REPORT

ICMI Gold Mine Recertification Audit - Summary Report

Gold Fields Tarkwa Gold Mine

Submitted to:

International Cyanide Management Institute (ICMI)
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Washington DC 2005
United States of America

Submitted by:

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Distribution List

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1.0 SUMMARY AUDIT REPORT FOR GOLD MINING OPERATIONS

Name of Cyanide User Facility:	Tarkwa Gold Mine
Name of Cyanide User Facility Owner:	Gold Fields Ghana Limited
Name of Cyanide User Facility Operator:	Gold Fields Ghana Limited
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2.0 LOCATION DETAILS AND DESCRIPTION OF OPERATION

Tarkwa Gold Mine is majority owned and operated by Gold Fields Ghana Limited (GFGL) (90%) and the Ghanaian Government (10%). It is situated in the Western Region of Ghana, approximately 350 km by road from the capital, Accra. Site conditions are tropical with annual rainfall of approximately 2,000 mm and temperature ranging between 25ºC and 35ºC.

In June 1993 the Government of Ghana entered into an agreement with GFGL for the operation of the mine by GFGL under a management contract. GFGL developed a heap leach surface mining operation. The initial development, Tarkwa Phase 1, was completed in April 1998 processing 4.7 million tonnes per annum (Mtpa) heap leach feed ore. An expansion, Phase 2, was completed in July 1999 increasing ore production to the heap leach to 7.2Mtpa. Process improvements and optimisations resulted in the throughput increasing to 9.4Mtpa. In August 2000, GFGL acquired the northern part of the Teberebie lease.

These facilities increased ore production to the heap leach to 16Mtpa. The north heap leach has had a number of pad expansions, the latest Phase 5, to enable current production capacity to be sustained.

Cyanide addition ceased on the south heap leach in October 2012 with leaching continuing for a period thereafter. The south heap leach has been decommissioned. The north heap leach cyanide addition ceased in September 2014. The mixing facility for the north heap leach has since been decommissioned.

The Tarkwa Gold Mine carbon in leach (CIL) plant was commissioned in October 2004 and utilised a single semi-autogenous grinding (SAG) mill, designed to mill 4.2 mtpa (525 tonnes per hour). Through the installation of a ball mill, along with additional upstream and downstream equipment, the plant has now been expanded to 14 mtpa (1,700 tonnes per hour).

The CIL circuit consists of two trains of eight tanks in series fed from a common leach tank. The loaded carbon passes into a 15-tonne acid wash column. The gold is recovered from the loaded carbon in two 15 tonne elution circuits. Gold is recovered from solution by electrowinning and smelted in the CIL smelt house in an induction furnace.

Tailings from the plant is deposited in the Tarkwa Gold Mine tailings storage facilities (TSF's), which are paddock type impoundments located approximately 3 km northwest of CIL plant site and immediate south of the existing north leach pads. The TSFs are comprised of TSF 1,2,3 and 5. TSF 5 was commissioned in 2018 but at the time of the recertification audit was not being used for the active deposition of tailings. The operation utilises hydrogen peroxide which is set up in close proximity to the CIL tailings hopper for cyanide destruction in CIL tails before deposition at the tailings storage facility.

All of the ore is now processed through the CIL. In 2018 a new gravity separation system (acacia intensive leach reactor - ILR) was installed at the plant due to the amount of coarse gold in the ore being supplied to the plant. This includes a Knelson concentrator as part of an ILR. The gravity separation system was commissioned in August 2018.

Water from the decant pond is returned to the mill return tank and the overflow is diverted into the process water pond. The water is pumped from the mill return tank to the mills.

The mine has a water treatment facility the treats ex-heap leach effluent. The treatment plant employs a stage-by-stage technology such as pre-filtration process, screen filtration, ultra-filtration and reverse osmosis to deal with suspended solids, dissolved solids (monovalent and multivalent ions) and microbes (bacteria and viruses) to achieving purification parameters with reduced conductivity levels to 100 µS/cm (microsiemens per

centimeter) from feed conductivity of 3800 µS/cm. Final discharge to the environment is permitted by the mine's Environmental Department after sampling and testing from the surveillance points.

Gold Fields Tarkwa Gold Mine
Name of Facility

Signature of Lead Auditor

March 2022
Date

3.0 SUMMARY AUDIT REPORT

3.1 Auditor Findings

	☒ **in full compliance with**	
Gold Fields Tarkwa Gold Plant is:	☐ in substantial compliance with	**The International Cyanide Management Code**
	☐ not in compliance with	

Audit Company:	Golder Associates Africa (Pty) Ltd
Audit Team Leader:	Marié Schlechter, Lead Auditor and Mine Technical Specialist
Email:	mschlechter@golder.co.za

This operation has not experienced compliance problems during the previous three-year audit cycle.

Name of Other Auditors

Gladys Anaman, Golder Ghana Signature: 

Dates of Audit

The Re-certification Audit was undertaken between 21 and 24 February 2022.

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 Mining Operations Verification Protocol and using standard and accepted practices for health, safety and environmental audits.

PRINCIPLE 1 – PRODUCTION

Encourage Responsible Cyanide Manufacturing by Purchasing from Manufacturers that Operate in a Safe and Environmentally Protective Manner

Standard of Practice 1.1: **Purchase cyanide from certified manufacturers employing appropriate practices and procedures to limit exposure of their workforce to cyanide, and to prevent releases of cyanide to the environment.**

☒ **in full compliance with**

The operation is ☐ in substantial compliance with **Standard of Practice 1.1**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 1.1; to purchase cyanide from certified manufacturers employing appropriate practices and procedures to limit exposure of their workforce to cyanide, and to prevent releases of cyanide to the environment.

The cyanide purchased for use at Tarkwa Gold Mine is manufactured at facilities certified as being in compliance with the Code:

- The Orica Australia (Pty) Ltd (Orica) Yarwun production facility is certified as being in full compliance with the Code on 17 September 2020 with prior recertification being dated 22 February 2017.
- The Tongsuh Petrochemical Corporation., Ltd production facility is certified as being in full compliance with the Code on 9 March 2020 with the prior recertification being dated March 2017.
- The TaeKwang Industrial Co., Ltd production facility is certified as being in full compliance with the Code on 24 July 2020 with prior recertification being dated June 2017.
- The Hebei Chengxin Co., Ltd production facility is certified as being in full compliance with the Code on 19 February 2019[1] with prior recertification being dated November 2015.
- The cyanide is repackaged in Ghana prior to delivery to the site at the Vehrad Transport & Haulage Repackaging Plant #2. The Vehrad Transport & Haulage Repackaging Plant #2 is certified as being in full compliance with the Code on 15 September 2021 with the prior recertification being dated January 2018.

[1] The deadline for conducting the recertification audit for Hebei Chengxin has been extended to 19 August 2022 due to health concerns and travel restrictions resulting from the COVID-19 virus.

PRINCIPLE 2 – TRANSPORTATION

Protect Communities and the Environment during Cyanide Transport

Standard of Practice 2.1: **Require that cyanide is safely managed through the entire transportation and delivery process from the production facility to the mine by use of certified transport with clear lines of responsibility for safety, security, release prevention, training and emergency response.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 2.1**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 2.1; require that cyanide is safely managed through the entire transportation and delivery process from the production facility to the mine by use of certified transport with clear lines of responsibility for safety, security, release prevention, training and emergency response.

