct it.
  - b. After completion of repair, the surface of the bunds is flushed using water which will be collected into the Wastewater treatment plant.

- Leakage during unloading

In the event of any leakage during the unloading, unloading is stopped immediately, the outlet valve from the tanker and drainage valve are closed, leaked liquid cyanide is absorbed using adsorption pad, then the surface of the bunds is flushed using water which will be collected into the Wastewater treatment plant



- Leakage of storage tanks
  - a. In the event of any leakage from the storage tanks, the outlet valve from the bund must be confirmed to be closed immediately and then reported to the supervisor
  - b. Site is inspected by qualified personnel from the liquid production line, leaked liquid cyanide is pumped to the emergency collection pond or transported by tankers, in addition, drainage valve of the stormwater is closed
  - c. Water quality of the drainage pipelines is monitored
  - d. Liquid cyanide in the bunds is recycled using submerged pump
  - e. After the recycling the liquid cyanide, flushing water is collected into the Wastewater Treatment Plant.

With regards to the stormwater collected in the bund and the first flush (collected from potentially contaminated areas within the first 15 minutes of a rainfall event), these streams are collected through underground pipelines and directed to the Wastewater Treatment Plant. The water quality of nominally clean stormwater is monitored both manually and automatically. Water meeting the target level of 0.2 mg/L total cyanide will be delivered into the stormwater system operated by Sinopec Anqing Branch and subsequently discharged to the Yangtze River after dilution with urban stormwater flows from the Anqing municipal drainage system.

Wastewater exceeding the target metering criteria will be diverted away from the clean stormwater flow for treatment with the contaminated waters in the Shuguang Wastewater Treatment Plant and then disposed of as treated wastewater to the Sinopec Anqing Branch regional petrochemical complex Wastewater Treatment Plant before separate discharge to the Yangtze River. Under agreement with Sinopec Anqing Branch, Shuguang is permitted to discharge wastewaters containing less than 3 mg/L total cyanide to the Sinopec Anqing Branch regional petrochemical complex Wastewater Treatment Plant.

The Management Procedure for Water Contamination Prevention states that the first 15 minutes of rainfall is collected in the waste water treatment plant (WWTP) (i.e. first flush chamber) and the monitor the stormwater quality. If the quality meets the criteria the water may be discharged to stormwater. If the water quality fails, the water is directed to the WWTP for treatment.

In the event of an uncontrolled release of cyanide contaminated water into the site's stormwater system, the water would be captured and treated with sodium sulphite at the site's discharge point. This stormwater would discharge to the adjacent Sinopec Anqing Branch petrochemical facility where it undergoes further monitoring prior to release to the municipal stormwater drainage system.

The facility has environmentally sound procedures for disposal of cyanide and cyanide-contaminated solids.

The types of solid waste include:

- Contaminated product which cannot be sold to the customer.
- Contaminated packaging materials, such as plastic bags, plastic drums and timber.
- Protective clothing such as coveralls, respirator filter cartridges and gloves.

Waste cyanide is reprocessed at the cyanide facility in accordance with a Hazardous Waste Disposal Permit.

The procedures clearly indicate the steps involved in disposal of cyanide or cyanide-contaminated solids.

The Management Procedure for Solid Waste states that sludge from the WWTP should be treated with sodium sulphite for 48 hours and then be sent to the licenced waste disposal contractor.

The Procedure for Remediation of Contaminated Soil states that contaminated soil will be tested for cyanide concentration. If the concentration exceeds the criteria (5 mg/L total cyanide), the soil will be placed in solid soaking pit, mixed with sodium sulphite and soaked for 48 hours. After the pre-treatment, the soil is to be transferred to licensed waste disposal contractor if it meets the criteria.

The Production Design Management and Emergency Response Procedure, state that in case of any leakage of cyanide solids (including the wet crystalloid), the solid sodium cyanide will be scraped up and placed in steel drums and disposed of at the site's solid dissolving pond.

The following actions will be undertaken to prevent environmental contamination:

- a. Clean and collect the spilled cyanide solids which are then dissolved and recycled through the dissolving pond. Direct flushing using water at the site of the spill is prohibited
- b. After solid cyanide is removed to the extent achievable, the affected surface will be flushed using water. Wastewater from the flushing is directed to the Wastewater treatment plant.

Under the terms of the Hazardous Waste Disposal Permit, contaminated solids are required to be cleaned by soaking in water in the dissolving pond for 48 hours and soaking in sodium hypochlorite solution for another 48 hours. And the end point of the dissolving process is determined when the leached cyanide concentration in the water being applied for soaking is measured falls below 1 mg/L total cyanide. Non-ferrous solids, after treatment (and meeting treatment specifications), will be transported to Wushan Solid Waste Treatment Company for further management in accordance with their permit to receive waste materials.

Cyanide is stored with adequate ventilation to prevent the build-up of hydrogen cyanide gas, avoid the potential for exposure to moisture, and in a secure area.

Solid cyanide is stored in two sizes:

- 50 kg plastic bags within steel drums, and
- 1000 kg within plastic bags within timber intermediate bulk containers (IBCs).

The drums and boxes are stored inside a secure warehouse building prior to despatch from site. The warehouse is enclosed with concrete floor, walls and roof to prevent exposure of cyanide to moisture.

The walls of the building are equipped with vents to ventilate the building. The build entry points have large doors which also provide for ventilation of the building during access by the forklifts that are used to move product in and out of the building. There is one fixed HCN monitors in the warehouse which alarm (visual and audible) in the warehouse control room.

When product is not being moved into or out of the warehouse, the warehouse building is locked and accessible only via the security office, which is manned by two security persons and fitted with security cameras which transmit to the security office. Visits to the warehouse are logged on paper records in a logbook.

The warehouse building is located within the cyanide facility boundaries. The site is surrounded by a concrete/brick wall. Access to the site is only via a manned security gate. Public access is prohibited. The warehouse is monitored by an online camera and is installed with infrared alarm, which signal is connected to the security room.

