INTERNATIONAL CYANIDE MANAGEMENT INSTITUTE

Mining Operations

Summary Recertification Audit Report

Chifeng Gold Group
Golden Star Resources Limited
Wassa Gold Mine
Ghana

16th – 21st April 2023

For the
International Cyanide Management Institute
Cyanide Code

Name of Operation:	Wassa Gold Mine
Name of Operation Owner:	Chifeng Gold Group Golden Star Resources Limited
Name of Operation Operator:	Golden Star
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Location detail and description of Operation

The Golden Star (Wassa) Limited Wassa gold mine is located in the Mpohor Wassa East District, in the Western Region of Ghana. The mine is approximately 80 km north of the Cape Coast and 150 km west of the capital, Accra. The mine was originally a heap leach operation, but was converted to a conventional carbon-in-leach (CIL) operation when GSR (Golden Star Resources) purchased the property in 2001. Golden Star commenced production from the surface operation at Wassa in 2005, and commercial production was achieved at Wassa Underground on January 1, 2017. In early 2018 Wassa transitioned into an underground-focused operation.

The Golden Star Plant consists of a conventional two (2) Ball mill and carbon-in-leach circuit. Ore from the underground mine is transported to a crushing, milling and classification circuit. Ore processing consists of carbon-in-leach cyanidation, elution and gold recovery. The cyanidation process is initiated in a pipe reactor feed (PRF) line. This reactor feed line is covered in a lined trench.

Golden Star Wassa has a contract with Samsung C&T Corporation (Samsung) and Orica Australia Pty Ltd (Orica) to supply cyanide on a Delivered Duty Paid (DDP) agreement. Samsung solid cyanide is transported from the Port of Pusan in South Korea to Ghana by sea. Vehrad, a GSWL (Golden Star Wassa Limited) approved and ICMI (International Cyanide Management Institute)-certified agent for Samsung, is responsible

for the delivery of cyanide from the Port of Tema (Ghana) to the Wassa mine site. Orica sodium cyanide is manufactured at Yarwun to Ghana by sea. ICMI-certified agent for Orica, All-Ship logistic Limited transports the cyanide from the Port of Tema (Ghana) to the cyanide warehouse located at Tarkwa-Dompim before delivery to Wassa mine site by the same logistics company, All-ship Logistics Limited. The cyanide arrives at the port of Tema, where it clears customs and is then transported by road convoy to the Samsung facility in Tema and Tarkwa. Cyanide destined for Wassa mines' specific delivery is transferred into specially designed, 20-foot containers for transport to the site. The 20 foot-containers are locked with security padlocks coded with a serial number. When the shipment arrives on site the 20 foot-container padlocks are checked by the plant security and a safety representative, or a designate, for integrity. No offloading of cyanide is allowed if the locks have been tampered with.

The cyanide unloading, dosing and mixing facilities at the Wassa mines mine have been designed and constructed by Metallurgical Design and Management Pty Ltd (MDM), a South African engineering and construction firm. The plant has two cyanide facilities located at the Mill and CIL areas, respectively, all of which are located in secondary containment. The mixing tank capacity is 17 m^3, and that of the dosing tank is 16 m^3.

The CIL desorption circuit consists of six leach tanks of 2500 m^3 each. The loaded carbon passes into a 12-ton acid wash column. The gold is recovered from the loaded carbon in 12-ton elution circuits. Gold is recovered from solution by electrowinning, and smelted in the CIL smelt house in an induction furnace.

In October 2019, a new intensive leach reactor (ILR), Acacia 3000-S plant, was installed at the Plant due to the increase in the amount of fine gold in the ore being supplied to the Plant.

Tailings material is conveyed by a 450 mm pipeline in a lined tailings trench, to an engineered, tailings storage facility (TSF 2) for final disposal. The decant return water is pumped into a temporary holding pond and later pumped into the plant for reuse in the process circuit. Wassa is currently not discharging any process water out of the plant and therefore, since the 2012 recertification, the detox plant has been inactive.

The TSF (Tailings Storage Facility) facility and process plant are designed as a zero-discharge operation. TSF 1 and the TSF 1 EXT are currently full and not operational. They are currently under a decommissioning process with a trial palm plantation project located on the surface.

The monthly process water dam data, except for two outliers, were below 0.5 mg/l WAD (Weak Acid Dissociable) cyanide, and thus the process water pond is not classified as a cyanide facility. The process water pond receives water from the decant at the TSF as well as stormwater. The process pond water is used in the milling circuit, and thus the milling circuit is also not classified as a cyanide facility.