The identified transporters are individually certified in compliance under the Code or included in certified supply chains:

- The Orica West Africa Supply Chain includes ocean transport of cyanide by the Mediterranean Shipping Company, management of cyanide shipments at the ports of Tema and Takoradi (Ghana) (amongst others) and road transportation in West Africa by Stellar Logistics and Allship Logistics. The Orica West Africa Supply Chain was recertified against the Code on 03 April 2018.
- The Samsung Africa Supply Chain includes transport from manufacturers in Korea, TaeKwang Industrial Co., Ltd. and TongSuh Petrochemical Co., Ltd, using certified carriers SAM IK Logistics Co. Ltd. and Hae Dong Logistics to Pusan New Port, South Korea, followed by ocean transport by shipping companies MSC, Maersk and Safmarine to the port of Tema (amongst others), followed by road transportation by, amongst others, Vehrad Transport and Haulage Ltd. The Samsung Africa Supply Chain is a certified transporter under the Code and was recertified against the Code on 15 June 2021.
- The Hebei Chengxin Transport Global Ocean Supply Chain includes road transport by Hebei Chenxin Transport from Hebei Chengxin's production facility to departure ports Qingdao, Shanghai, Tianjin, Lianyungang and ocean transport using ocean carriers CMA CGM, Hapag Lloyd, KMTC, Maersk, MSC, Hamburg Sud and Swire Shipping from departure ports to destination ports, including the port of Tema in Ghana. The Hebei Chengxin Transport Global Ocean Supply Chain was recertified against the Code on 10 August 2020.
- The Hanwha Corporation Africa Supply Chain includes transport from Taekwang Industrial Company production plant by Hae Dong Logistics, management at the Pusan New Port, ocean transport by MSC and management at the port of Tema in Ghana. The Hanwha Corporation Africa Supply Chain was recertified against the Code on 25 February 2020.
- Vehrad Transport and Haulage is a certified transporter under the Code and was recertified on 23 September 2021.
- Movis Ghana Ltd. Is a certified transporter under the Code and was recertified on 03 May 2019.

The operation has chain of custody records identifying all the elements of the supply chain that handle the cyanide brought to Tarkwa Gold Mine. Sodium cyanide was ordered and transported as follows:

- Orica Australia Pty Ltd. via the certified West Africa Supply Chain to the port of Tema, transported by Movis Ghana Ltd to the mine.
- Samsung C&T Deutschland GMBH via the certified Africa Supply Chain to the port of Tema, transported by Vehrad Transport and Haulage to the mine.
- Hebei Transport Global Ocean Supply Chain to the port of Tema, transported by Movis Ghana Ltd to the mine.
- Hanwa Africa Supply Chain to the port of Tema, transported by Movis Ghana Limited to the mine.

PRINCIPLE 3 – HANDLING AND STORAGE

Protect Workers and the Environment during Cyanide Handling and Storage

Standard of Practice 3.1: **Design and construct unloading, storage and mixing facilities consistent with sound, accepted engineering practices, quality control/quality assurance procedures, spill prevention and spill containment measures.**

☒ **in full compliance with**

The operation is ☐ in substantial compliance with **Standard of Practice 3.1**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 3.1; design and construct unloading, storage and mixing facilities consistent with sound, accepted engineering practices, quality control/quality assurance procedures, spill prevention and spill containment measures.

The facilities for unloading, storing and mixing of cyanide have been professionally designed and constructed, as highlighted in the previous recertification audit reports.

The cyanide reagent facilities consist of a cyanide mixing tank, located at the external reagents area, and a cyanide storage tank, located at the internal reagents area. The original steel cyanide mixing and storage tanks were replaced with fiber glass tanks in 2020. The new fiber glass tanks were manufactured in accordance with the original specifications and designs drawings for the original tanks, designed by Lycopodium (2003).

The cyanide unloading area and mixing tank, located at the external reagent area and the cyanide storage tank, located at the internal reagent area, are located away from people and surface water. Both areas are within a locked fenced area, and there is no surface water present in the vicinity of these areas. These areas are equipped with outer drain channels that report to sumps equipped with pumps to return any spillage to the process.

The operation receives solid cyanide in wooden crates.

There is a method to prevent the overfilling of the cyanide mixing and storage tanks, such as a level indicators and automated cut off on the pumps and valves to prevent overfilling. The levels of the cyanide mixing and storage tanks are visible and controlled from the plant control room. Testing and maintenance of the automated level and cut-off instrumentation installed on the cyanide mixing and storage tanks is undertaken through the SAP System for planned and preventative maintenance.

The cyanide mixing and storage tanks are placed on elevated concrete foundations within a concrete bund, lined with chemical resistant bricks. These concrete foundations were originally concrete ring beams that have been infilled with concrete during the installation of the new tanks.

The solid cyanide crates are stored in the external reagents area in a shed, under a roof, on a concrete surface. The wooden crates have built-in pallets, thereby lifting the crate off the ground to minimise the potential for contact with water.

The shed is roofed to prevent direct exposure to sunlight and rain, and the two open sides provides adequate ventilation to prevent the build-up of hydrogen cyanide gas. The cyanide mixing and storage tanks are equipped

with ventilation pipes to release any hydrogen cyanide (HCN) that is present in the tanks. The tanks are located in an open-air environment.

The cyanide storage shed, cyanide mixing tank and cyanide storage tank are located in fenced and locked areas preventing public and unauthorised access.

Cyanide is stored separate from incompatible materials.

Standard of Practice 3.2: **Operate unloading, storage and mixing facilities using inspections, preventive maintenance and contingency plans to prevent or contain releases and control and respond to worker exposures.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 3.2**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 3.2; operate unloading, storage and mixing facilities using inspections, preventive maintenance and contingency plans to prevent or contain releases and control and respond to worker exposures.

Tarkwa Mine has implemented the *Dismantling Empty Cyanide Boxes* procedure. The procedures requires that cyanide boxes are dismantled and packed in the sea container to prevent any unauthorised use of the boxes.

No washing of the plastic liners or wooden crates take place on site. The plastic bags and liners are placed with the dismantled wooden crates, in a separate empty crate, in the sea container and are returned to Vehrad's site in Tema for incineration. Movis Ghana Ltd also takes dismantled boxes to Vehrad's incinerator.

Procedures are in place that detail:

- The operation and sequencing of feed and discharge valves during and after mixing.
- The handling of cyanide boxes during mixing to minimise the risk of rupturing or puncturing by the forklift.
- Limiting the height of stacking or cyanide boxes in the storage shed.
- Timely clean-up of solid or liquid cyanide spills during mixing.
- The requirement for a second individual to observe the mixing event from a safe distance.
- The addition of carmoisine dye during cyanide mixing.

All of the procedures include the specification of personal protective equipment (PPE) to be used.

PRINCIPLE 4 – OPERATIONS

Manage Cyanide Process Solutions and Waste Streams to Protect Human Health and the Environment

Standard of Practice 4.1: **Implement management and operating systems designed to protect human health and the environment including contingency planning and inspection and preventive maintenance procedures.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 4.1**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 4.1; to implement management and operating systems designed to protect human health and the environment including contingency planning and inspection and preventive maintenance procedures.

Tarkwa Gold Mine has developed procedures for the operation of cyanide facilities including unloading, mixing and storage facilities, carbon-in-leach (CIL) plant procedures, TSF procedures and water treatment procedures. The procedures detail the special requirements, prescribed personal protective equipment (PPE), prescribed tools and equipment, general notes, hazard classification, potential hazards, task methodology.

Critical design parameters are referenced in the original design criteria as well as in various management plans, standard operating procedures, and standard task procedures.

Critical parameters include:

- pH in the cyanide mixing tank and CIL tanks.
- Weak acid dissociable (WAD) cyanide levels to prevent releases and exposures.
- The design storm event for plant ponds and impoundments.
- Minimum freeboard for ponds to prevent overtopping or releases.

The operation has plans and procedures that describe the standard practices necessary for the safe and environmentally sound operation of the facility including the specific measures needed for compliance with the Code, such as water management, inspection and preventative maintenance activities.

The mine undertakes a number of operational inspections to ensure the facilities are operated in a safe and environmentally sound manner. The following operational inspections are conducted:

- Tailings inspections
  - Plant operator daily inspection
  - Plant operator weekly inspection
  - Plant operator monthly inspection
  - Quarterly / annual TSF inspections
  - Daily inspection on the TSF pipelines. (visual inspection, if any deficiency is observed, it is reported to the TSF supervisor).