The cyanide facility packages cyanide in accordance with the Chinese regulatory standards for packing of solid cyanide. The standard was prepared to meet the requirements of the United Nations Recommendation on the Transport of Dangerous Goods – Model Regulations (2005).

The Standard for Packing of Solid Cyanide specifies the requirements for packing cyanide for export, including the packaging materials and method for inspecting the packaging. The facility sources their drums and IBCs from a third party that supply compliance certificates with each supply of the packaging.

The cyanide facility's packaging procedure in the Provision for Products Packaging and Labelling specifies the packaging requirements, including that the packaging must meet the Standard for Packing of Solid Cyanide.

The Anhui Anqing Entry-Exit Inspection and Quarantine Bureau inspected the cyanide facility's packaging systems for each supply consignment during the audit period (2016-2019) and approved the packaging systems for international transport of the cyanide.

Stored cyanide was observed to be labelled in Chinese and English with global harmonised system GHS pictograms and UN number identifying the product.

### 2.1.3 Production Practice 1.3

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

in full compliance with

**Shuguang is**

in substantial compliance with

**Production Practice 1.3**

not in compliance with

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

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

The facility conducts routine inspections of tanks, valves, pipelines, containments and other cyanide production and storage facilities, including:

- Tanks and vessels holding cyanide solutions for structural integrity and signs of corrosion and leakage
- Secondary containments for their integrity, the presence of fluids and their available capacity, and to ensure that any drains are closed and, if necessary, locked to prevent accidental releases to the environment, and
- Pipelines, pumps and valves for deterioration and leakage.

As noted above, preventive maintenance has been the focus of continual improvement efforts. Based on the risk level of different facilities, annual or monthly maintenance plans are developed and implemented.

The approach adopted focuses on departmental responsibilities for processing systems, considering the commonality of processing conditions (composition, temperature and pressure etc.), and materials of construction. These systems are groups of equipment that comprise larger systems at various steps through the material flow sequence of the manufacturing process.

The Production Facility is routinely inspected every two hours covering the tanks, pipelines and pumps. The inspections are undertaken by separate teams for each department with the team typically comprised of at least five personnel: two operators, a plant maintenance engineer, an electrical engineer and an instrument engineer. The requirements for the inspections are assigned to members of the team and are as set out in the relevant procedures such as the Maintenance Department Procedure (mechanical plant) and the Inspection Procedure (operations). Requirements covered include monthly bund and valve inspection: if any fluids (such as stormwater) and objects are present in the bunds, measures are taken so that the bund is restored to the correct available capacity. The bunds are assessed on each two-hour inspection for the presence of fluids but this requirement is not specified on the inspection sheet.

Valves to drain from the bunds are required to be kept closed at all times to prevent accidental releases to the environment.

If there is a deficiency found during the inspection, corrective actions will be undertaken on the same day or as soon as practicable, which was verified by the Daily Maintenance Records. The records clearly state the date, personnel, and acceptance conditions with regards to the maintenance, and involved workers sign off.

Additional inspections are undertaken on less frequent intervals as noted in the following.

### **Tank Inspections**

The equipment register lists the equipment in the cyanide production plant. A reactor (V-2101), sodium cyanide storage tank (V-602A) and an evaporator (V-4201) were identified on the register.

The Maintenance Procedures for Critical Equipment specifies that cyanide equipment shall be undertaken monthly.

The Monthly Tank Inspection Records require observation of the physical condition of the tank and signs of corrosion and leakage.

There are detailed tank inspections records including diagrams showing the tank function and geometry, components, instruments, accessory pipes and valves, foundations, anti-corrosion coating, heating insulation layer to support recording of observation of integrity as well as any signs of corrosion or leakage during monthly inspections. Ultrasonic test for the thickness of tanks is tested 6-monthly to ensure any corrosion is detected early and preventive action taken. In addition to Shuguang's own tests of the tanks, pipes and valves, tests are conducted every year by the China General Administration of Quality Supervision, Inspection and Quarantine.

### **Tanks and Vessels**

The facility maintains a register of tanks and vessels and identifies which ones contain cyanide solutions. Inspections on the integrity of the tanks are conducted monthly, which including pipe work, flanges, pumps, high level alarms and tanks to identify deterioration and leaks. The inspection records are dated.

The inspection records are dated and detail the results of inspection including the following items:

- Tank foundation stability
- Insulation and corrosion prevention materials
- Stairs and fences
- Bund

- Tank volume indicator
- High level alarms
- Tank valves
- Tanks signage
- Pipeline connection integrity
- Flanges and valve condition
- Wastewater collection facilities
- Presence of tank corrosion or leakage.

In addition to the inspection, the wall thickness of the vessels is tested monthly.

### Secondary Containments

A site inspection confirmed secondary containments are in reasonable condition and evidence of periodic maintenance and patching was observed. The facility has updated its inspection process to better define standards for secondary containments.

Minor defects in south tank farm bund and liquid cyanide unloading area were rectified during the audit.

Discharge from the secondary containment is via underground pipe system, that discharges to the stormwater first flush containment tanks at the site's wastewater treatment plant, or for a concentrated liquid cyanide spill, to a mobile tanker for re-use at the cyanide facility.

### Pipes

The thickness of the wall of cyanide carrying pipes is monitored 6-monthly via ultrasonic test internally. The inspection records note the integrity of the pipe and support structures. The inspection records are dated. Records were sighted for selected pipelines for 2017, 2018, and 2019. The integrity test will be conducted every three years or six years, depending on the results of the last test results by third certified parties.

Inspection frequencies are sufficient to assure that equipment is functioning within design parameters.

Facility operation is monitored continuously for levels, flows, temperatures, pressures and composition-related parameters using permanently installed process instrumentation. Most control parameters are displayed in the central control room via the DCS system. When abnormal conditions occur, alarms will be initiated. In addition, the interlock system is triggered to ensure safe operation.

