



June 2014

INTERNATIONAL CYANIDE MANAGEMENT CODE

Orica Australia Limited, Cyanide Production (Box to Sparge Facility) Recertification Summary Audit Report, Ghana, West Africa

Submitted to:

International Cyanide Management Institute (ICMI)
1400 I Street, NW- Suite 550
WASHINGTON DC 20005
UNITED STATES OF AMERICA

Orica Australia Pty Ltd
Reid Road via Gladstone
PO Box 375
GLADSTONE QLD 4680
AUSTRALIA

REPORT

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APPENDICES

APPENDIX A

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1.0 INTRODUCTION

1.1 Operational Information

Name of Production Facility:	Box to Sparge Bulk Cyanide Transfer Facility
Name of Facility Owner:	Orica Australia Pty Ltd
Name of Facility Operator:	Orica Australia Pty Ltd
Name of Responsible Manager:	Daniel Shipley, Project Manager – Mining Chemicals
Address:	Orica Australia Pty Ltd 1 Nicholson Street Melbourne 3000
State/Province:	Victoria
Country:	Australia
Telephone:	+61 3 9665 7106
Fax:	+61 3 9665 7474
Email:	daniel.shipley@orica.com

1.2 Description of Operations

1.3 Orica Australia Pty Ltd

Orica is an Australian-owned, publicly listed company with global operations. Orica is managed as discrete business units that produce a wide variety of products and services. The Mining Chemicals unit is based in Australia and exports products to Asia, Africa and the Americas, as well as supplying the local Australian industry. This unit's main product is sodium cyanide, which is manufactured at Orica's Yarwun facility in Queensland, Australia.

1.4 Yarwun Production Facility

Orica's Yarwun facility, which is located approximately eight kilometres by road from Gladstone, Queensland, commenced operations in 1989 and is engaged in the manufacture of cyanide (both solid and liquid forms), ammonium nitrate, nitric acid, chlorine, sodium hydroxide, sodium hypochlorite, hydrochloric acid and expanded polystyrene balls. The cyanide production facility at Yarwun was certified by ICMI as being compliant with the Code on 1 December 2006 and recertified on 17 March 2010 and again on 29 October 2013.

Cyanide manufactured at Yarwun is repackaged at the Transfer Facility in Ghana.

1.5 Ghana Box to Sparge Transfer Facility

The Transfer Facility is used to transfer cyanide briquettes (or "cyanoids") contained within boxes to a sparge isotainer. The cyanide briquettes are manufactured at Orica's Yarwun Cyanide Facility in Queensland, Australia and transported to Ghana.

Box to Sparge Bulk Cyanide Transfer Facility

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The Transfer Facility is comprised of the following areas and activities:

- The cyanide Box to Sparge Transfer Facility adjoining the eastern section of Barbex's Warehouse 1. This Transfer Facility includes a dedicated IBC storage area, a staging area where the IBCs to be transferred are marshalled before the transfer operation begins, a sparge tank filling area, hoppers, and a hopper loading bay.
- Warehousing activities
 - Warehouse 1 (IBC storage) – The eastern end of this warehouse is connected to the Transfer Facility IBC storage area.
 - Warehouse 2 (IBC Storage) – Connected to the southern side of Warehouse 1.
 - Warehouse 3 (waste bag temporary storage area and IBC Storage) – Located to the south of Warehouse 2.
 - Jubilee Warehouse (IBC storage) – Located to the east of Warehouse 3.
- A covered, secured breezeway storage area between Warehouse 2 and 3. Cladding has been installed at the eastern entrance and plastic drapes across the access way to prevent stormwater ingress
- Waste management activities
 - The waste management annex at the rear of Warehouse 1, 2 and 3 is used for dismantling IBCs and the temporary storage of waste bags. The area contains a decontamination area (wash tubs, sumps, press etc.) that is now decommissioned and waste bag strapping facility
 - Annex between Warehouse 2 and 3
 - Incinerator for disposal of waste bags and IBCs (decommissioned).
- Change house.

The Facility is located on land occupied by Barbex Technical Services Limited (Barbex) at AngloGold Ashanti's Tarkwa Gold Mine. Barbex operates the Transfer Facility under a Service Agreement with Orica and for the purposes of the Code, certain facilities owned by Barbex are also subject to this audit. The land occupied by Barbex is referred to in this report as the Site.

The Box to Sparge Bulk Cyanide Transfer Facility (Transfer Facility) was certified as being fully compliant with the Code on 8 March 2011.

1.6 Barbex Technical Services

Barbex was established in 1990 as a logistical support company. In 1997, Barbex constructed a warehouse complex (1200 m²) on the Teberebie Goldfields property near Tarkwa in the Western Region of Ghana. Barbex manage the Transfer Facility on behalf of Orica.

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1.7 Auditors Findings and Attestation

Orica's Production Facility is: in full compliance with **The International Cyanide Management Code**
 in substantial compliance with
 not in compliance with

Audit Company: Golder Associates Pty Ltd
Audit Team Leader: Edward Clerk Exemplar Global (105995)
Email: eclerk@golder.com.au

No significant cyanide exposures and releases were noted as occurring during the audit period.