- Plant Inspections
  - Plant operator daily inspection - CIL 1 & 2 tanks and cyanide emergency room.
  - Plant operator daily inspection - internal reagents & cyanide emergency room.
  - Plant operator daily inspection - external reagents and cyanide emergency room.
  - Plant operator daily inspection - CIL, elution, spill containment, detox shed, fire pumps, process and event pond
  - Plant operator daily inspection – elution and water services
  - Plant operator daily inspection – SAG and Ball Mill
  - Plant operator daily inspection – Acacia plant

Tarkwa Gold Mine has implemented an *Asset Management and Maintenance* procedure for the identification and notification of all maintenance work. The plant uses SAP, a computerised maintenance system to plan and schedule inspection and maintenance activities at varying frequencies. Job cards are also raised where ad hoc maintenance is required by the plant inspections or observations from foremen and the control room.

Tarkwa Gold Mine has implemented a *Change Management* procedure. The procedure details the change management process used at the mine to ensure a structured approach is applied to the management of change on site and information relating to changes to the business is communicated to all interested and affected parties. The change management forms are signed off by the Safety, Environmental, CIL and Engineering Departments.

The operation has developed a number of procedures for contingencies and non-standard operating conditions, including upset in water balance, corrective action, and either planned or emergency shutdowns. Contingency procedures for these types of conditions in critical areas are provided for in the following documents:

- Plant shutdown, start-up and decommissioning procedures
- Process water management procedures
- Equipment failure procedures
- TSF contingency plan

The plant shut down procedures makes provision for both short term and long-term shutdown as well as final cessation of plant operations.

The operation inspects the following at unloading, storage, mixing, grinding and process areas, as applicable to the site:

- Tanks holding cyanide solutions for structural integrity and signs of corrosion and leakage.
- Secondary containments provided for tanks and pipelines for physical integrity, the presence of fluids and available capacity, and to ensure that any drains are closed and, if necessary, locked, to prevent accidental releases to the environment.
- Leak detection and collection systems at leach pads and ponds, as required in the design documents.
- Pipelines, pumps and valves for deterioration and leakage.

- Ponds and impoundments for the parameters identified in their design documents as critical to their containment of cyanide and solutions and maintenance of the water balance, such as available freeboard and integrity of surface water diversions.

The inspection frequency is adequate to assure that the facility operates within design parameters.

The inspections are documented, including the date of the inspection, the name of the inspector, and any observed deficiencies; the nature and date of corrective actions are documented, and records retained.

Preventative maintenance programs are implemented and activities documented to ensure that equipment and devices function as necessary for safe cyanide management. Tarkwa Gold Mine has implemented an *Asset Management and Maintenance* procedure for the identification and notification of all maintenance work. The plant uses SAP, a computerised maintenance system to plan and schedule inspection and maintenance activities at varying frequencies. Job cards are also raised where ad hoc maintenance is required by the plant inspections or observations from foremen and the control room.

Two generator sets (gensets) (emergency generators) are available for the CIL section of the plant to prevent unintentional releases and exposures in the event of a power failure. An emergency GenSet is available for seepage management at TSF 2 (toe drains) and another is available at the Heap Leach solution ponds to pump water during a power failure. The generators are maintained as per the SAP system. The generators are inspected mechanically and run for 1 hr on a weekly basis to ensure availability during a power failure.

Standard of Practice 4.2: Introduce management and operating systems to minimize cyanide use, thereby limiting concentrations of cyanide in mill tailings.

	☒ **in full compliance with**	
The operation is	☐ in substantial compliance with	**Standard of Practice 4.2**
	☐ not in compliance with	

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 4.2; To introduce management and operating systems to minimize cyanide use, thereby limiting concentrations of cyanide in mill tailings.

The operation conducts a program to determine appropriate cyanide addition rates in the CIL and evaluate and adjust addition rates as necessary when ore types or processing practices change cyanide requirements.

The cyanide reduction programme, implemented at Tarkwa Gold Mine, consists of having a cyanide setpoint, monitoring cyanide content and undertaking cyanide addition control via the automatic TAC 1000 analyser.

CIL leach feed samples are collected daily (shift basis) and are filter pressed, dried and composited. Samples are prepared and subjected to bottle roll analysis with varied cyanide concentration at a set pulp density and residence time of 24 hours. The objective of the test work is to investigate the optimum cyanide concentration to achieve better gold recovery at the CIL plant.

Manual titrations are done on samples from the leach tanks every 4 hours. To ensure that the online TAC 1000 analyser is performing optimally and correct.

Standard of Practice 4.3: **Implement a comprehensive water management program to protect against unintentional releases.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 4.3**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 4.3; To implement a comprehensive water management program to protect against unintentional releases.

Tarkwa Gold Mine has implemented a comprehensive and probabilistic water balance model incorporating the process plant and TSF facilities using the Goldsim software.

The current model provides a monthly water balance for 5 years of Tarkwa Gold Mine Life of Mine (LoM) starting in 2020 and ending in 2025. The model is based on the production schedule provided by the mine. The actual model runs from 2018 to 2026 to allow the model to generate enough data for the period under consideration. The model assists with the planning and risk assessment of surface water shortages and excesses during the next five years. It further aims to estimate probable water shortages at the plant as well as the releases of excesses to the environment.

Data pertaining to rainfall, water requirements for the plant, slurry to the TSF, water treatment at the clarifier, discharge, return water from the TSF are collected daily by the operational personnel. A monthly report, containing the collated data, is submitted to the Environmental Department for inclusion in the water balance model.

The water balance model considers the following:

- Tailings deposition rates at TSF1, TSF 2 and TSF5. The water balance model considers the tailings deposition plan from 2020 to 2026.
- A design storm duration and storm return interval based three possible scenarios to prevent overtopping of the ponds.
- Rainfall data collected in the area since 1939 and supplemented with daily rainfall recorded at the mine, and evaporation data collected 1998 and 2012 by the local meteorological agency.
- Runoff coefficients for the various types of catchment areas based on the site conditions.
- Freezing, thawing conditions are not applicable as Ghana is situated in the tropics and is therefore not affected by these conditions.
- The capacity of decant systems and possible seepage from the various TSFs and the percentage of water removed by the underdrains as well as account for seepage on the embankments.
- Various scenarios including a significant storm event with no pumping of decant water to the plant. Sufficient emergency standby power is available at the TSFs and plant (back up diesel generators) to pump water during emergency situations.

- The capacity of discharge to surface water, including the availability of the detox system capacity, clarifier (to remove some of the solids) and water treatment plant (treating surface run-off from the decommissioned heap leach facilities).
- The phreatic surface of the TSF as measured by the piezometers.

The ponds and impoundments are designed and operated with adequate freeboard above the maximum design storage capacity determined to be necessary from water balance calculations. The TSF are operated with a minimum freeboard of 1.5m at the supernatant pond level and the toe of the slurry against the main embankment, as stated in the respective raise design and construction reports. The freeboard at the TSF beach is 0.5m as stated in the *Process Water Balance Management Procedure*.

The process water pond, located inside the plant area, contains return water from the TSF. The overflow of the process water pond runs into the event pond. The process water pond is equipped with a pump to pump the water to the mills for use in the process. It is required that the event pond is kept empty to be able to contain spillages and overflows from the process water pond.

The *Storm Water and Solution Management Procedures* requires that pond levels in the heap leach excess and containment ponds area at as low as possible level (heap leach ponds).

The pond levels are checked daily during process plant operational inspections and TSF inspections to ensure that it is operated at a safe level. The control room operator can observe the level of the event pond and the operation of the automatic pump on the Supervisory Control and Data Acquisition (SCADA) system.

The operation measures precipitation on a daily basis and compares the results to design assumptions and revises operating practices as necessary. Rainfall is recorded on-site and included in the monthly sheet used for updating of the water balance.