As described above, there is an extensive range of inspections carried out ranging from every two hours through daily and monthly to annually to ensure that equipment is functioning within design parameters.

The facility has documented inspections that are retained. The documentation identifies specific items to be observed and includes the date of the inspection, the name of the inspector, and observed deficiencies. The nature and date of corrective actions were noted as being documented, and records are retained. The facility also assigned Training Centre for the management system documents maintenance.

## 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

Shuguang is

in substantial compliance with

**Production Practice 2.1**

not in compliance with

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

Shuguang 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 *Operating Procedure of Sodium Cyanide Production Process* 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 DCS in the control room.

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

- Working at heights
- Confined space
- Lifting
- Digging
- Machinery maintenance
- Flow isolation plate, and
- Hot work.

The procedure discusses the PPE that must be worn and to undertake a field level risk assessment prior to commencing work. 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 and undertaking gas testing.

As discussed in Standard of Practice 1.2, the Facility has implemented a formal site change management process.

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 to be reviewed by suitably qualified person from the EHS, Production and Equipment and Maintenance departments. Before being enacted, the proposed change must be signed off by the General Manager, or delegate. 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.

The employees are involved in the hazard identification and risk control measures through specific meetings, Team Meetings and suggestions from employees.

Employees can make suggestions regarding process or procedural changes to their supervisors or management via the Employee Suggestion Box, company email, Office Automation system and Wechat. Based on records review, the company has established online tracking system to make sure prompt response to the valuable suggestions. The facility also gives awards to the staff who has provide the valuable suggestions.

The facility uses monitoring devices to confirm that controls are adequate to limit worker exposure to hydrogen cyanide gas and sodium, calcium or potassium cyanide dust to 4.7 ppm (5 mg/m<sup>3</sup>) or less, as cyanide.

Twenty-five fixed HCN monitors are installed throughout the cyanide bearing areas within the production facility and warehouse. Additionally, personnel have access to two portable HCN monitors. Each type of monitor is set to alarm at 4.7 ppm (5 mg/m<sup>3</sup>).

In addition to gas monitoring, Shuguang undertake daily, weekly, fortnightly and monthly manual cyanide dust monitoring at a number of locations throughout the facility. The monitoring frequency is dependent on the level of risk to personnel. These locations include:

- Packing area
- Reactor area
- Main control room
- NaCN storage tank
- Dryer operations area
- Northern factory gate
- Western factory gate
- Centrifugation workshop
- Moulding control room
- Vacuum filter
- Laboratory
- Warehouse.

Analysis of dust sampling is undertaken at the facility's laboratory. The Chinese standard is 1 mg/m<sup>3</sup>. The records reviewed for 2017-2019 were all less than this standard.

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

The Facility has identified areas and activities where workers may be exposed to HCN gas or sodium cyanide dust at more than 4.7 ppm (5 mg/m<sup>3</sup>) or less, as cyanide, and requires the use of personal protective equipment as necessary in these areas when these activities are being performed.

The areas identified include:

- Packaging Operation
- Packaging Control Room
- Storage Warehouse
- Centrifuging Operation
- Drying Operation
- Reactor Areas
- Vacuum Filters
- Shaping Control Room
- Central Control Room.

Twenty-five fixed HCN monitors are located around the facility in cyanide bearing areas.

The overall extent of the operation where there are risks of cyanide exposure has been demarcated with a distinctive red line. There are defined PPE requirements applicable to entry to the area within the red line. Signs displayed, and Standard Operating Procedures set out requirements for the use of defined PPE specific to the distinct areas listed above. Minimum PPE requirements and hygiene practices apply everywhere within the red line.

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

The Production Facility has provisions for a buddy system, or workers can otherwise notify or communicate with other personnel for assistance, help or aid where deemed necessary.

The *Production Design Management and Emergency Response* procedure clearly specifies that all the operations must be conducted by at least two operators, and generally by four operators. Also, at least one doctor and one nurse are present during each shift in the First Aid Station.

The workers are equipped mobile phones and walkie talkies and there are several fixed calling points located in the major HCN bearing areas, e.g. reaction areas, centrifuge operation area, shaping operation area, storage warehouse and etc, which were sighted during the site audit. Any emergency happens, they can choose the fast way to report.

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 (Anqing City). 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 Occupational Disease Prevention System 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 four sets of clothes every year and all employees in the cyanide department have their clothes washed for them on site by the department. If wear of the clothing occurs, the employee can get a new set.

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, boots cover 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 for both sodium cyanide and hydrogen cyanide are placed in all process and storage areas. The signs include PPE requirements.

Warning signs were observed to be located on the outside of the warehouse buildings at entrance points and within the warehouse. Warning signs were present at production area.

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.*

	<input checked="" type="checkbox"/> <b>in full compliance with</b>	
<b>Shuguang is</b>	<input type="checkbox"/> in substantial compliance with	<b>Production Practice 2.2</b>
	<input type="checkbox"/> not in compliance with	

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

Shuguang 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 and an on-site disposal method to illustrate detailed treatment procedure after a spill or exposure.

The operation has access to trained medical personnel at all times and the persons interviewed knew to relocate exposed person off site 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.

Qualified doctors provide annual first aid training to the employees. Topics include:

- Poisoning rates and exposure pathways

- First aid measures
- Safety protection and prevention.

An Emergency Response Knowledge Question and Answer Card has been prepared and distributed to each on-site employee. This card specifies the emergency response procedures in case of cyanide exposure involving skin contact, eye contact, or inhalation.

Warning signs that provide emergency response procedures are also posted in the plant.

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 monthly preventative maintenance inspection and servicing programme. According to the equipment list of 2019, there are 203 dry powder fire extinguishers assigned throughout the Facility. Weekly inspection has been conducted by fire safety officer as well as monthly inspection conducted by production team. There are 18 emergency showers/eye wash stations assigned production and storage area within 15 m radius of the nearest workstation, biweekly inspection has been conducted.