Name and Signatures of Auditors:

Name	Position	Signature	Date
Ed Clerk	Lead Auditor and Technical Specialist		26 June 2014
Mike Woods	Auditor		26 June 2014

Dates of Audit:

The production audit and reporting was undertaken between March and June 2014. The field component of the audit was undertaken 5 - 7 March 2014.

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.

Box to Sparge Bulk Cyanide Transfer Facility
Name of Facility Signature of Lead Auditor 26 June 2014
Date



2.0 PRINCIPLE 1 – OPERATIONS

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

2.1.1 Production Practice 1.1

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

in full compliance with

The operation is in substantial compliance with **Production Practice 1.1**

not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Production Practice 1.1 requiring the operation design and construct cyanide production facilities consistent with sound, accepted engineering practices and quality control/quality assurance procedures.

Quality control and quality assurance (QA/QC) programs for the design of Transfer Facility were addressed during the February 2011 Certification Audit. Since this time, the Transfer Facility has been subject to a number of modifications relevant to the ICMC. To address this, Orica engaged a Consulting Engineer registered in Ghana to undertake an assessment of the site.

The Consulting Engineer’s Report concluded that the continued operation of the Transfer Facility within established parameters will protect against cyanide exposures and releases subject to a number of recommendations which, at the time of the audit had been completed or incorporated into a scheduled maintenance programme.

Independent to the Consulting Engineer’s report, Orica engaged another engineering firm to conduct a more expansive engineering review. At the time of the audit, it was verified through interviews and site inspections that all recommendation had been completed.

As-built drawings and or QA/QC engineering documentation were provided for all new capital works completed as part of the engineering report recommendations.

The materials used for construction of cyanide production facilities appear to be compatible with the reagents used and the processes employed. It was noted that stainless steel is used for process equipment that comes into contact with cyanoids during box to bulk transfer operations. The cyanide solution pump and associated hoses and pipework, are fabricated from a range of materials including poly vinyls chloride, mild steel and rubber. The area around where cyanoids are transferred is comprehensively sealed with concrete that appeared to be in good condition at the time of inspection. The lowest point of the concrete sealed system is a sump in the pad that acts as a secondary containment for the isotainer during transfer operations. A steel tank has been installed within the sump to provide primary containment for potential cyanide solution that may not be pumped away effectively from the sump.

Automatic systems, or “interlocks”, to shut down production systems and prevent releases due to power outages or equipment failures are not required due to safety features designed into the Transfer Facility.

Cyanide is managed on a concrete surface that can minimise seepage to the subsurface. All cyanide storage, transfers and the handling of waste packaging occurs in roofed warehouses on concrete floors.

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Methods to prevent the overfilling of cyanide process and storage vessels are used at the Transfer Facility. These methods rely on checklists and procedural controls during loading. To avoid overfilling at any hatch, a defined portion of the total load is loaded through each hatch. In addition to the formalised checks, the operators can readily see whether the transfer hopper has sufficient capacity to hold a bag of cyanoids before introducing the bag to the hopper for discharge. As the hoppers each have the capacity to hold the contents of one bag plus a safety margin, overfilling is unlikely to occur.

Secondary containments are provided for process and storage tanks. The isotainer loading bay is considered to be a secondary containment. It is sealed with concrete and kerbed to increase its effectiveness in containing any cyanoids spilled during filling.

Spill containment measures are provided for all cyanide solution pipelines. Flexible hoses are installed to connect the cyanide solution pump to the IBCs holding cyanide solution, and to the loading bay sump, to enable solution transfers to be made as required. The hoses are contained within the banded loading bay area and the building cladding will act to deflect any release from those hoses to within the containment area.

2.1.2 Production Practice 1.2

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

in full compliance with
The operation is in substantial compliance with **Production Practice 1.2**
 not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation 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 Transfer Facility has procedures that describe the standard practices necessary for its safe and environmentally sound operation. The main procedures in use at the Transfer Facility were originally developed by employees at Orica's Yarwun Cyanide Production Facility based on experience and systems for the isotainer filling undertaken at the Yarwun Facility. In 2014 the Orica procedures describing the operation of the transfer facility were consolidated into a single procedure. Barbex has a safety health and environment policy and management system that is designed to comply with the principles adopted by Orica. It has developed procedures that describe safe practices in a level of detail commensurate with the risks involved.

The Transfer Facility has procedures for contingencies during upsets in its activities that may result in cyanide exposures or releases. The *Orica Mining Chemical Systems Ghana Transfer Facility Operating Instruction* procedure includes information on

- Normal Operation
- Start-up & Shutdown
- Abnormal operations and troubleshooting

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Barbex has developed a Cyanide Emergency Response Plan (ERP) that contains procedural information to prevent or reduce the risk of cyanide exposures or releases. These actions have been specified for three basic scenarios:

- dry sodium cyanide spill
- sodium cyanide spill to water
- fire.