Standard of Practice 4.4: **Implement measures to protect birds, other wildlife and livestock from adverse effects of cyanide process solutions.**

☒ **in full compliance with**

The operation is ☐ in substantial compliance with **Standard of Practice 4.4**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 4.4; to implement measures to protect birds, other wildlife and livestock from adverse effects of cyanide process solutions.

WAD samples are collected twice a week at the TSF discharge spigot and monthly at the TSF supernatant pond. The WAD cyanide results for the past 3 years revealed no exceedances above 50 WAD ppm.

Maintaining a WAD cyanide concentration of 50 mg/l or less in open water is effective in preventing significant wildlife mortality as no cyanide related wildlife mortalities have been recorded in the last 3 years.

Daily inspections at the TSFs, heap leach solution ponds and operational areas requires that the facility and surrounding areas are checked for wildlife mortalities.

Standard of Practice 4.5: **Implement measures to protect fish and wildlife from direct and indirect discharges of cyanide process solutions to surface water.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 4.5**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 4.5; to implement measures to protect fish and wildlife from direct and indirect discharges of cyanide process solutions to surface water.

Water from the water treatment plant (water from the heap leach facility) is discharge to the RCAD (River Catchment Area), the final compliance point for the mine. From the RCAD the water is discharged into the environment. Prior to release, the water is tested and a Surface Water Discharge Authorisation is issued by the Environmental Department to authorise the discharge of the water. In addition, the water contained in the RCAD is tested monthly. The auditors observed the monthly test results for January 2019 to October 2021. WAD cyanide was below 0.007 mg/l WAD cyanide for the period.

The Effluent and Water Discharge Authorisation issued to Tarkwa Gold Mine requires the testing for free cyanide prior to release of water to the environment. The auditors observed samples of completed Effluent and Water Discharge Authorisations for 2020 to 2021. Free cyanide levels were below 0.0023 mg/l free cyanide.

Tarkwa Gold Mine conducts surface water monitoring at various points at upstream and downstream locations of the site. It can be demonstrated that the release of the water from the RCAD do not cause the concentration of free cyanide in the receiving water to exceed 0.022 mg/l.

It is evident from the surface and groundwater monitoring that that indirect discharges to surface water do not cause the in-stream concentration of free cyanide to exceed 0.022 mg/l.

There is no evidence that any indirect discharge to surface water have caused cyanide concentrations in surface water to rise above levels protective of a designated beneficial use for aquatic life.

Standard of Practice 4.6: **Implement measures designed to manage seepage from cyanide facilities to protect the beneficial uses of groundwater.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 4.6**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 4.6; to implement measures designed to manage seepage from cyanide facilities to protect the beneficial uses of groundwater.

The operation implements specific water management or other measures to manage seepage to protect the beneficial use(s) of groundwater beneath and/or immediately down-gradient of the operation. Communities around the operations use groundwater for domestic use.

Measures implemented at the TSFs include toe drains, finger drains, toe seepage collection trenches and sumps, clay lining at TSF 1, TSF2 and TSF3, High Density Polyethylene (HDPE) lining at TSF5, underdrain towers and pumps to reduce phreatic levels and storm water trenches to direct runoff away from the facilities. The heap leach solution ponds, the process water pond and the event ponds are all HDPE lined.

WAD cyanide concentrations in groundwater downgradient of the facilities and site are below levels that are protective of identified beneficial use of groundwater, namely the use of groundwater for domestic use.

The numerical standard for WAD Cyanide in effluent discharge is 0.6 mg/l WAD as detailed in Ghana Standards Authority, Ghana Standard GS 1212:2019 – *Environmental Protection Requirements for Effluent Discharge*. Borehole sampling is conducted around the TSFs, heap leach facilities, plant and downstream of the mine site on a monthly basis. None of the results for the period since the previous recertification audit to the current audit were equal to or exceeded 0.6 mg/l WAD cyanide.

The operation does not use mill tailings as underground backfill.

Standard of Practice 4.7: **Provide spill prevention or containment measures for process tanks and pipelines.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 4.7**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 4.7; to provide spill prevention or containment measures for process tanks and pipelines.

The cyanide mixing tank and cyanide storage tanks are installed on concrete foundations and placed in bunded, concrete secondary containments. The bunds are adequately sized to take the volume of the tanks and any rainfall. It was verified during the site inspection that the secondary containments (floors and bunds) are in adequate conditions for the purpose of holding any solution. The floors of the bunds have been laid with chemical resistant bricks.

The CIL tanks are located within a concreted secondary containment area with concrete floors and bunds in adequate condition. The secondary containment for the CIL area is a combination of the concrete CIL bund, however this is not sufficient for a whole tank. If a whole tank were to leak the CIL bund would eventually overflow to the event pond, which is fully HDPE lined and located adjacent to the plant. The elution tanks, residue tanks and Acacia plant have been installed in concreted bunded secondary containments. The milling section is within the slurry dump bund area which is adequately sized to contain the contents of both mills.

Secondary containments for cyanide unloading, storage, sparge and process tanks are sized to hold a volume greater than that of the largest tank within the containment and any piping draining back to the tank, and with additional capacity for the design storm event. The cyanide mixing, storage and process tanks are designed with adequate storage to contain at least the capacity of the largest tank in the bunded area plus 10% of the bund volume for a 1:25 year 24-hour storm event.

There are procedures in place and being implemented to prevent discharge to the environment or any cyanide solution or cyanide contaminated water that is collected in the secondary containment area. All secondary containments are equipped with pumps and pumping systems returning the contents to the process. No sump pump piping systems are directed to the environment.

Spill prevention or containment measures have been provided for all cyanide process solution pipelines. Process pipelines are within the plant area. These pipelines are either above or within the concrete bund area. The reagent strength pipelines are HDPE pipes that runs over bunded areas to the cyanide dosing point. Regular inspections of pipelines are undertaken as part of the daily plant operator inspections and the planned maintenance system to monitor any damages to pipelines. The TSF pipelines are placed inside an HDPE lined trench and inspected daily.

During the site inspection, the auditors confirmed that there was no area where the cyanide pipeline could present a risk to surface water and therefore no special protection needs are required.

The cyanide tanks and pipelines are constructed of material compatible with cyanide and high pH solutions. Tanks and pipes within the CIL plant, tailings pipelines, and return water pipelines are manufactured from mild steel or HDPE. Cyanide mixing and storage tanks are constructed of fibreglass. Reagent strength pipelines are HDPE. TSF pipelines and return water pipelines are constructed of HDPE.

Standard of Practice 4.8: **Implement quality control/quality assurance procedures to confirm that cyanide facilities are constructed according to accepted engineering standards and specifications.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 4.8**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in Full Compliance with Standard of Practice 4.8; to implement quality control/quality assurance procedures to confirm that cyanide facilities are constructed according to accepted engineering standards and specifications.

Quality control and quality assurance (QCQA) programs have been implemented during construction of all new cyanide facilities and modifications to existing facilities, including cyanide unloading, storage, mixing facilities and other cyanide facilities. The QCQA for the operation's cyanide facilities were addressed in the original International Cyanide Management Code (ICMC) certification audit and the subsequent recertification audits.

Since the 2019 recertification audit, the following construction and modification to cyanide facilities have been undertaken:

- A TSF wall raise, TSF1 Stage 10, started in March 2020 and was completed in March 2021.
- A TSF wall raise and wall buttress construction, TSF1 Stage 11A, started in August 2021 and is still ongoing.
- A TSF wall raise, TSF2 Stage 7, started in June 2021 and is still ongoing.
- A TSF wall raise, TSF5 Stage 2, started in September 2020 and is still ongoing.
- Installation of new fiber glass cyanide mixing and storage tanks (refer to 3.1).

QAQC documentation observed during the current audit addressed the suitability of materials and adequacy of soil compaction for earth works, the installation of the liner and the construction of the tanks.