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

First aid kits are reported and observed in the following areas: production workshop, packaging workshop, storage warehouse, and control rooms of the production building. These medical kits are checked by the First Aid station personnel on weekly basis.

The emergency response equipment maintained on site includes the oxygen cylinders, oxygen cylinder trolley, resuscitators and ambulance. Antidote medicine (sodium nitrate, sodium thiosulfate, and methylene blue) are stored in the first aid station. Each cyanide related workstation is also provided with amyl nitrite as the antidote. Mobile phones, walkie-talkies and fixed calling points are readily available as a means of communication in the event of emergency.

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 so that they will be effective when used.

Biweekly inspection has been conducted for emergency showers/eye wash stations and the other emergency equipment is inspected as follows:

- Amyl nitrate – weekly
- Sodium thiosulphate – monthly
- Oxygen cylinders – monthly
- Other first aid consumables (e.g. gauze, bandages etc.) – monthly.

Antidotes are stored under temperature conditions per manufacturer's specifications. The storage conditions specified by the manufacturer of amyl nitrite are for the antidote to be stored in a shaded cool area where the temperature does not exceed 20°C. As amyl nitrite is stored at locations throughout the centrifuge area, dry area, modelling area, reaction area, packing area, warehouse, auxiliary production area at First Aid Stations, small refrigerators are provided at each location to maintain the storage conditions recommended by the manufacturer. The stocks of sodium thiosulphate are stored in a glass box in the First Aid Station consistent with manufacturers' recommendations that these antidotes are stored in the shade out of direct sunlight.

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.

There are four doctors and four nurses assigned on Site for each shift. 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 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.

The *Emergency Response Knowledge Question and Answer Card* is distributed to all employees. This card describes the first aid procedures in the event of a cyanide exposure.

Dangerous Chemical Safety Notification Cards for cyanide are posted on the wall in work areas where there is a potential for exposure with cyanide. The main information contained in the SDS (e.g. hazards, first aid measures, emergency response measures, etc.) are included in the notification cards in the Chinese language. 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 and chemical formula in both Chinese and English.

The flow directions are clearly indicated on the pipelines and the content (e.g. NaCN) are also posted in Chinese together with the chemical formula.

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

All visitors and facility workers receive induction training detailing information about the danger of cyanide, risks at the plant and safety information in general, including cyanide exposure procedures.

The procedures specify 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.

In the case of skin exposure, the procedures specify that the clothes must be removed and the person involved must be washed using showers for at least twenty minutes and then seek assistance from the First Aid Station.

The Facility has its own on-site capability to provide first aid 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 four fully qualified doctors and four nurses.

All the doctors have been certificated by Hygiene Department of Anhui Province.

If any cyanide exposure, it will be treated by site medical staff in the first instance. Should the injuries be too severe to successfully treat on-site, patients can be transferred to the Anqing Shi Hua Hospital via ambulance, which is a 3.0 km journey. The ambulance is stationed in Shuguang Facility and is available 24 hours a day.

Shuguang has signed a medical cooperation protocol with the Anqing Shi Hua Hospital for the treatment of cyanide injuries, which is in validation during Site visit.

The Facility has developed a procedure to transport exposed workers to locally qualified, off-site medical facilities.

Shuguang has signed a medical cooperation protocol with the Anqing Shi Hua Hospital for the treatment of cyanide injuries, which is in validation during Site visit.

If any cyanide exposure, it will be treated by site medical staff in the first instance. Should the injuries be too severe to successfully treat on-site, patients can be transferred to the Anqing Shi Hua Hospital via ambulance, which is a 3.0 km journey. The ambulance is stationed in Shuguang Facility and is available 24 hours a day.

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.

As described in above, if any cyanide exposure, it will be treated by site medical staff in the first instance. Should the injuries be too severe to successfully treat on-site, patients can be transferred to the Anqing Shi Hua Hospital via its own ambulance with 15 minutes.

In addition, a copy of the latest version of the *Emergency Response Scenarios for the Cyanide Plant SG/Z09-016-2018* has been provided to the hospital and the acceptance record has been retained.

As reported by Dr. Ming Li, Anqing Shi Hua Hospital is an integrated hospital with appropriate equipment, and qualified and experienced staff to treat patients with cyanide poisoning.

Mock emergency drills are conducted periodically to test response procedures for various exposure scenarios.

The whole of the Facility undertakes two emergency response drills each year in accordance with Chinese standards and the facility's Emergency Response Plan. The mock drills include the scenarios of fire accident, poisoning and leakage of cyanide. These are discussed further in Standard of Practice 5.6.

The purpose of the mock drills is to test the procedures, equipment and first aid capability of the Facility. And completed drill reports are developed that outline the lesson and deficiency of the process 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 Accident Management Procedure. It details an accident classification system which 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 EHS department along with the production department to determine the root cause of the incident.

The accident and treatment report will detail 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.*

**in full compliance with**

**Shuguang is**  in substantial compliance with **Production Practice 3.1**

not in compliance with

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

Shuguang 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 a direct discharge to surface water.

The facility has its own wastewater treatment plant (WWTP) for preliminary treatment. The wastewater is then piped to the wastewater treatment plant in the Sinopec Anqing Branch and together with other wastewater streams generated by Sinopec Anqing Branch is further treated before ultimate discharge to the Yangtze River about 11 km south of Shuguang Facility. Domestic wastewater (e.g. bathroom, toilet, laundry room) is discharged directly to Sinopec Anqing Branch without on-site treatment by the facility WWTP. Wastewater monitoring is conducted daily by Shuguang and annually by a third-party testing institute. Online monitoring system has been installed at the final outlet before discharging into Sinopec Anqing Branch wastewater system. The internal and external wastewater monitoring records from 2017 to 2019 were provided for review, and the records shown the total cyanide content in the wastewater discharging to Sinopec Anqing Branch is around 0.1mg/L, well below 0.5 mg/L(total cyanide ).