Orica does have a management of change procedure and has updated the procedure to reflect the new management arrangements at the site. The procedure requires the use of the *Modification of Authority* form that prompts the assessment of safety and environmental impacts but also requires the person initiating the change to detail the present practice and proposed alteration. Completed modification forms were provided for review.

There was an issue identified by Orica during the audit period relating to the application of the change management procedure to modifications in waste handling and management practices. Orica's surveillance programs identified the deviation and Orica took immediate action to correct the issue including assessment of the underlying cause and implementation of technical and management actions to prevent re-occurrence. The updated management of change procedure has been rolled out and there is evidence of its use for the assessment and verification of changes made to the site.

The *Orica Mining Chemical Systems Ghana Transfer Facility Operating Instruction* procedure describes the programme of periodic checks that are documented on weekly and fortnightly record sheets. Orica had a third party engineering firm and engineering consultant undertake inspections of the Transfer Facility for QA/QC and preventative maintenance purposes. The reports identified a number of actions that were included in a capitals works program that has been subsequently completed. A process has been established to engage third party engineering firms to conduct inspections and preventative maintenance programs on a two yearly basis. This is in conjunction with the ongoing procedural checks and inspections conducted.

Process parameters are monitored with necessary instrumentation. The nature of the operation is such that process instrumentation does not play a critical role in managing the risk of potential exposures and releases and so there are no instruments required to be calibrated according to manufacturer's recommendations.

The Transfer Facility has a procedure to prevent unauthorised/unregulated discharge to the environment of any cyanide solution or cyanide-contaminated water that is collected in a secondary containment area within the designed Transfer Facility. Water collected in the Transfer Facility secondary containment is pumped into a one cubic metre intermediate bulk container where it is temporarily stored prior to being transported and discharged into a local mine tailings storage facility (TSF).

Cyanide warehouses are enclosed and stormwater is prevented from coming into contact with cyanide product or packaging including waste packaging. Between 2011 and 2013, potentially contaminated stormwater runoff from the former incinerator area was collected in a series of sumps and was tested prior to being collected and transported off site to a tailings storage facility for disposal. These sumps are now decommissioned for cyanide solutions.

The Transfer Facility does have environmentally sound procedures for the disposal waste of cyanide packaging. The process of shipping packaging material back to Australia and disposal of packaging in a tailings storage facility was stopped during the audit period. This initially resulted in a stockpiling of waste on site prior to arranging with a third party ICMC compliant contractor to dispose of the packaging waste within their EPA approved incineration facility. Use of this disposal method has been in effect since January 2014.

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Cyanide is stored with adequate cross ventilation and procedural controls to prevent the build-up of hydrogen cyanide gas. All cyanide stored onsite is contained in IBCs within roofed warehouses and sealed floors to prevent contact with moisture.

The Transfer Facility is located within the Barbex facility with adequate security measure to prevent unauthorised public access.

Procedural arrangements are in place to allow cyanide supplied by Orica to be packaged as required by the political jurisdictions through which loads will pass. Orica monitors international legislation applicable to its supply of cyanide throughout the world. Orica has determined that there is no specific legislation covering the transport of dangerous goods in Ghana at this time. However, Ghana is a signatory to the International *Maritime Dangerous Goods Code*, which establishes a reasonable expectation that dangerous goods transported within Ghana will be transported to international standards or higher. Before filling isotainers at Tarkwa, the isotainers are checked to ensure that placards are displayed on both the rear and the side of the vessel.

2.1.3 Production Practice 1.3

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

in full compliance with

The operation is

in substantial compliance with

Production Practice 1.3

not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

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

Routine inspections are conducted on tanks, valves, pipelines, containments and other cyanide production and storage facilities with the Orica Designed Transfer Facility.

The major plant items that require inspection are those used in the handling of solid sodium cyanide from boxes through the transfer system to the isotainers. The checklists developed by Orica address the inspection of these facilities for their integrity and signs of leaks in detail.

Orica had a third party engineering firm undertake an inspection of the facility for preventative maintenance purposes in April 2013. The report identified a number of actions that were included in a capitals works program that has been subsequently completed. A process has now been established to engage a third party engineering firm to conduct inspections and preventative maintenance programs on a two yearly basis. This is in conjunction with the ongoing procedural checks and inspections conducted.

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

Checklists for documenting inspections occur batch-wise, weekly and fortnightly. There are no obvious deficiencies in the distribution of actions throughout these lists. Based on conditions observed during the audit, there is no evidence to suggest that inspections should be carried out more frequently than is currently the case.

Inspections are documented. The documentation (internal inspection checklists and external engineering reports) identifies specific items observed and includes the date of the inspection, the name of the inspector, and observed deficiencies.

Barbex has an action tracking register that track actions derived from inspections conducted. The engineering reviews conducted at the site by the contract engineers both recorded the nature and date of corrective actions undertaken.

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2.2 Principle 2 – Worker Safety

Protect workers’ health and safety from exposure to cyanide

2.2.1 Production Practice 2.1

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

in full compliance with

The Transfer Facility is in substantial compliance with

Production Practice 2.1

not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation 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.