QCQA records cyanide facilities have been retained and this was addressed in the original International Cyanide Management Code (ICMC) certification audit and subsequent recertification audits, including the current audit.

The review of cyanide facility construction by appropriately qualified personnel was addressed in the original ICMC certification audit and subsequent recertification audits.

The TSF1 Stage 10 Wall Raise Construction Report was prepared by an external consulting firm and signed by an appropriately qualified person.

Construction activities for the TSF1 Stage 11A, TSF2 Stage 1 and TSF5 Stage 2 wall raise projects are still ongoing.

After the installation of the new fibre glass cyanide mixing tank (TK-TK-601) and cyanide storage tank (61-TK-612), cold commissioning and hot commissioning were conducted for both the tanks. After the completion of the testing, the tanks were signed off for use by the Tarkwa Gold Mine Plant Engineer.

Standard of Practice 4.9: **Implement monitoring programs to evaluate the effects of cyanide use on wildlife, and surface and groundwater quality.**

☒ **in full compliance with**

The operation is ☐ in substantial compliance with **Standard of Practice 4.9**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 4.9; to implement monitoring programs to evaluate the effects of cyanide use on wildlife, and surface and groundwater quality.

The operation has developed written standard procedures for monitoring activities, including:

- The *Water Quality Monitoring and Quality Assurance Program* for ground and surface water monitoring.
- The *TSF Contingency Plan* and plant and daily operational checklist for the monitoring and recording of wildlife mortalities.

The *Water Quality Monitoring and Quality Assurance Program* was developed by Kwame Asante-Krobia, the Senior Environmental Officer.

The procedures specify how and where the samples should be taken, sample preservation techniques, chain of custody procedures, shipping instructions, cyanide species to be analysed and quality assurance and quality control requirements for cyanide analysis.

Sampling conditions and procedures are documented in writing on the Water Quality Field Analysis Sheet.

Monitoring is conducted at frequencies adequate to characterise the medium being monitored and to identify changes in a timely manner. Groundwater and surface water monitoring is conducted monthly. When discharging water from the RCAD to the environment, water sampling of the receiving water is conducted daily. Wildlife monitoring is conducted daily during the plant and TSF operational inspections and monthly during surface and ground water monitoring.

PRINCIPLE 5 – DECOMMISSIONING

Protect Communities and the Environment from Cyanide Through Development and Implementation of Decommissioning Plans for Cyanide Facilities

Standard of Practice 5.1: **Plan and implement procedures for effective decommissioning of cyanide facilities to protect human health, wildlife, livestock, and the environment.**

☒ **in full compliance with**

The operation is ☐ in substantial compliance with **Emergency Response Practice 5.1**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 5.1; to plan and implement procedures for effective decommissioning of cyanide facilities to protect human health, wildlife, livestock, and the environment.

Tarkwa Gold Mine has compiled detailed closure plans for the decommissioning and closure of TSF3 and North and South Heap Leach facilities. To ensure the receipt of requisite regulatory approvals for the smooth execution of decommissioning and rehabilitation of TSF3 and the two heap leach facilities, a detailed closure plan is required as per the relevant regulatory requirements.

In addition to the detailed decommissioning and closure plans for the TSF3 and North and South Heap Leach facilities, the mine has an overall reclamation plan describing the closure objectives for the mining areas, including TSFs, heap leach pads, processing ponds and processing plant. It provides a high-level description of closure activity per area and associated costing.

High-level reclamation and closure measures are detailed in the Tarkwa Gold Mine Environmental Management Plan and are applicable to infrastructure currently still in use and not close to decommissioning. The detailed decommissioning and reclamation plan must be compiled within 5 years of planned decommissioning.

Schedules for the completion of closure programmes for TSF3, the North and South Heap Leach facilities, the processing ponds and processing plant are described in the detailed decommissioning and closure plans and costing report.

The Reclamation Plan for Tarkwa Gold Mine is updated externally every 2 years and internally the alternating two years. Once the detailed decommissioning and closure Plans (e.g., TSF3 and North and South Heap Leach Facilities) have been submitted to the Regulator, no further changes are made.

Standard of Practice 5.2: **Establish a financial assurance mechanism capable of fully funding cyanide-related decommissioning activities.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 5.2**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 5.2; to establish a financial assurance mechanism capable of fully funding cyanide-related decommissioning activities.

The operation has developed an estimate of the cost to fully fund third party implementation of the cyanide-related decommissioning measures as identified in its site decommissioning or closure plan. The auditors observed the reclamation plan and 2021 cost model.

The closure and liability costs are updated annually.

The operation has established a financial mechanism approved by the applicable jurisdiction to cover the estimated costs for cyanide-related decommissioning activities as identified in its decommissioning and closure strategy. The auditors reviewed a bank guarantee and 3 cash deposits. The cash deposits and bank guarantee are sufficient to cover the cyanide related decommissioning measures as identified in the site reclamation plan.

PRINCIPLE 6 – WORKER SAFETY

Protect Workers' Health and Safety from Exposure to Cyanide

Standard of Practice 6.1: Identify potential cyanide exposure scenarios and take measures as necessary to eliminate, reduce and control them.

☒ **in full compliance with**

The operation is

☐ in substantial compliance with **Standard of Practice 6.1**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 6.1; to identify potential cyanide exposure scenarios and take measures as necessary to eliminate, reduce and control them.

Tarkwa Gold Mine has developed procedures describing how cyanide-related tasks such as unloading, mixing, plant operations, entry into confined spaces, and equipment decontamination prior to maintenance should be conducted to minimize worker exposure.

The operational procedures include the following, as applicable:

- Special requirements (training, pre-task actions/checks/requirements)
- Prescribed protective equipment
- Prescribed tools and equipment
- General notes
- General standard task review team
- Required task/actions
- Review history

The procedures require, where necessary, the use of PPE and address pre-work inspections.

When a procedure is drafted and subsequently reviewed, a General Standard Task Procedure Review Team is convened to contribute into the writing of the procedures. The review team consists of employees at various levels, thereby providing perspective from both management, middle management and operational personnel. Once the procedure has been reviewed and signed off, the updated procedure is communicated to the applicable section operators during training sessions.

Standard of Practice 6.2: **Operate and monitor cyanide facilities to protect worker health and safety and periodically evaluate the effectiveness of health and safety measures.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 6.2**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 6.2; to operate and monitor cyanide facilities to protect worker health and safety and periodically evaluate the effectiveness of health and safety measures.

The operation has determined that the optimal pH control for process solutions is greater than 10.5 to prevent the evolution of HCN gas. The pH in the leach tanks is measured in the first leach tank (common tank) with an online pH monitor. The set point for the pH is >10.5.

The operation has identified areas where workers may be exposed to cyanide through an initial hotspot survey.

Hotspot surveys are conducted once a year to confirm the areas, except if a change in the process occurs.

The signs in the identified areas indicate the required PPE.

Where the potential exists for significant cyanide exposure, the operation uses ambient and personal monitoring devices to confirm that controls are adequate to limit worker exposure to hydrogen cyanide gas to 10 ppm on an instantaneous basis and 4.7 ppm continuously over an 8-hour period, as cyanide.

Fixed monitors have been installed at in the following areas, with the first alarm set at 4.7 ppm and the second alarm at 10 ppm:

- CIL top common tank
- Tailings 1 hopper
- Tailings 2 hopper
- External reagent area
- Cyanide storage tank
- Acacia plant

15 HCN personal monitors are available for use of which 5 are used at the external reagents area and 10 inside the plant.

The *Procedure to Follow when Cyanide Gas is Detected* provides the actions to follow in the event that cyanide gas is detected by the personal cyanide gas monitoring equipment (Dräger Pac 7000) or by the fixed cyanide gas monitoring equipment installed at the identified hotspot areas.