In January 2023, an online Weak Acid Dissociable (WAD) analyser was installed on the CIL tails hopper to analyse the WAD cyanide levels in the tailings slurry to the TSF. The WAD cyanide levels in the tailings slurry have consistently been < 50 ppm prior to disposal into the TSF dam.

Wassa is currently backfilling its underground stopes with the cement paste generated from the mixture of tailings slurry and cement. Tails slurry (solution and solids) to the paste plant are below 0.5 ppm WAD cyanide levels. However, there are two HCN (Hydrogen Cyanide) gas monitors at the paste plant located at the thickener overflow and the filter house for early detection of any possible HCN gas traces.

In 2020 the mine contracted GNSER, a private power supply company, to provide a reliable power supply to its operations. The National Grid now serves as a backup to the mine operation, as well as the in-house, diesel-powered standby generators.

Auditor's Finding

This operation is

X in full compliance

☐ in substantial compliance *(see below)

☐ not in compliance

with the International Cyanide Management Code.

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

Audit Company: Eagle Environmental

Audit Team Leader: Arend Hoogervorst

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Names and Signatures of Other Auditors:

Name: Dawid Viljoen Signature _____ Date: 20 OCTOBER 2023
Mining Technical Auditor

Dates of Audit: 16th – 21st April 2023

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 Mine Operations and using standard and accepted practices for health, safety and environmental audits.

Wassa Gold Mine

20 October 2023

Facility | Signature of Lead Auditor | Date

Audit Findings

Principle 1 - PRODUCTION AND PURCHASE
Encourage responsible cyanide manufacturing by purchasing from manufacturers that operate in a safe and environmentally protective manner.

Standard of Practice1.1
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.

X in full compliance with

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

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
During the site visit, the solid cyanide store was observed to contain cyanide from TaeKwang Industrial Co., Ltd (TaeKwang), Tongsuh Petrochemical Corporation, Ltd (Tongsuh) and Hebei Chengxin Co., Ltd (Hebei Chengxin). Certified Consignor, Samsung C&T Corporation (Samsung) sources its cyanide from TaeKwang and Tongsuh. Cyanide producer, Hebei Chengxin, has supplied Wassa with 20 boxes of cyanide for trial and test purposes.
TaeKwang was certified fully compliant as an ICMI (International Cyanide Management Institute) cyanide production facility on 24 July 2020, Tongsuh was certified fully compliant as an ICMI cyanide production facility on 19 April 2023 and Hebei Chengxin was certified fully compliant as an ICMI cyanide production facility on 18 April 2023.
Consignor, Samsung's supply contract with Wassa ended in 2020, but a purchase of cyanide was made in that year. Orica Australia Pty Ltd (Orica) has a supply contract to supply Wassa with Code-compliant cyanide from 1 July 2021 for three years to 1 July 2024, with an option to extend by mutual agreement. Samsung supplied cyanide to Wassa in 2022 when Orica was unable to supply cyanide.
Orica was certified fully compliant as an ICMI cyanide production facility on 17 September 2020. The Orica contract requires Orica to remain a signatory to the ICMI and comply with the requirements of the Cyanide Code.
As the operation has purchased and used cyanide produced at fully ICMI-certified production facilities, this Standard of Practice is fully compliant.

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.

X in full compliance with

The operation is in substantial compliance with **Standard of Practice 2.1**

 not in compliance with

Basis for this Finding/Deficiencies Identified:
Golden Star Wassa purchases cyanide from Samsung and Orica. Samples of the chain of custody records for shipments from Samsung and Orica in 2020, 2021 and 2022 were reviewed. The documentation included: the Golden Star Purchase Orders; the Commercial Invoices; the Shipping Bills of Lading, and the Waybills (vehicular delivery notes).
All identified transporters are included in Samsung C&T Corporation's Africa Supply Chain; Orica's Australia and Global Marine Supply Chain; and Hebei Chengxin Transport Global Ocean Supply Chain. The Supply Chains include road transporters from the production site to the port, the shipping component, and road transport from the receiving port to the mine site.

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.

X in full compliance with

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

 not in compliance with

Basis for this Finding/Deficiencies Identified:

Evidence from a previous re-certification audit in 2016 indicated, "…There have been no substantive changes to the cyanide unloading, mixing, and storage areas since the 2012 recertification audit. The operation has two cyanide mixing/storage facilities, each consisting of a bag-splitting cabinet and mixing tank and storage tank, situated within a concrete containment. The active facility is located at the mill, and another inactive facility is located at the CIL (Carbon in Leach) plant; the latter has not been used since the 2012 recertification audit. Metallurgical Design and Management (Pty) Ltd. (MDM) design drawings for these facilities and documentation of an independent review of same by Top Sky (Francis Mensah, Professional Engineer) as requested in the original 2009 audit remain on file.