Orica has developed formal procedures to minimise worker exposure. The Orica procedure detail the operation of the tasks of operating the Transfer Facility and the Barbex procedures cover the warehousing aspects and general control of the site. Barbex has developed procedures to cover the overall site (e.g. Security) and the warehousing and waste management facilities that are separate from the Transfer Facility within the site.

The updated *Management of Change* procedure reflects the new management arrangements at the site. The procedure requires the use of the *Modification of Authority* form that prompts the assessment of safety and environmental impacts but also requires the person initiating the change to detail the present practice and proposed alteration. The form includes an assessment of impact across, but not limited to, safety, environment, plant, quality, engineering, materials and controls systems. The *Modification of Authority* form includes a completion checklist that requires the assessment of the implementation of the change.

Orica through Barbex does solicit and consider worker input in developing and evaluating health and safety procedures. Weekly SHE Meetings are used to obtain input regarding its health and safety procedures.

Personal HCN monitors are available and used in designated areas. The devices are set to alarm at 4.5 ppm and 10 ppm. The operation also has ambient monitoring undertaken by the EPA and uses this to assess time weighted averages (TWA) for worker exposure. The HCN monitoring equipment is maintained in accordance with manufactures requirements. Calibration records were available for the monitors observed on site.

Orica through Barbex does solicit and consider worker input in developing and evaluating health and safety procedures. Weekly SHE Meetings are used to obtain input regarding its health and safety procedures. Employee input during these meetings is used in developing and evaluating the Transfer Facility’s procedures. An Orica representative attends the Weekly SHE Meetings and then escalation of issues follows the line management structure.

Personal HCN monitors are available and used in designated areas. The devices are set to alarm at 4.5 ppm and 10 ppm. The operation also has ambient monitoring undertaken by the Ghana Environmental Protection Authority (EPA) and uses this to assess time weighted averages (TWA) for worker exposure. The operation requires the use of HCN detectors for a number of cyanide related activities. The operation requires HCN monitors to be used in the transfer area and the cyanide packaging waste management area. HCN monitors are also required for unloading containers and entering the bonded warehouse.

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Orica has identified areas and activities where workers may be exposed to HCN gas or sodium cyanide dust and requires HCN monitors to be used in the transfer area and cyanide packaging waste management area. The transfer and cyanide packaging waste areas are designed with a blue line.

Orica has provisions to ensure that a buddy system is used, or workers can otherwise notify or communicate with other personnel for assistance, help or aid where deemed necessary. Each work team has a supervisor that oversees the work crew and can raise the alarm verbally. Work crews are a minimum of two people plus a supervisor. Due to the small size of the site and relatively low operational background noise, verbal communication is considered to be an adequate method of communication to request assistance.

Orica through Barbex does assess the health of employees to determine their fitness to perform their specified tasks. The pre-employment medical includes a drug and alcohol screen. The operation also has a pass/fail blood alcohol assessment device that is used by site security for assessment of personnel entering the site on a suspect and random basis.

The facility does have a clothing change policy or procedure for employees, contractors and visitors to areas with the potential for cyanide contamination of clothing. Personnel working within blue line area of the waste packaging handling and the transfer facility need to wear blue coveralls and are required to change out of the overalls at the end of the day and for their meal break. Supervisors visiting the area are required to wear a blue overcoat which is removed once they have left the area. There are designate locations for changing and storing blue clothing required for these areas. The site visit confirmed that personnel working within the blue line areas were wearing PPE and clothing in accordance with the procedure and signage displayed at the site.

Warning signs are posted advising workers that cyanide is present and the necessary personal protective equipment that must be worn. Signage is placed at strategic locations around the facilities including the front entrance to the site, entrance to the blue line areas. Warning signs indicate that cyanide is present and that smoking, eating and drinking is prohibited and what PPE is required.

Personnel are prohibited from smoking, eating and drinking, and having open flames within the Transfer Facility.

Signage is displayed at the main gate and at the access point to the site office to communicate these prohibitions. Additional signs are displayed at the entrance to the Transfer Facility building to prohibit smoking, eating and drinking. These messages are reinforced in the Site Induction and in the Orica Cyanide Safety Training materials.

2.2.2 Production Practice 2.2

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

in full compliance with

The operation is

in substantial compliance with

Production Practice 2.2

not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation 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.

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Orica has developed specific written emergency response plans for cyanide exposures at the Transfer Facility. Section 7 of the ERP plan provides details on cyanide treatment and response. Scheduled training also provides instruction to administer oxygen if the casualty is not breathing, whilst protecting the rescuer and provides specific information on the response to inhalation, skin absorption and ingestion-type exposures.

Showers, low-pressure eye wash stations and non-acidic fire extinguishers are located at strategic locations throughout the Transfer Facility and are maintained and inspected or tested on a regular basis. Dry powder fire extinguishers were observed throughout the Transfer Facility and the pressure indicated that the extinguishers were charged. A new, improved safety shower and eye wash system including new tank, pumping and supply lines has been installed at the site using Australian Standards as a specification level for the system. The showers and eye wash were tested and worked suitably. The operation conducts regular inspections that include checks on safety showers and fire extinguishers.