Hydrogen cyanide monitoring equipment is maintained, tested, and calibrated as directed by the manufacturer, and are records retained for at least 3 years.

The personal hydrogen cyanide gas monitors (Pac 7000) and the fixed hydrogen cyanide gas monitors (Polytron 7000) are calibrated every 6 months.

Warning signs, in areas where cyanide is used advising workers that cyanide is present, have been placed at the external reagents area (cyanide mixing tank), internal reagents area (cyanide storage tank), CIL section, Acacia plant, milling section, TSFs. The signs advise of the presence of cyanide and warn against eating, drinking, smoking, and the use of open flames. The signs further instruct that the appropriate PPE should be worn.

Carmoisine dye is added to the cyanide solution during cyanide mixing for clear identification. It was confirmed by the auditors during observation at the cyanide dosing point.

Showers and low-pressure eyewash stations and dry powder fire extinguishers were observed at the cyanide mixing area (external reagents area), cyanide storage area (internal reagents area), at the top of the CIL tanks, elution tank area, at the Acacia plant, at the milling section, residue tanks near the WAD1 analyser and the clinic. The safety showers and fire extinguishers are checked daily as part of the daily plant operational inspections. In addition, the fire extinguishers are inspected monthly by the emergency response team (ERT) and maintenance is conducted annually by an external contractor.

All process tanks and pipelines containing cyanide and other piping within the process plant and external reagent area are colour coded in accordance with the plant's colour coding system. Reagent strength cyanide tanks and distribution pipes are colour coded and the flow of cyanide in pipelines are indicated. The TSF pipelines are marked to indicate the flow direction and content being conveyed.

Safety Data Sheets (SDS) and safety instructions for cyanide handling are posted at the external reagents area, internal reagent area, intense leach reactor, CIL section, plant emergency rooms and TSF.

The operational language for the mine and plant is English in written and verbal communications. This was confirmed through interviews.

Tarkwa Gold Mine has implemented the *Incident Management Procedure*. This procedure will also be used in the event of a cyanide exposure. The purpose of this procedure is to ensure that, in the event of an incident/accident taking place that:

- Root and basic causes are determined
- The facts are established
- The adequacy of existing controls and procedures are reviewed
- Findings are reported
- Corrective actions that can improve efficiency, reduce risk and prevent recurrence are identified
- Key learnings are distributed
- That the apportioning of blame must not be the focus.

Standard of Practice 6.3: **Develop and implement emergency response plans and procedures to respond to worker exposure to cyanide.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 6.3**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 6.3; to develop and implement emergency response plans and procedures to respond to worker exposure to cyanide.

The operation has water, oxygen, a resuscitator, antidote kits and a radio, telephone, alarm system or other means of communications or emergency notification readily available for use at the external reagent area (cyanide unloading and mixing area), inside the process plant at the top of the CIL and in close proximity to the cyanide storage area, milling section and Acacia plant (intense leach reactor) locations.

Site inspection confirmed emergency showers and water was available throughout the plant. Resuscitator and antidote kits are kept at the plant cyanide emergency rooms, hospital and ERT Mike Romeo station. Oxygen and water are available at the TSF workshop, situated next to the TSFs. The antidote kit available at Tarkwa Gold Mine is the Tripac-Cyano and will only be administered by a medical officer only.

The operation inspects its first aid equipment on a shift, daily and monthly basis to ensure that it is available when needed, and materials such as cyanide antidotes are stored and/or tested as directed by their manufacturer and replaced on a schedule to ensure that they will be effective when needed.

The operation has developed cyanide exposure emergency response procedures to respond to cyanide exposures. These include the:

- Sodium Cyanide First Aid Procedure.
- Cyanide Emergency Response Plan.
- Tarkwa Mine Emergency Preparedness and Response Plan.

The operation has its own on-site capability to provide first aid or medical assistance to workers exposed to cyanide. The plant first responder teams consist of plant employees trained to respond in the event of a cyanide exposure or release. The ERT, consisting of a rescue team and a paramedic, is stationed within the mine at the ERT Mike Romeo facility. The shift team consist of two rescuers, a paramedic and an ERT coordinator. The ERT will respond to any cyanide emergency and will transport the patient with the mine's ambulance to the on-site hospital. The Tarkwa Mine Hospital, operated by Accra Medical Centre, has the capability to treat multiple casualties. This includes a 24/7 staffed emergency room with nurses, doctors, pharmacists, and various other support services.

The mine has a fully equipped on site hospital to which patients requiring treatment as a result of cyanide exposure will be transported and treated. If subsequently they require specialist treatment, they will either be transported by road to a local or regional hospital or airlifted to the necessary hospital in Accra or if necessary, to an international facility. Tarkwa Mine Hospital has working agreements with specific regional and hospitals and hospitals in Accra.

It was confirmed during the site assessment that the hospital staff are aware of the potential need to treat patients for cyanide exposure and the medical facility has adequate, qualified staff and equipment and expertise to respond to cyanide exposures. The doctor on duty and the Health Services Unit Manager were interviewed confirming the actions to be undertaken in the event of a cyanide exposure.

The hospital is involved in a full cyanide exposure drill. The mine provides cyanide awareness training to the medical staff.

PRINCIPLE 7 – EMERGENCY RESPONSE

Protect Communities and the Environment through the Development of Emergency Response Strategies and Capabilities

Standard of Practice 7.1: Prepare detailed emergency response plans for potential cyanide releases.

☒ **in full compliance with**

The operation is ☐ in substantial compliance with **Standard of Practice 7.1**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 7.1; to prepare detailed emergency response plans for potential cyanide releases.

The operation has developed emergency response plans to address potential accidental releases of cyanide and cyanide exposure incidents.

Tarkwa Gold Mine developed the following emergency response plans:

- Sodium Cyanide First Aid Procedure
- Cyanide Emergency Response Plan
- Emergency Preparedness and Response Plan

The plans provide guidance on cyanide emergency response, spill response, first aid and communication.

The Cyanide Emergency Response Plan lists the various credible event scenarios for the site inclusive of cyanide incidents. The plan accounts for the following events:

a) Catastrophic release of hydrogen cyanide from storage, process or regeneration facilities.

b) Transportation accidents occurring on site or in close proximity to the operation.

c) Cyanide releases during unloading and mixing.

d) Cyanide releases during fires and explosions.

e) Pipe, valve and tank ruptures.

f) Overtopping of ponds and impoundments.

g) Power outages and pump failures.

h) Uncontrolled seepage.

i) Failure of cyanide treatment, destruction or recovery systems.

j) Failure of tailings impoundments, heap leach facilities and other cyanide facilities.

Transport related emergencies outside the mine are the responsibility of the cyanide transporter (either Movis Ghana Limited or Vehrad Transport and Haulage) and will be handled in accordance with their respective transportation emergency response plans.

The response plans consider the transportation routes, physical and chemical form of the cyanide, method of transport, condition of the selected roads and the design of the transport vehicles.

The emergency plans describe the specific actions to be taken to clear site personnel and potentially affected communities from exposure areas, the use of cyanide antidotes and first aid measures for cyanide exposures, control of the releases at source, containment, assessment, mitigation and future prevention of releases.

Gold Fields Tarkwa Gold Mine
Name of Facility

Signature of Lead Auditor

March 2022
Date

Standard of Practice 7.2: Involve site personnel and stakeholders in the planning process.

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 7.2**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 7.2; to involve site personnel and stakeholders in the planning process.

The operation has involved its workforce and stakeholders, including potentially affected communities, in the cyanide emergency response planning.

The workforce is included in the emergency response planning process through the following:

- Induction and refresher training where they are trained on the use of the emergency response process.
- Through the daily toolbox meetings.
- Through the testing of the emergency response plan when conducting mock drills to test response procedures for various cyanide exposure scenarios. The auditors observed mock drill documentation for 2019 to 2022.

Selected employees have been trained as plant first responders.