Clean storm-water runoff from the facility is collected and stored in an on-site storm water storage pit (312 m<sup>3</sup>) before discharge to the storm water collection system of Sinopec Anqing Branch and finally to the municipal storm water drainage system of Anqing City. The first flush storm water from areas where the water may possibly be contaminated by cyanide is segregated and treated in the WWTP of Shuguang Facility. Stormwater self-monitoring records (SG/J09-01-050) conducted by Shuguang for 2017 to 2019 were provided for review and the randomly selected reports shown the results ranges from 0.05 to 0.12 mg/L for total

cyanide, which meet the Class III of Environmental Quality Standards for Surface Water (GB3838-2002) specified in Environment Impact Assessment (EIA) Report (total cyanide $\leq$ 0.2 mg/L).

As described above, the facility does not have a direct discharge to surface water. The process wastewater and potentially contaminated storm water collected at the site are treated prior to being discharged from the Sinopec Anqing Branch treatment system. The clean stormwater is discharged to the municipal stormwater drainage system which merges with other water streams before finally being discharged to the Yangtze River.

In addition, reported by the EHS manager, surface water quality monitoring is conducted monthly by Anqing Environmental Monitoring Station (EMS) at the cross-section of Yangtze River close to the wastewater discharge outlet of Sinopec Anqing Branch and the results for total cyanide in recent three years are below 0.022 mg/L as per the communication with the Anqing EMS. However, the relevant monitoring reports maintained by the Anqing EMS were not available for review during the site audit.

The cyanide facility does not have an indirect discharge to surface water.

The nearest surface water body is a local lake which is located about 3.0 km east of the facility.

The process wastewater after pre-treatment is discharged to the WWTP of Sinopec Anqing Branch for further treatment before finally being discharged to the Yangtze River, which is about 11 km away from Shuguang Facility. As the wastewater is sent via further treatment and Shuguang meets acceptance criteria, subsequent discharge from this facility is not considered to be an indirect discharge from Shuguang.

Clean storm-water runoff from the facility is collected and stored in the on-site storm water storage pit (312 m<sup>3</sup>) before being discharge to the storm water collection system and finally to the municipal storm water drainage system of Anqing City. The first flush storm water from areas with possible contaminated cyanide are segregated for treatment in the Shuguang Facility's WWTP.

Two groundwater monitoring wells have been installed at the western and eastern site boundaries (up-gradient and down-gradient of the cyanide plant) to inspect any seepage potentially containing cyanide. Groundwater at the two groundwater monitoring wells was sampled and monitored September 20, 2018. The result of total CN is below 0.002mg/L which showed compliance with the applicable Chinese groundwater quality standards (Groundwater Quality Standard, GBT14848-2017) and were consistent with the monitoring results obtained by Shuguang for the same period.

Based on the monitoring undertaken of groundwater at the facility, there is no evidence of groundwater contamination at the facility that could impact on surface water quality to the extent specified by the Code.

The facility monitors for cyanide in groundwater up and down gradient of the cyanide facility at two locations. Two groundwater monitoring wells have been installed at the western and eastern site boundaries. Groundwater monitoring is conducted by a third-party vendor on annual basis and by Shuguang Facility every month (twice per month).

As reported in the Environmental Impact Assessment (EIA) Report for the facility, there are no beneficial groundwater uses for domestic/production within the vicinity of the facility were identified.

In the updated Environmental Protection Construction Acceptance of January 2019. The groundwater monitoring conducted in September 2018 has showed that the cyanide concentrations are well below the applicable Chinese Groundwater Quality Standard, (Class III,  $\leq$ 0.05mg/L for total cyanide). Both the results of total CN in the groundwater monitoring wells are below 0.002 mg/L. The internal and external wastewater monitoring records from 2017 to 2019 were provided for review, and the records shown the total cyanide content in the wastewater discharging to Sinopec Anqing Branch are well below the regulatory limit.

In addition to cyanide the other parameters monitored are pH, total hardness, total dissolved solid, sulfate, chloride, heavy metal, and etc. The monitoring results shown compliance with Class III limit of the Chinese Groundwater Quality Standard.

Seepage from the facility has not caused the concentration of cyanide in the groundwater to exceed that necessary to protect its beneficial use.

The facility limits the atmospheric emissions of hydrogen cyanide gas such that the health of workers and the community are protected.

Engineering controls for minimising emissions of hydrogen cyanide include the following,

- a) Pre-treatment of air emissions from the drying process by cyclone-type dust removal, water scrubber and alkaline scrubber prior to discharge through a 50 m high stack. An online HCN meter is installed in the dryer stack
- b) Air emission from the shaping and packing process is discharged through local exhaust ventilation for processing equipment and mechanical ventilation system is installed for the workshop.

There are twenty-five fixed HCN detectors that constantly monitor the manufacturing processes. The HCN detectors are mainly located at liquid hydrocyanic acid inlet pipes, reaction area, evaporation area, crystallisation area, centrifuge area, modelling area, packing area, boundary area and warehouse.

Shuguang has retained a licensed third-party contractor to conduct annual air emissions monitoring. In the report prepared by Shanghai Xinjie Test Technology Co., Ltd. on September 30, 2018, the results for hydrogen cyanide is 0.09 mg/m<sup>3</sup>, below the applicable Chinese standard of 1.9 mg/m<sup>3</sup>. Interim results from 2019 monitor demonstrate ongoing compliance with the emissions standard.

The local environmental monitoring station under the local Environmental Protection Bureau (EPB) conducts annual monitoring as well.

The online HCN monitoring records are also indicate compliance with the applicable Chinese air emission standards (1.9 mg/m<sup>3</sup>).

The discharges from the cracking furnaces pass through the condensers, bag filters and then to absorption tanks in a closed system. A fixed hydrogen cyanide gas detector is located between the two tanks in each pair of absorption tanks. Online monitoring gas detectors with 1 ppm alarm limitation have been installed at the outlets.