The Transfer Facility has readily available water, oxygen, a resuscitator, antidote and a means of communication or emergency notification. The operation has medical oxygen available at the administration office. The antidote is stored in the store room fridge in the main administration building with the emergency response equipment grab bags and PPE.

Water is available at the facility through the safety shower system and there are hose connections available around the facility. Safety showers are located strategically in the cyanide areas for ready access.

First aid equipment is inspected regularly and is stored and/or tested as per manufactures directions. Personnel check the equipment weekly. Included items are HCN detectors, safety showers, fire extinguishers, first aid kits, and a mobile oxygen cylinder with valved mouthpiece. A review of inspection checklists shows they are completed regularly and equipment observed during the inspection was found to be available and serviceable condition.

Material Safety Data Sheets (MSDS) and first aid procedures on cyanide safety are in the language of the workforce (English) and are available to workers at the Transfer Facility.

Notices concerning the symptoms of cyanide poisoning and first aid measure to be taken were also observed throughout the site. The information notices were produced by Orica. All the signs and procedures are in English, the official language of Ghana.

Storage tanks, containers and piping containing cyanide are identified to alert workers of their contents and the directions of flow.

An IBC used to store potential cyanide solution in the loading bay (resulting from hopper cleaning) has been labelled to indicate that it contains cyanide. The funnel used to convey cyanide solution into the IBC in the loading bay has been labelled to indicate that they are used with cyanide solution and so may be contaminated with cyanide.

The need for a decontamination policy is replaced with a clothing change procedure for employees, contractors and visitors to areas with the potential for cyanide contamination of clothing. In the instance of skin exposure to cyanide, the emergency response process is initiated. This includes the person being placed under an emergency shower.

The Transfer Facility has its own on-site capability to provide first aid, but not medical assistance to workers exposed to cyanide. All Transfer Facility personnel are trained in First Aid (every two years) and in the administration of oxygen (as part of annual emergency response training). In the event that medical treatment is required, the casualty would be transported to obtain qualified medical treatment at one of the two nearby mines.

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The Transfer Facility has developed a procedure to transport exposed workers to locally qualified, off-site medical facilities. In the event that medical treatment is required, the response coordinator makes telephone contact with the AngloGold Ashanti Iduapriem Limited (AAIL) clinic to raise the alert. Meanwhile, oxygen administration is continued whilst a Barbex vehicle is used to transport the affected person to the AAIL clinic.

The Transfer Facility has alerted a local mine and hospital of the potential need to treat patients for cyanide exposure, and the operation is confident that the medical facility has adequate, qualified staff, equipment and expertise to respond to cyanide exposures.

The medical clinic at the neighbouring AngloGold Ashanti Iduapriem Gold Mine is the closest medical provider to the facility. Barbex has established a relationship with this clinic to provide routine medical support, including medical assessment of employees. The clinic has been alerted to the role that it is expected to play in the event of a cyanide exposure. Letters have been written to other medical facilities in Tarkwa to alert them to the possibility that they could be asked to become involved in emergencies, but it is not considered likely that this will be required under current circumstances.

Mock emergency drills are conducted periodically to test response procedures for various exposure scenarios; and lessons learnt are incorporated into response planning. The operation has conducted numerous drills during the audit period. Briefing notes are produced at the end of each mock drill. Documented corrective actions are tracked to completion.

Procedures are in place to investigate and evaluate cyanide exposure incidents to determine if the Transfer Facility's programmes and procedures, to protect worker health and safety and to respond to cyanide exposures, are adequate or need to be revised. The Site has a formalised incident reporting procedure. Incidents in the Transfer Facility are reported to the Site based Operations Supervisor and Distribution Manager (formerly Orica's Off-Sites Facility Manager) as well as to Barbex management. Investigations and corrective action are tracked using both the Orica and Barbex procedures, which are similar.

PRINCIPLE 3 – MONITORING

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

2.2.3 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

The operation is

in substantial compliance with

Production Practice 3.1

not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation 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 Transfer Facility (including its waste disposal activities) involves the repackaging or disposal of solid product in an enclosed warehouse with sealed floors. The site does not have a direct discharge to surface water.

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WAD cyanide concentrations in groundwater at the Transfer Facility are at or below levels that are protective of identified beneficial uses of the groundwater. The site has three groundwater monitoring bores to monitor groundwater at the Transfer Facility. The bores were positioned by a hydrogeologist with knowledge of geology and hydrogeology of the immediate area.

The beneficial use to be protected of groundwater beneath and/or immediately downgradient from the Transfer Facility has not been designated by the Ghana EPA. The closest groundwater extraction to the Transfer Facility was determined to be dewatering of the Goldfields Ghana Teberebie Pit for the beneficial use of mining and/or processing purposes. The applicable numerical standard at the point of dewatering was derived from the Ghana EPA Mining Effluent Guidelines.