Neighbouring communities are not directly involved in the emergency response planning process. The Public Relations Department maintains contact with relevant community figures and utilises the Community Consultative Committee Meetings (TMCCM) to share relevant information pertaining to emergency response planning.

The main response agencies are the Plant First Response Team, the mine's Emergency Response Team and the on-site hospital. These have all been involved in the emergency planning and response process. The Plant First Response Team, mine ERT and onsite hospital personnel take part in mock drills to test their response to emergency situations.

Local outside responders are not involved in cyanide emergencies due to the lack of appropriate equipment and training.

Standard of Practice 7.3: **Designate appropriate personnel and commit necessary equipment and resources for emergency response.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 7.3**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 7.3; to designate appropriate personnel and commit necessary equipment and resources for emergency response.

It is stated in the Emergency Preparedness and Response Plan that an Emergency Management Team (EMT) will be immediately formed to manage response, logistics and communication during any emergency occurring at Tarkwa Gold Mine. The General Manager or his designate will act as the Emergency Manager of the EMT and immediately contact and appoint other team members after being notified of a developing or on-going emergency.

The Cyanide Emergency Response Team (Plant First Response Team) is detailed on the CIL Emergency Response Team document that is displayed on the notice boards in the plant. An email is sent every week to notify all employees of the Health and Safety official on standby.

The Emergency Preparedness and Response Plan states that emergency response teams will be formed, trained and equipped to respond to medical emergencies, spills and fires/explosions.

The emergency contact list in included in the Emergency Preparedness and Response Plan. The emergency response procedures and plans include call-out procedures and contact numbers for initiating response to emergencies, including cyanide related emergencies.

The Emergency Preparedness and Response Plan describes the duties and responsibilities of the emergency response coordinator, emergency logistics coordinator, emergency communications coordinator, protection services control room.

Emergency equipment are detailed in the Emergency Preparedness and Response Plan. The Cyanide Emergency Response Plan specifies that the emergency response equipment kept in the emergency response trailer is inspected monthly and recorded on a checklist.

In the event of a cyanide emergency incident, the Emergency Preparedness and Response procedure states that the emergency response personnel must be contacted who will organise for the patient to be transferred to the onsite hospital and inform the hospital that the patient is in transit via the onsite ambulance. The patient will only be airlifted to another facility in Accra once it has been determined what further treatment is required. The onsite hospital is equipped to provide full treatment in the event of a cyanide incident.

The mine has an on-site hospital that are aware of the potential need to treat patients for cyanide exposure and the operation has assured that the medical facility has adequate, qualified staff and equipment and expertise to respond to cyanide exposures. The hospital is involved in full chain mock drills. The local communities and Tarkwa town emergency response services do not have designated responsibilities in the mine emergency response plan and are therefore not included in mock drills. Tarkwa Gold Mine will notify the local police and fire services in the event of a catastrophic incident, should their services be required.

Standard of Practice 7.4: **Develop procedures for internal and external emergency notification and reporting.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 7.4**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in full compliance with Standard of Practice 7.4; to develop procedures for internal and external emergency notification and reporting.

The *Emergency Preparedness and Response Plan* includes the requirements for internal and external communication (regulatory authorities) as well communication with the plant emergency response teams, the mine medical response team the onsite hospital and mine fire brigade. The plan includes the procedures and contact information for notifying mine emergency services, government departments, the Ghana Environmental Protection Agency (EPA), the Ghana Mines Inspectorate, mine management.

Notifying potentially affected communities of cyanide related incidents and any necessary response measures will be done in accordance with the *Procedure for notifying potentially affected communities* and will be done by the Community Affairs Manager and in consultation with the ERT and General Manager.

The Emergency Preparedness and Response Plan states that external communication must be pre-approved by the General Manager or his designate. Any emergency involving spillage of large quantities of hydrocarbons, chemicals or a fire/explosion relating to these substances must be communicated to the EPA and the Chief Inspector of Mines (CIM). Communication with local government, local communities, public emergency response services and media sources will happen after permission from General Manager via the Community Relations Department.

The *Cyanide Emergency Response Plan* stipulates the required to communicate a significant cyanide incident to the ICMI. It is required that the incident is initially communicated within 24hrs of the incident occurrence and in accordance with the requirements of the site's *Incident Management Procedure.* Further details on the root cause, health, safety and environmental impacts, and any mitigation measures must be supplied to the ICMI within 7 days of the incident.

No significant cyanide incidents, as defined in the ICMI's *Definitions and Acronyms* document, have occurred during the current recertification period.

Standard of Practice 7.5: **Incorporate remediation measures and monitoring elements into response plans and account for the additional hazards of using cyanide treatment chemicals.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 7.5**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in full compliance with Standard of Practice 7.5; to incorporate remediation measures and monitoring elements into response plans and account for the additional hazards of using cyanide treatment chemicals.

The plans and procedures describe specific remediation measures as appropriate for the likely cyanide release scenarios.

The *Cyanide Emergency Response Plan* states that the most suitable neutralisation agent is ferrous sulphate monohydrate (sulphate of iron) however sodium or calcium hypochlorite solution or hydrogen peroxide solution can also be used. The ferrous sulphate is stored at the external reagents area. The procedure describes the ratio of ferrous sulphate agent to spilled cyanide to ensure effective neutralisation.

The *Cyanide Emergency Response Plan* provides the measures to take to contain the spilled cyanide solution or solids, requires neutralisation and either returning the solution back into the process under controlled conditions or clean-up and disposal of contaminated soil at the TSF. It is further required to take soil samples of remaining soil after cleaning out the contaminated soil.

Local surface water is not in proximity to where process solution strength cyanide solution is used, solid cyanide is stored or the TSF is located. The closest community, Abekoase, is located approximately 2.5 km from TSF 2 (operational) and approximately 1 km from TSF 3 (decommissioned). Measures are in place to provide Abekoase with an alternate source of drinking water, if required.

. The *Cyanide Emergency Response Plan* states that if surface water is in danger of contamination, the community will be informed via the Community Relations Manager.

The *Cyanide Emergency Response Plan* prohibits the use of detoxification chemicals such as hypochlorite, hydrogen peroxide and ferrous sulphate to treat spillages into stream or natural ponds.

The *Cyanide Emergency Response Plan* stipulates the requirement to take samples of spilled solution for free cyanide, WAD cyanide and pH analysis in accordance with the relevant environmental monitoring procedure.

Standard of Practice 7.6: **Periodically evaluate response procedures and capabilities and revise them as needed.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 7.6**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 7.6; to periodically evaluate response procedures and capabilities and revise them as needed.

The Emergency Preparedness and Response Plan states that the emergency response procedures will be reviewed after every major incident or drill and tested bi-annually using realistic accident simulation exercises (mock drills) to ensure that an effective emergency response system is maintained.

One mock drill per year is conducted at each of the following areas: CIL, tailings and external reagents areas. The drills simulating cyanide exposure incidents are full chain drills up to the hospital, including the ER Team. Mock emergency drills are conducted annually at the three plant areas to test response procedures for various exposure scenarios, including cyanide releases and exposures.

It is evident from the revision record in the *Emergency Preparedness and Response Plan* that the plan was updated in 2006 following an incident investigation. It was confirmed to the auditor that no such updates were required in the period of the current recertification audit.

PRINCIPLE 8 – TRAINING

Train Workers and Emergency Response Personnel to Manage Cyanide in a Safe and Environmentally Protective Manner

Standard of Practice 8.1: Train workers to understand the hazards associated with cyanide use.

	☒ **in full compliance with**	
The operation is	☐ in substantial compliance with	**Standard of Practice 8.1**
	☐ not in compliance with	

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 8.1; to train workers to understand the hazards associated with cyanide use.

The operation trains all plant employees and contractors who may encounter cyanide, in cyanide hazard recognition. All employees, long-term contractors and short-term contractors must attend plant specific induction at start of employment and then again after return from annual leave. A test is written after completion of the cyanide induction training.