This Standard of Practice was evaluated via direct observation, discussion with the CJGSW (Chifeng Jilong Golden Star Wassa) ICMC (International Cyanide Management Code) Coordinator, and review of the noted design records…."

With regard to the cyanide high-strength facilities, the warehouse storing the cyanide boxes, cyanide mixing at the Mill and the cyanide mixing area at the CIL were all inspected, and it was concluded these were in good condition. It was reported during the interviews with the plant staff that no changes were made to the facilitates since the previous re-certification audit, and thus the findings of this audit, including the documents reviewed during 2012, were still valid and therefore, no review of the design and QA/QC (Quality Assurance/Quality Control) documents was done, as per the ICMI (International Cyanide Management Institute) recertification guidelines. It was, however, confirmed by interview that the documents are still available.

The redundant cyanide mixing and dosing plant at the CIL was built as a backup facility in case the pipe reactor system of cyanide dosing was insufficient. The pipe reactor concept includes adding cyanide at the Mill section dewatering cyclone underflow, followed by pumping the slurry to the CIL plant 800m from the mill. The resulting mixing in the pipe with cyanide results in improved leach kinetics and efficiency. The redundant mixing plant was a contingency, in case the cyanide levels were inadequate at the CIL, and additional cyanide dosing is required at the CIL. This was never an issue since commissioning, and thus the mixing facility has been redundant since the 2012 recertification audit, and therefore, cannot be regarded as a cyanide facility in terms of the ICMI Definitions and Acronyms document, or a part of the scope of this audit.

It was confirmed during the site inspection that unloading and liquid cyanide mixing and solid cyanide storage facilities were located away from people and surface waters. The cyanide storage area is equipped with a trench that will direct any spillage away from the area to the plastic-lined mill antipollution pond. Only solid cyanide is used and delivered to the site. However, in the Offloading procedure, it states, "…do not offload cyanide boxes outside the designated concrete pad…."

There are systems in place to prevent overfilling of storage tanks. In the Cyanide Mixing Procedure, it states, "…The SCADA (**S**upervisory **C**ontrol **A**nd **D**ata **A**cquisition) operator will communicate to the reagent operator if the cyanide mixing tank is 20% or less on shift start.

- Open the water valve and fill the mixing tank to the required level (Ensure the cyanide mixing tank does not overflow by monitoring the filling process - Do not leave the area unattended)

- An audible high-level alarm is sounded at 95%, and is alarmed on the SCADA. The water valve must be closed manually...". The level sensor is included in the daily mill cyanide mixing and dosing areas checklist and inspections (Daily cyanide mixing and dosing areas checklist (PM005)), which includes checking if the cyanide mixing and dosing tanks' level sensors are faulty. It was confirmed that the level measurements and alarms are included in the Pronto (proprietary name) PMS (Planned Maintenance System) system. The Instrument Technician inspects the level measurement instruments and cleans the probes weekly. The Mill Reagent Circuit Weekly Inspection (Instrument Technician) work order also identifies specific inspections on fixed-level probes and sensors.

During the site inspection, it was confirmed that the cyanide tanks are located on ring beams filled with compacted fill. The ring beam is cast onto the solid concrete bund, and the tanks are placed onto a plastic liner between the tank base and the bitumen top layer. The Milling reagents area foundations concrete drawing further confirmed this. The mixing and storage tanks are located inside concrete bunds. The condition of the bunds is sound, and no cracks were observed. The cyanide mixing facility in the CIL area has been redundant since 2012, and previous audits have stated this. This facility has never received cyanide.

The solid cyanide warehouse has a roof and is fitted with galvanised sheeting on two sides. The roof overhang and position of the boxes are placed to minimise the risk of rainwater coming into contact with cyanide boxes. The concrete floor is sloped towards a drain placed outside the building, with a hump beyond preventing solutions from escaping to the soil. The concrete slopes towards a concrete drain, directing the spillage solutions to the antipollution pond. The solid cyanide warehouse is open on one side, and ventilation is deemed adequate. The cyanide mixing tanks ventilate through the bag breakers, and the solution storage tanks through the overflow pipes. The ventilation is deemed adequate. The warehouse and the mixing facilities are located within the fenced boundaries of the plant access control system. The facilities are also individually fenced and locked. Solid and liquid cyanide is stored away from incompatible materials such as acids, strong oxidizers and explosives and apart from foods, animal feeds and tobacco products.