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

The Transfer Facility limits atmospheric process emissions of HCN gas, such that the health of workers and the community are protected. Four main activities have been identified in the Transfer Facility where atmospheric process emissions of HCN have the potential to affect the health of workers. The Transfer Facility has implemented controls to minimising emissions of hydrogen cyanide during these operations.

The Ghana EPA does not provide numerical limits for atmospheric emissions of cyanide. The exposure limits adopted for hydrogen cyanide at the Transfer Facility are based on the standards applicable to sodium cyanide as published on the Orica Safety Data Sheet. Those limits are 4.7 ppm over an eight hour period and 10 ppm peak limitation. The Orica Safety Data Sheet is based on the Australian National Occupational Health and Safety Commission. Australia is the country where Orica's headquarters is based. All employees working in areas with the potential for HCN generation are required to wear HCN monitors that are set to alarm at 4.7 ppm and 10 ppm HCN.

There are no communities in close proximity to the Transfer Facility, however potential receptors are Metso Minerals and AngloGold Ashanti Iduapriem who share the western and northern boundaries respectively. These are located approximately 100 meters from the transfer facility. Ambient air is monitored at the site using a portable HCN monitors. Monitoring is scheduled for 15 to 30 minutes every week at Warehouse 1, Warehouse 2, Warehouse 3, Breezeway, Jubilee Warehouse, waste bag bailing area, transfer facility, incinerator (decommissioned) area and yard. No results were noted as exceeding 10 ppm HCN.

Regulatory monitoring is conducted every six months by the Ghanaian Regulator the Inspectorate Division of Minerals Commission. The Inspectorate Division of Minerals Commission's monitoring includes hydrogen cyanide. Monitoring is conducted at the sparging area, warehouses, incinerator area and general yard.

Orica monitors the quality of water flowing in the stream at two locations upstream and downstream of the relevant site boundaries on a weekly (internal analysis) and monthly (external analysis) basis. Surface water monitoring downstream of the site was stopped in June 2013 due to access issues.

Surface water and groundwater monitoring is carried out monthly. The monitoring results indicate consistent trends in both media. The only aberration is that the shallow groundwater bores do not always yield a sample of perched groundwater. Given the consistent trends in monitoring data and that cyanide is handled predominantly in dry form in a sheltered building with sealed floor surfaces, it appears that monitoring is conducted at appropriate frequencies.

Environmental monitoring for air emissions is not undertaken as there are no nearby environmental receptors for cyanide in air. Health and safety monitoring for cyanide in air is undertaken through the use of personal monitors. The personal detectors are used daily for the duration that a worker is handling cyanide.

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PRINCIPLE 4 – TRAINING

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

2.2.4 Production Practice 4.1

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

in full compliance with

The operation is

in substantial compliance with

Production Practice 4.1

not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation 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 Transfer Facility trains workers to understand the hazards of cyanide and refresher training is periodically conducted. The Orica Mining Chemicals Sodium Cyanide Safety Awareness (Cyanide Safety Awareness) Presentation is provided to all staff on a two yearly basis.

The facility does train workers in the use of personal protective equipment and when and where this equipment is required. The primary training provided on PPE is through the induction process and through site signage. The operation has some materials and conducts training of personnel in the use of PPE through toolbox style presentations. The training materials reviewed detailed what equipment need to be worn including basic and supplementary PPE.

Workers are trained to perform their normal production tasks. The materials used for Sodium Cyanide Box to Sparge Training are comprehensive. They include photographs of key equipment (PPE, sparge isotainer, flange guards, sparge hatch access point, transfer hopper and chute, crane hoist including bag lifter and bag splitter) and steps involved in its use. Toolbox sessions are also used to train staff on specific issues identified as needing raised awareness or requiring refreshing.

Barbex in consultation with Orica personnel have developed a training matrix to manage the training requirements for all employees and visitors entering the Transfer Facility. Training records were observed confirming that training has been conducted in accordance with the training matrix.

Personnel at the operation have been trained by suitably qualified personnel. The initial training of operators was undertaken by Orica at the time of establishing the operation in a train the trainer forum. Training is provided by the Barbex Safety Advisors. The Orica Operation’s Coordinator undertakes daily checks on operations and provides guidance on tasks and compliance. The checks include an assessment of the competencies of Barbex personnel involved in the operation of the Transfer Facility.

The operations utilises external trainers for first aid training and initial forklift certification as per local requirements.

Employees are trained prior to being allowed to work with cyanide. The training is provided through the Site Induction and the Cyanide Awareness Training which is completed prior to allowing employees and contractors to work in the cyanide areas on site.

The facility evaluates the effectiveness of cyanide training by testing. Evaluation quizzes are used to evaluate the effectiveness of training. The documentation on which these evaluations have been based is filed in individual staff files. The evaluations are conducted in English.

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In addition to formalised training, the operation also undertakes informal workplace observations and more formalised audits where deviations from procedures are identified and corrected. The Orica Operation's Coordinator undertakes daily checks on operations and provides guidance on tasks and compliance. The checks include an assessment of the competencies of Barbex personnel involved in the operation of the Transfer Facility.