There is no discharge to surface water and as such surface waters within the vicinity of the facility are not monitored. However, the facility monitors for cyanide in groundwater up-gradient and down-gradient of the site.

According to the site personnel, groundwater monitoring is conducted by a third-party vendor on an annual basis and by Shuguang Facility every month (twice per month).

In the updated Environmental Inspection and Acceptance report which prepared by third-party on December 2018 shown the cyanide contents are well below the applicable Chinese Groundwater Quality Standard (Class III, ≤0.05 mg/L TCN).

- Monitoring well at the west portion (MW1): below 0.002 mg/L TCN
- Monitoring well at the east portion (MW2): below 0.002 mg/L TCN.



Besides the cyanide concentration, other parameters monitored are pH, total hardness, total dissolved solid, sulfate, chloride and iron and the monitoring results shown compliance with Class III limit of the Chinese Groundwater Quality Standard.

Monitoring of the water (stormwater and wastewater) discharged by Shuguang is conducted at the final discharge points from the facility to Sinopec Anqing Branch to be merged with water streams from Sinopec Anqing Branch which then finally discharged to surface water body.

Storm-water self-monitoring records (SG/J09-01-050) conducted by Shuguang for 2017 to 2019 were provided for review and the results in 2019 shown the results ranges from 0.052 to 0.104 mg/L for total cyanide. And all the stormwater will be discharge into the Sinopec Anqing Branch stormwater system.

Wastewater monitoring is conducted by Shuguang daily and by a third-party testing institute once a year as well as online monitoring system. The wastewater monitoring records (SG/J09-01-033) from 2017 to 2019 were provided for review and the detailed review of the results for January to February 2019 show the total cyanide content in the wastewater discharging to Sinopec Anqing Branch is around 0.1 mg/L, well below 0.5 mg/L. The annual third-party wastewater monitoring report prepared by Shanghai Xinjie Test Technology Co., Ltd. on 30 September 2018, show the cyanide content ranges from 0.081 to 0.083 mg/L TCN.

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 –online monitoring, annually externally
- Stormwater discharges –online monitoring, annually externally
- Groundwater quality – twice a month internally, annually externally
- Air quality – online monitoring, annually externally.

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.*

Shuguang 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 accordance with the annual training plan.

The plant manager and safety manager accept the safety training from Emergency Response Management Bureau every three years and need to pass the exam to obtain the certificates, which are all in validation.

Interviews with personnel and personnel training files 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.

An annual training plan is developed at the beginning of the year which included Training elements include the physical and chemical characteristics of cyanide, fire prevention, personal protection equipment, EHS management procedures, Emergency Response Plan, safety operation process, occupational health requirement, maintenance requirement etc., and also specific training materials regarding each post. New employees are partnered with an experience person to learn the job and this is overseen by the supervisor for the area.

The department leader has overall responsibility for the provision of training and delegates the training sessions to the qualified trainers (normally the experienced and knowledgeable engineers).

Emergency response training is conducted in the department level safety training and annual refresher training held by the EHS Department.

The training elements are necessary for each job identified in training materials.

An annual training plan is developed at the beginning of the year which included Training elements include the physical and chemical characteristics of cyanide, fire prevention, personal protection equipment, EHS management procedures, Emergency Response Plan, safety operation process, occupational health requirement, maintenance requirement etc., and also specific training materials regarding each post.

Training is provided by appropriately qualified personnel.

According to the *Production Design Management and Emergency Response Procedure*, trainers should be qualified on both the technical competence and their communication skills.

The Facility has 41 personnel with safety management certificate verified by Anqing Emergency Management Bureau. 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. Also, the Facility daily, weekly, monthly, annually inspection and evaluation for employees EHS performance.

#### 2.4.2 Production Practice 4.2

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

in full compliance with

Shuguang is

in substantial compliance with

**Production Practice 4.2**

not in compliance with

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

Shuguang 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 41 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 are conducted with workers to train them and test their response skills. The facility has conducted worker exposure scenarios. 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 address 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 Facility 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.*

Shuguang 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:

Shuguang 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:

- Emergency Incident Management Plan, Production Design Management and Emergency Response Procedure and Environmental Incident Emergency Response Plan which provide high level guidance for the preparation of the following subordinate plans.
- Emergency Response Scenarios for the Cyanide Plant details the emergency response for potential releases of cyanide.

In the emergency response management procedures, the main elements included as below:

- General guideline
- Hazard analysis of potential cyanide release
- Emergency response procedures for cyanide release
- Participation of internal staff and outside responders
- Organization chart and responsibilities
- Rescue and reporting procedures
- Treatment and monitoring of cyanide release
- Drill, assessment and updating of emergency response plan
- Emergency response organization chart
- Chain of command and emergency response process chart
- Evacuation map
- List of emergency response facilities, specification, number, location and responsible department
- Various response scenarios to an emergency.

The emergency procedures do consider the potential failure scenarios appropriate for its site-specific environmental and operating circumstances.

The *Emergency Incident Management Plan* outlines 17 emergency scenarios of which nine are specifically related to cyanide release. The nine cyanide release-related scenarios are:

- HCN spill/leakage
- Power outages for cyanide manufacturing facilities
- Explosions of pressure vessels containing cyanide
- Cyanide release from tanks
- Explosions of cyanide reaction facilities
- Abnormal conditions of cyanide reaction facilities
- Steam outages for cyanide manufacturing facilities
- Environmental emergency response during hazardous chemicals release and explosions of pressure vessels
- Flood prevention for cyanide manufacturing facilities.

And the detailed response process has been specified in the *Emergency Response Scenarios for the Cyanide Plant*. These seem appropriate for the site-specific environmental and operating circumstances.

The emergency procedures do describe specific response actions, as appropriate for the anticipated emergency situations, such as evacuating site personnel and potentially affected communities from the area of exposure.