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.

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 3.2**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:

Cyanide boxes are managed to prevent them from being used for any purpose other than holding cyanide. In the cyanide mixing procedure, it states, "…On completion of the addition of the cyanide, place the lids on the cyanide boxes and transport the used boxes immediately to Cyanide Storage Facility at the Mill. (Under no circumstances should the empty cyanide boxes be stored outside the mixing or storage area) …" In the Cyanide Offloading Procedure, it states in the Completion section, "…Reload (sea) container with empty, broken cyanide boxes…The containers with the boxes are transported by Vehrad (Transport and Haulage) back to their incinerator facilities in Tema where the empty packaging material is incinerated…". Finally, in The Disposal of Empty Boxes Procedure, it states, "…- For the boxes that need to be stored, the following procedure is to be used.

- Move the empty box to the concrete pad at the mill cyanide storage shed
- Safely demolish all the empty cyanide boxes on the concrete pad or move the whole box into the storage area. Clean up instantly any traces of broken pieces of the boxes to avoid environmental contamination.
- For the empty/broken boxes that are being stored under the reagent storage shed that need to be moved off-site, the following procedure will be used.
- Use the telehandler (or similar) to move the boxes whole/broken from the storage shed to the isotainer under the monitoring of the security supervisor or delegate
- Lock the isocontainer with the container seal from the vendor after the final truck inspection at the security gate.
- Empty cyanide containers or sacks should not be used for any purpose other than holding cyanide. Empty cyanide containers should not be given out to anybody for domestic use…."

According to the Mixing Procedure, "…8. Thoroughly rinse the empty sack via the inbuilt hose pipe in the cutting hood to ensure the bag is totally empty with no residual cyanide traces...". With regard to cleaning cyanide residues from containers, hoses and couplings, in the Cyanide mixing procedure, it states, "…- In case of any spillage, quickly hose with water while ensuring that the sump pump is operational to pump it to either CIL tank if mixing was done at CIL and CIL feed hopper if mixing was done at Mill.

- Thoroughly hose down cyanide mixing area with water from the top to bottom and start the cyanide area sump pump to pump either to CIL tank 2 or CIL feed hopper depending on where mixing was carried out.
- Check the cyanide mixing area thoroughly for cyanide briquettes/spillage and decontaminate as per the decontamination procedure (Procedure No 015 Dry Sodium Cyanide Spill Decontamination) …" Similarly, in the Cyanide Offloading procedure, it states, "…If residue is observed on the outside of any box or there is a hole punched in a box, it must be isolated and/or decontaminated and used immediately.
- Remove and decontaminate any spilled cyanide briquettes and dust with Hydrogen peroxide as per decontamination procedure…."

There are a number of procedures that have been written to prevent exposures and releases during cyanide unloading and mixing activities. The operation and sequencing of hoses and valves is described in the Cyanide Mixing Procedure. It states, "…1. Open the

valve for the water addition to the mixing tank and add water until the level is above the agitator blades (approx. 65%), and then shut the water isolation valve.

* Open the water valve and fill the mixing tank to the required level (Ensure the cyanide mixing tank does not overflow by monitoring the filling process - Do not leave the area unattended) …" The Daily Inspection check list for cyanide valves, pumps and pipes (PM No 002) checks for leakage of all equipment in the cyanide areas and prompts for a check of the "health" of other equipment.

To avoid rupturing or puncturing the cyanide boxes during handling, the Cyanide Mixing procedure requires that the operator of the forklift/ "telly-handler" must have a valid operator permit and he must complete and document the forklift/" telly-handler" safety checks. In addition, procedures state that cyanide boxes must not be stacked more than two boxes high.

In both the Cyanide Mixing and Cyanide Offloading procedures, it states that all personnel involved must have completed Cyanide Safety training, and a 2nd person must be available with the emergency oxygen Pack to assist and act as "buddy" (and must also be in full cyanide PPE (Personal Protective Equipment). The Cyanide Mixing procedure requires that red Carmoisine food dye must be added to the cyanide mixing tank, on completion of the addition of cyanide briquettes to the water.

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.

	X in full compliance with
The operation is	□ in substantial compliance with **Standard of Practice 4.1**
	□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The operation has 33 cyanide procedures, 3 cyanide-related environmental procedures, a comprehensive, integrated Cyanide Management Plan, and a TSF combined operating procedure. In addition, the TSF Design Report, the TSF Quarterly Geotechnical Engineers Reports, The TSF Annual Safety Reports and the TSF Quarterly Annual Environmental Audit Reports contain recommendations and action lists which are used as operating guidance and to revise operating parameters, as appropriate.