2.2.5 Production Practice 4.2

Train employees to respond to cyanide exposures and releases.

in full compliance with

The operation is

in substantial compliance with

Production Practice 4.2

not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

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

Emergency response training of appropriate personnel is provided. The Cyanide Emergency Response Plan (ERP) and the Training Matrix lists the emergency training requirements of Barbex Emergency Response Personnel. There is annual and biannual training. Personnel interviewed on site could describe the response actions including raising the alarm, evacuation and spill response. Training records were reviewed for cyanide training modules.

The facility trains workers to respond exposure to cyanide and routine drills are used to test and improve their response skills. The main component of training for workers is the Cyanide Awareness Training package that provides information on response actions.

The operation has reinvigorated the emergency response team and has developed an 18 month mock emergency drill and training plan. The team has completed first aid training and training on the updated ERP.

The operation has conducted numerous drills during the audit period. These drills are documented and the report includes a review of the drill along with any identified corrective actions which are tracked to completion.

Emergency drills are evaluated from a training aspect to determine if personnel have the knowledge and skills required for effective response. The ERP requires emergency response simulation drills to be conducted twice a year at a minimum whereby one specific aspect of the plan is evaluated at a time. Briefing notes are produced at the end of each mock drill.

Part of the role of the Orica Operation's Coordinator is to assess the competencies of Barbex personnel involved in the operation of the Transfer Facility. This extends to training.

Evidence was observed to indicate a review and update process of both Orica and Barbex procedures at the Transfer facility.

Confirmation of training attendance/participation records are retained throughout an individual's employment documenting the training they have received, including the names of the employee and the trainer, the date of training, the topics covered. The records indicate whether an employee demonstrated an understanding of the training materials. This is done either through a question and answer sheet or through the trainer's observations after verbalising the questions.

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PRINCIPLE 5 – EMERGENCY RESPONSE

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

2.2.6 Production Practice 5.1

Prepare detailed emergency response plans for potential cyanide releases.

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

Summarise the basis for this Finding/Deficiencies Identified:

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

There is an ERP for the management of cyanide related emergencies associated with the Transfer Facility and cyanide transportation. The Orica Mining Chemical Sodium Cyanide Emergency Response Guide is included in the ERP as an Appendix.

The ERP was developed by Barbex with the assistance of Orica to ensure the ERP is consistent with emergency response guidance issued to Barbex by Orica. Orica provides oversight of the ERP and is provided opportunity to comment on revisions to the ERP.

The ERP considers the potential failure scenarios appropriate for its site-specific environmental and operating circumstances. The ERP notes that the document applies to the Barbex Warehouse in Tarkwa and from there to customer mine sites.

Actions have been specified for three basic scenarios; dry sodium cyanide spill, sodium cyanide spill to water and fire. Due to the nature of the operation, rupture of tanks, power outages and overtopping of ponds or impoundments are not applicable.

The ERP and supporting procedures do provide:

- Specific response actions, as appropriate for the anticipated emergency situations, such as evacuating site personnel and potentially affected communities from the area of exposure.
- Use of cyanide antidotes and first aid measures for cyanide exposure.
- Control of releases at their source.
- Containment, assessment, mitigation and future prevention of releases.

These response actions are principally based around three key scenarios.

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2.2.7 Production Practice 5.2

Involve site personnel and stakeholders in the planning process.

The operation 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:

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

The Transfer Facility has involved its workforce and stakeholders in the emergency response planning process. The workforce and stakeholders assigned emergency response duties are specified within the ERP. Orica play a significant advisory and technical role in the emergency response process in the event of a cyanide release. Orica has assisted in the original development of the ERP.

Communities have not been consulted within regard to Transfer Facility specific emergencies as no community or neighbouring business has been identified as having the potential to be affected, based on a review of the three basic release scenarios described in the ERP. This is due to the small volume of spilt product, the physical nature of the product (solid) and the distances involved.

Local response agencies such as outside responders and medical facilities have been involved in the emergency planning and response process. External responders include medical facilities, police and mine emergency response teams.

Police, emergency services, and mine site responders, have been advised of their responsibilities in writing. The roles and responsibilities of the police are consistent with their normal duties associated with traffic and crowd control. Fire services for the Transfer Facility are provided by the Ghana National Fire Service Tarkwa District (Western Region).

Barbex have also attended Tarkwa Mine Consultative Meetings where they provided cyanide awareness training along with information concerning Barbex’s roles in emergency response. Similar sessions have been held at other mine sites.

The Transfer Facility has engaged in regular consultation and communication with stakeholders to assure them that the ERP addresses current conditions and risks. The ERP notes that the Facility Manager and Safety, Health and Environment Coordinator are responsible for updating and reviewing the plan and informing all plan holders of any relevant changes.