Records are kept of when each employee has completed the annual cyanide induction or cyanide refresher training as well as the pass rate achieved.

Employees that return from annual leave are required to attend the processing plant induction programme prior to commencing work and after attending the two-day mine induction.

Training records are retained for the duration of employment and thereafter it is archived.

Standard of Practice 8.2: **Train appropriate personnel to operate the facility according to systems and procedures that protect human health, the community and the environment.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 8.2**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 8.2; to train appropriate personnel to operate the facility according to systems and procedures that protect human health, the community and the environment.

The operation trains workers to perform their normal production tasks, including unloading, mixing, production and maintenance, with minimum risk to worker health and safety in a manner that prevents unplanned cyanide releases. The cyanide training matrix document stipulates the training requirements as identified per occupation and per section of the plant such as crusher, leaching, reagents, etc.

The training elements necessary for each job involving cyanide management are identified in training materials. The training elements/procedures required for each job are identified for each area/ team on the training matrix. From the training matrix an excel spreadsheet is generated showing the training that must be undertaken for each individual based on the training elements necessary for each job involving cyanide management.

The Metallurgy Senior Training Officer conducts the training and is appropriately qualified in the subject matter and training credentials and relevant experience.

Workers are trained prior to working with cyanide. All personnel working at the plant and TSF are trained in cyanide hazard recognition through the initial induction for the processing plant.

Job specific training is presented to all new employees (per section). When an employee moves to a new section, training specific to that section will be provided. Training is refreshed when procedures are updated.

Refresher training on cyanide management is provided to ensure that employees continue to perform their jobs in a safe and environmentally protective manner.

Planned Task Observations (PTOs) are undertaken on a regular basis to ensure that employees continue to perform their jobs in safe and environmentally protective manner.

Records 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.

Standard of Practice 8.3: **Train appropriate workers and personnel to respond to worker exposures and environmental releases of cyanide.**

The operation is

☒ **in full compliance with**

☐ in substantial compliance with **Standard of Practice 8.3**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 8.3; to train appropriate workers and personnel to respond to worker exposures and environmental releases of cyanide.

All cyanide unloading, mixing, production and maintenance personnel are trained in the procedures to be followed if cyanide is to be released. The cyanide awareness and cyanide refresher training include training in the procedures to be followed if cyanide is released, including the decontamination of a cyanide exposure victim and first aid treatment. The cyanide awareness training is presented to new employees and contractors and the cyanide refresher training is undertaken when individuals return from annual leave, approximately every 12 months, for those personnel that may encounter cyanide. The reagent operators, ERT and metallurgical team receives additional training on the requirements of the cyanide Emergency Response Plan and cyanide first aid procedure.

The plant First Responders Team and ERT are trained in the procedures included in the emergency response plans regarding cyanide, including the use of necessary response equipment. In addition to the standard emergency response training that the ERT receive i.e., firefighting, use of SCBA, etc., the ERT also receive the cyanide induction training at the Metallurgy Training Centre.

No community members, local responders or off-site medical providers will respond to emergencies related to cyanide. For all cyanide related emergencies, the mine emergency personnel will provide the response team as the local external responders are not trained in responding to cyanide emergencies. The mine has a hospital on site which will treat any incidents of cyanide exposure. The plant First Responders Team and members of the ERT are trained in the procedures included in the Emergency Response Plans regarding cyanide, including the safe use of the necessary emergency response equipment. The Tarkwa Mine Hospital personnel receive periodic cyanide awareness training presented by the Metallurgy Senior Training Officer.

Refresher training for response to cyanide exposures and releases is
conducted annually as part of the plant cyanide refresher training. Employees and contractors that return from annual leave are required to attend the plant induction programme prior to commencing work and after attending the two-day mine induction. The plant First Response Team are trained annually as part of refresher in response to cyanide exposures and releases.

The records are retained, documenting the cyanide training, 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.

PRINCIPLE 9 – DIALOGUE

Engage in Public Consultation and Disclosure

Standard of Practice 9.1: Promote dialogue with stakeholders regarding cyanide management and responsibly address identified concerns.

☒ **in full compliance with**

The operation is ☐ in substantial compliance with **Standard of Practice 9.1**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 9.1; to promote dialogue with stakeholders regarding cyanide management and responsibly address identified concerns.

The operation provides stakeholders with information on its cyanide management practices and engage with them regarding their concerns.

The Tarkwa Mine Community Consultative Committee Meeting (TMCCCM), is undertaken quarterly (none for 2020 due to Covid-19 pandemic) and involve representatives from various groups within the communities. The aim of meeting is to provide the opportunity for Gold Fields to share relevant company information with the communities and to provide community members with the opportunity to ask questions and raise any concerns. Feedback from the TMCCCMs is taken to larger community meetings undertaken in each of the nine communities.

The Community Relations Office (located in the mine village and outside the active mining and plant areas) is accessible to anyone from the local community. Community members can obtain information or raise concerns at the office. In addition, complaints can be lodged via a dedicated telephone number directly to the Community Affairs Office.

In addition to the TMCCCMs, ad hoc community meetings, training sessions and mine tours are held with multiple communities to provide an open forum to discuss various topics and to provide a platform to raise any concerns.

Company information and cyanide awareness information is placed on the community notice boards that are available at the community centres in all the communities. The community centres are used for community meetings. Additional notice boards have been placed at strategic points within the communities.

Standard of Practice 9.2: **Make appropriate operational and environmental information regarding cyanide available to stakeholders.**

☒ **in full compliance with**

The operation is ☐ in substantial compliance with **Standard of Practice 9.2**

☐ not in compliance with

Summarise the basis for this Finding/Deficiencies Identified:

The operation is in FULL COMPLIANCE with Standard of Practice 9.2; to make appropriate operational and environmental information regarding cyanide available to stakeholders.

The operation has developed written descriptions of how their activities are conducted and how cyanide is managed. These descriptions are available to communities and other stakeholders. Written cyanide information (in pictorial and written format) is available on the notice boards in the neighbouring communities. The information provides written and pictorial basic information on the use and management of cyanide to the community.

The operation has disseminated information on cyanide in verbal form where a significant percentage of the local population is illiterate. Tarkwa Gold Mine has developed a cyanide awareness presentation that is presented in the local language during community meetings.

The operation makes information publicly available on confirmed cyanide releases or exposure incidents. Tarkwa Gold Mine reports incidents in accordance with the Gold Fields Global Reporting Initiative (GRI) system. It is required that all incidents are reported on the online GRI Portal. The incidents listed in a) to e) of this section would typically be classified as a Level 3 to 5 incident dependent on severity. Level 1 to 5 incidents reported to the GRI Portal are featured in the annual group environmental performance information published in the sustainability section on the company's website. The information provided on the website is at a high-level.

Exposure and release incidents meeting the legal requirements for reporting would have to be reported within 24 hours to the Ghana Environmental Protection Agency (EPA) and Ghana Minerals Commission. Such reporting will require a high level of detail, differentiating between the type of cyanide of release of exposure as listed in a) to e) of this question. The Ghana EPA and Ghana Minerals Commission will make publicly available information reported to them on the types of incidents listed.

Cyanide related incidents, as listed in a) to e) of this question, will be made publicly available by Tarkwa Gold Mine during meetings with stakeholders such at the Community Consultative Committee Meetings described in 9.1 or via special communication through the Community Relations Office.

Tarkwa Gold Mine has not experienced any cyanide releases or exposures as listed under items a) to e) of this question in the period since the last recertification audit.

Signature Page

Golder Associates Africa (Pty) Ltd.

Marié Schlechter
ICMI Lead and Mine Technical Expert Auditor

https://golderassociates.sharepoint.com/sites/151238/project files/6 deliverables/final client deliverables/final submission to the icmi/gold fields tarkwa_icmirecertaudit_summary_final_13june2022.docx

APPENDIX A

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