- a) *Specific response actions, as appropriate for the anticipated emergency situations, such as evacuating site personnel and potentially affected communities from the area of exposure.*

Chapter 8 of *Production Design Management and Emergency Response* sets out the specific response actions, such as evacuating site personnel and potentially affected communities from the area of exposure. Section 4 in Chapter 8 details the response actions required for each department involved in the management of the emergency. The response actions include those outlined above for the nine release related scenarios.

Additionally, Shuguang has an emergency response protocol with the nearby village (Wu Li village), which is approximately 200 m from the facility. This protocol outlines a number of response actions in the event of an emergency that are specific to the village. During Site visit, the village has moved out of the area as reported.

- b) *Use of cyanide antidotes and first aid measures for cyanide exposure.*

Production Design Management and Emergency Response describes cyanide first aid measures for persons impacted by HCN or cyanide.

- c) *Control of release at their source*

The *Emergency Incident Management Plan* describes specific steps to control cyanide release at the source for a number of scenarios, as described above.

d) *Containment, assessment, mitigation and future prevention of releases.*

The *Emergency Incident Management Plan* specified the containment steps which are outlined in response scenarios for containment measures.

Shuguang Facility also stipulate relevant measures in Section 5 and Section 6 of Chapter 8 of *Production Design Management and Emergency Response Procedure* which state that a cyanide release event should be reported to the supervisor and the relevant administrative department in the plant. An incident investigation team will be organized to investigate and identify the cause of the incident and other characteristics of the event, lessons learned and the corresponding corrective to be also drawn up to prevent similar incidents with the risk of cyanide exposure from recurrence or to improve the nature of the response if there is a recurrence.

**2.5.2 Production Practice 5.2**

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

Shuguang is  in full compliance with **Production Practice 5.2**  
 in substantial compliance with  
 not in compliance with

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

Shuguang 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 EHS Manager indicated that the workforce has opportunities to comment on the emergency response documentation during annual training on its content.

Shuguang has identified the following external stakeholders:

- Anqing Petrochemical Fire-fighting Bureau sited next-door to Shuguang.
- Emergency Management Bureau
- Environmental Ecological Management Bureau
- Fire Prevention Bureau
- Anqing Shi Hua Hospital
- First line staff.

Wuli Village was located approximately 200 m north of the site, and the village has moved out of the area in October of 2018.

Each external stakeholder has received controlled copies of the emergency response documentation following each update of the documents. In addition, Shuguang has cooperation protocol with the local hospital.

The Facility has not made potentially affected communities aware of the nature of their risks associated with accidental cyanide releases as the scenarios identified at the site are unlikely to affect or require actions by the community.

According to the latest Environment Impact Assessment Report of 2017, the impact size is 500 m radius from the site. Wuli Village was used to locate in 200 m radius from the Site. However, the village moved out from the area in October of 2018.

The Facility has involved local response agencies such as outside responders and medical facilities in the emergency planning and response process.

The *Production Design Management and Emergency Response Procedure* details the roles of outside responders.

The outside responders include:

- Anqing Petrochemical Fire-fighting Bureau sited next-door to Shuguang
- Emergency Management Bureau
- Environmental Ecological Management Bureau
- Fire Prevention Bureau
- Anqing Shi Hua Hospital.

As detailed previously, these agencies have been provided with controlled copies of the emergency response documentation.

The operation engages in regular consultation and communication with stakeholders to assure that the Plan addresses current conditions and risks as detailed in above. Shuguang is in regular consultation with the following external stakeholders through the provision of updated emergency response documentation:

- Wuli Village
- Anqing Petrochemical Company
- Safety Protection Bureau
- Environmental Protection Bureau
- Anqing Shi Hua Hospital.

### 2.5.3 Production Practice 5.3

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

Shuguang is  in full compliance with **Production Practice 5.3**  
 in substantial compliance with  
 not in compliance with

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

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

The emergency response documentation:

- a) *Does designate primary and alternate emergency response coordinators.*

As specified in Section 5 of the *Production Design Management and Emergency Response Procedure*, a commander team will be organized in case of emergency. General Manager will be the commander in chief, and Vice General Manager will be the backup. Leaders of each department will be the members of the commander team.

- b) *Identifies Emergency Response Teams.*

Designated responders from each department consist of the emergency response and rescue team. Duties of each department are detailed in Section 5 of the *Production Design Management and Emergency Response Procedure*.

A list of trained emergency responders is maintained by the EHS Department.

- c) *Requires appropriate training for emergency responders.*

The *Production Design Management and Emergency Response Procedure* stipulates the requirement for annual training of Emergency Commanders. The *Safety Training and Education Procedure* outlines the requirements for regular emergency response training for employees. Training records indicate that employees receive annual training in emergency response and participate in annual mock drills.

- d) *Includes call-out procedures and 24-h contact information for the coordinators and response team members.*

Appendix 2 of the *Production Design Management and Emergency Response Procedure* details contact information for all internal and external persons directly involved in the Emergency Response.

The EHS Department maintains a list of all emergency response trained employees, which includes contact information.

- e) *Specifies the duties and responsibilities of the coordinators and team members.*

Section 5 of the *Production Design Management and Emergency Response Procedure* clearly specify the duties for the Command Team and each department to be involved in emergency response.

- f) *Lists all emergency response equipment that should be available.*

Appendix 4 of the *Production Design Management and Emergency Response Procedure* lists the emergency response facilities and equipment, specifications for the equipment items, the number of each item that is required to be available, the locations of the facilities and items and identifies the department responsible ensuring the equipment is kept available and expected to use the equipment in an emergency response situation. The emergency response equipment mainly 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.



- g) *Includes procedures to inspect emergency response equipment and assure its availability when required.*

Section 5.3 of the *Production Design Management and Emergency Response Procedure*, requires that emergency response equipment should be inspected monthly. 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.

- h) *Describes the role of outside responders, medical facilities or communities in emergency response procedures.*

The *Production Design Management and Emergency Response Procedure* clearly describes the call out procedures and contact information for outside responders, medical facilities and community representatives in Section 6. The roles of outside responders are clearly described in Standard of Practice 5.2 of the *Production Design Management and Emergency Response Procedure*, supported by further details contained together with the agreement with Anqing Shi Hua Hospital.