2.2.8 Production Practice 5.3

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

The operation 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:

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

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The ERP:

- Designates primary and alternate emergency response coordinators. The coordinators have authority to commit resources necessary to implement the ERP during an emergency situation.
- Identifies Emergency Response Teams. Each team consists of a Team Leader and four Responders. Mobile numbers of the ERT and other internal emergency numbers are listed.
- List minimum training for ERT and the training frequency. It also lists the requirement for yearly mock drills.
- Includes call-out procedures and 24-hour contact information for the coordinators and response team members.
- Specifies the duties and responsibilities of the all personnel involved in an incident, including external responders.
- Includes a requirement to inspect all emergency response equipment kept in the Barbex warehouse, in trucks and escort vehicles.

External responders, medical facilities and communities have been advised of their roles and/or mutual aid during an emergency response. However, the nature of the Transfer Facility operation, and limited local availability of qualified external responders means that emergency response is largely self-contained.

The ERP identifies the roles and responsibilities of outside responders, and Barbex has advised them of their designated responsibilities through correspondence and their involvement in emergency response exercises. Barbex have also attended Tarkwa Mine Consultative Meetings where they provided cyanide awareness training along with information concerning Barbex's roles in emergency response. Similar sessions have been held for other mine sites previously.

2.2.9 Production Practice 5.4

Develop procedures for internal and external emergency notification and reporting.

in full compliance with

The operation is

in substantial compliance with

Production Practice 5.4

not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

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

Procedures and contact information for notifying the shipper, the receiver/consignee (various mines), regulatory agencies (EPA), outside response providers, medical facilities and potentially affected communities of an emergency are all contained in an Appendix of the ERP.

The ERP includes procedures and contact information for notifying potentially affected communities of incidents and/or response measures.

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The Transfer Facility is located on the AngloGold Ashanti *Iduapriem* mining lease adjacent to the Goldfields Tarkwa mining lease. The closest community is approximately five kilometres from the Transfer Facility gate. Due to the nature of activities communities are unlikely to be impacted and have not been consulted within regard to Transfer Facility specific emergencies.

Responsibilities have been allocated within the ERP for communicating with the media. The ERP designates the Barbex Sales and Technical Manager as the media contact in relaying important information between the organization and the media.

2.2.10 Production Practice 5.5

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

in full compliance with

The operation is

in substantial compliance with

Production Practice 5.5

not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

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

The ERP describes 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, and provision of an alternate drinking water supply, as appropriate.

The ERP details steps for cleaning up and decontaminating an area specifically for persons, clothing including PPE and contaminated areas and equipment.

An Appendix of the ERP also includes procedures for remediation, such as recovery or neutralisation of solutions or solids, decontamination of soils or other contaminated media and management of spill clean-up debris.

The ERP does specifically prohibit the use of chemicals such as sodium hypochlorite, ferrous sulphate and hydrogen peroxide to treat cyanide that has been released into surface water.

The ERP does address the potential need for environmental monitoring to identify the extent and effects of a release. The ERP states that Barbex shall arrange for the incident area to be monitored in conjunction with the Ghana EPA and in accordance with direction from the Ghana EPA and the product manufacturer. The ERP details a monitoring programme to be implemented in the event of an accident or incident involving a cyanide release.

Appendices of the ERP also address the potential need for environmental monitoring to identify the extent and effects of a release; generic information of environmental monitoring and test methods for cyanide on surfaces, in water and soil.

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2.2.11 Production Practice 5.6

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

in full compliance with

The operation is

in substantial compliance with

Production Practice 5.6

not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

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

The ERP contains provisions for periodically reviewing and evaluating the ERP's adequacy and they are being implemented. The ERP states:

The Health and Safety Manager is responsible for updating and reviewing the plan and informing all plan holders of any changes. The plan shall be reviewed and updated, if applicable, on an annual basis and as a follow on from incidents and exercises/drills. The plan will be issued to stakeholders if amendments to the Plan are relevant to them. Contact numbers shall be updated twice in a year and mock drills performed twice in a year. A record of plan amendments shall be maintained.

The ERP (Revision 10) was last reviewed on 11 July 2013.

Mock emergency drills are conducted periodically as part of the ERP evaluation process. The ERP requires mock drills to be performed twice annually. The operation has conducted numerous drills during the audit period. Briefing notes are produced at the end of each mock drill. The briefing notes are used to amend the ERP where appropriate.

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3.0 LIMITATIONS

Your attention is drawn to the document - "Limitations", which is included as Appendix A to this report. This document is intended to assist you in ensuring that your expectations of this report are realistic, and that you understand the inherent limitations of a report of this nature. If you are uncertain as to whether this report is appropriate for any particular purpose please discuss this issue with us.

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GOLDER ASSOCIATES PTY LTD

Ed Clerk
ICMI Lead Auditor and Technical Specialist

Mike Woods
ICMI Auditor

RB_MW/EWC/asu

A.B.N. 64 006 107 857

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APPENDIX A

Limitations



LIMITATIONS

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Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Pty Ltd
Level 3, 1 Havelock Street
West Perth, Western Australia 6005
Australia
T: +61 8 9213 7600