The facility has confirmed that outside entities included in the Emergency Response Plan (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 Anqing Petrochemical Company, Anqing Petrochemical Fire-fighting Bureau sited next-door to Shuguang, Emergency Management Bureau, Environmental Ecological Management Bureau, Fire Prevention Bureau and Anqing Shi Hua Hospital.

The mock drills conducted in June annually. The outside responders have participated in mock drills in the last three year.

### 2.5.4 Production Practice 5.4

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

in full compliance with

**Shuguang 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 emergency response documentation contains clear flow charts and contact information describing the call out procedures for notifying management, regulatory agencies, outside response providers and medical facilities.

Section 5 and Section 6 of *Production Design Management and Emergency Response Procedure* describe the duties of management, each department, regulatory agencies, outside responders, including the hospital as well as outlines the reporting procedures.

Appendix 2, Chain of command and emergency response process chart of *Production Design Management and Emergency Response Procedure* provides contact phone numbers for all internal and external responders.

In addition, contact information for the emergency response team, the on-site doctor, ambulance, fire and hospital is on the obvious position of the Site.

The emergency response documentation includes procedures and contact information for notifying potentially affected communities and communication with the media.

Based on a review of potential releases from the Shuguang site and the distances involved, Wu Li Village has been identified as the only residential community that could potentially be affected by incidents at the site. However, the village has moved out of the area in October of 2018. No other villages in the 1000 m radius of the Site.

As an industrial neighbour also handling hydrogen cyanide, the Anqing Petrochemical Company's facility in Jingbei Road has been identified as potentially affected by incidents at the site.

As noted in Section 5.5 of the *Production Design Management and Emergency Response Procedure*, the command team is required to inform the neighbouring community and Anqing Petrochemical Company and if based on the estimation of affected scope, request them to evacuate the village. The contact information of Wu Li Village, the neighbouring company and the media contacts considered appropriate by Shuguang for emergency notification is detailed in Section 6 of the *Production Design Management and Emergency Response Procedure*.

### 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.*

**Shuguang 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:

Shuguang 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 emergency response documentation does describe specific, appropriate remediation measures, such as recovery or neutralisation of solutions or solids, decontamination of soils or other contaminated media and management and/or disposal of spill clean-up debris. Alternate drinking water supply is regarded as not applicable to the Shuguang site given that the drinking water supply is municipal water, and that the nearest surface water is approximately 3 km from the site. The drinking water source is the Yangtze River, which is about 11 km south-east of the Site.

The *Pollution Remediation Management Procedure* details response and remediation methods for:

- Soil contamination
  - Isolate area
  - Test soil for cyanide
  - If above 5 mg/l total cyanide
    - Neutralise using sodium hypochlorite
    - Excavate soil

- Dispose of soil via a solid waste vendor
  - Retest area and continue to excavate if cyanide concentration is still above 5 mg/L
- Groundwater contamination
    - Use a pump to extract groundwater
    - Analyse water for cyanide
    - Dispose water via the site's wastewater treatment station
    - Monitor groundwater every two hours.

Continue extracting until cyanide concentrations are below 0.05 mg/L.

The emergency response documentation prohibits the use of chemicals such as sodium hypochlorite, ferrous sulfate and hydrogen peroxide to treat cyanide that has been released into surface water.

Section 7.2.3 of *Production Design Management and Emergency Response* states that “Sodium hypochlorite, ferrous sulfate and hydrogen peroxide should not be used to treat a cyanide release once it has entered surface water”.

Despite this requirement, the facility is at least 3 km away from the nearest surface water and it is unlikely therefore that there will be any emergency with direct discharge of cyanide to surface water. The operation does not consider the release of cyanide to surface water through the stormwater system to be a credible scenario.

The emergency response documentation does address the potential need for environmental monitoring to identify the extent and effects of a release, and include sampling methodologies, parameters and, where practical, possible locations.

Plans for environmental monitoring of groundwater and soil in connection with an emergency are specified in the *Pollution Remediation Management Procedure*. This procedure notes the steps involved, test methods and concentration limits.

### 2.5.6 Production Practice 5.6

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

in full compliance with

Shuguang is  in substantial compliance with **Production Practice 5.6**

not in compliance with

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

Shuguang 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 emergency response documentation contains provisions for periodically reviewing and evaluating its adequacy and they are being implemented.

Section 8.1 of the *Production Design Management and Emergency Response Procedure* states that the plan is required to be evaluated annually and updated if any deficiencies are identified during the implementation of the procedure. A record of review was sighted by the Auditor.

Additionally, evidence of reviews of the procedure was provided in the form of signed receipts of acknowledgement from external stakeholders who are sent updates of the emergency response documentation.

Mock emergency drills are conducted periodically to test response procedures for various exposure scenarios.

Mock drills involving exposure to an environmental release of cyanide were conducted in June annually and involved the following entities:

- Anqing Petrochemical Fire-fighting Bureau sited next-door to Shuguang.
- Emergency Management Bureau
- Environmental Ecological Management Bureau
- Fire Prevention Bureau.

In addition to the drills, employees receive annual training on emergency response procedures for the scenarios identified in the emergency response documentation.

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.

The facility has provisions to evaluate the plan after an emergency that required implementation of the plan, and for revising the plan as necessary.

Section 8.3 in Chapter 8 of *Production Design Management and Emergency Response Procedure* stipulates that after each mock drill, evaluation team should be organised to assess the performance and effectiveness of the mock drill, therefore correct or improve the content of the emergency response plan if any deficiencies identified.

The post mock drill evaluation documents for 2017, 2018, and 2019 were reviewed during the site audit which showed that no deficiencies were identified during the mock drill evaluation meeting. There have been no cyanide related emergencies in the period since the last ICMC audit.

### 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**

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