The total freeboard (TSF) for ponds and impoundments is obtained from the equation: 500mm minimum + 1:100 year 24-hour storm event. The 1:100-year 24-hour storm event has been calculated to result in approximately 300 mm of water on the facility. Thus, the

minimum total freeboard is estimated to be 800 mm below the spillway invert level (lowest point on the perimeter of the facility). The concentration of cyanide discharged to and allowed in surface water is controlled by the fact that no discharge is allowed to surface water. The design of the TSF storm capacity for a 1:100-year 24-hour storm event. The facility has been provided with a spillway to allow the controlled release of stormwater if a storm exceeds the storage capacity of the TSF, preventing the overtopping of the embankment and possible catastrophic failure of the facility. The Cyanide Management Plan states," … The Environmental department samples the supernatant pond process water, and the tails slurry (spigotting slurry) leaving the plant once a week to confirm WAD cyanide level in the process water, supernatant pond and the spigotting slurry are maintained below 50ppm. Additionally, the process department carries out an hourly sample on the tails slurry and analyse for free cyanide ensuring that concentration is within requirement (< 50ppm) …"

The Comprehensive Cyanide Management Plan" states that, "Golden Star Wassa has implemented a Change Management Procedure as part of the operation's Management System (MS). This procedure helps to ensure that the relevant risks are captured, evaluated, controlled and before changes to facilities, equipment, processes, and/or resources and equipment are implemented." The Change Management Plan has replaced the Change Management Procedure and is driven by a process called SIPOC (Supplier Inputs Process Outcome Customer). Once a change project arises, an approval process is developed which outlines the change and develops an approval process which is guided by the GSR (Golden Star Resources) Risk Assessment Matrix. This matrix has, as its core, Health, Safety and Environment, and guides the composition of the Change Design Team. The mine's Health Safety and Environment Manager is an integral member of the Design Team and ensures that Health, Safety and Environmental considerations are considered in the change management plan. There are no formal signoffs by health, safety and environmental officials, but the mine Health Safety and Environment Manager acts as the custodian to ensure that appropriate inputs are made to the design and decision process. There were no changes made to the process plant that would increase the risk of cyanide exposure or releases since the previous re-certification audit.

Procedure PM 038: Contingency plan in the upset in the operation water balance, and Procedure PM 037: Monitoring and management water levels at the process pond are in place. The procedures do not require the plant to be stopped in the event of an upset in the water balance. Procedures PM 004 – Working inside a cyanide storage tank, and PM 006 – Working on Pumps, Valves Pipelines, and other Cyanide Equipment, include the precautionary and preparatory measures to manage cyanide safety under normal and abnormal conditions, which would also apply during long-term shutdowns or cessation of activities. The plant will be closed temporarily in the case of a tailings pipeline failure, equipment failure or planned maintenance shutdown using the standard procedures for stopping and starting of the plant. Alternative lines to bypass and to keep slurry moving to the TSF in the case of failure of existing lines or pumps are in place. The Emergency Response Plan has Emergency Response Procedures in place to deal with other abnormal or emergency conditions. The Decommissioning Plan and Associated Asset Retirement Obligations for Golden Star Wassa Limited also includes measures to manage cyanide

solid and solutions safely during the rundown to, and at the cessation of, mining processing activities.
There are a series of operational and planned maintenance inspections undertaken in the Plant and on the TSF. These include: -

Tanks
All tanks (CIL Slurry Tanks, CIL Cyanide Mixing and Dosing Tanks, CIL and Caustic Mixing Tank, CIL Feed Hopper, CIL Tailings Hopper, Strip Solution Tank, Elution Column, Acid Wash Cone, Mill Cyanide Mixing and Dosing Tanks, and the Pipe Reactor Feed line (from discharge pumps at the Mill area to the CIL slurry tanks) are subject to monthly boilermaker visual inspections. In addition, all tanks undergo quarterly thickness testing. Vessels undergo two yearly thickness testing in addition to the statutory legal inspections. Samples of various NDT (Non-Destructive Test) Thickness Tests were sighted and reviewed. The PM Planned Maintenance) Inspections CIL Reagent Circuit Weekly Check Mechanical (PM Task 82114) checklist includes the CIL Cyanide Mixing Tank and the CIL Cyanide Storage tank, checking for leaks in the tanks and leakage on pipelines and valves. All tanks in the high-strength cyanide area are inspected weekly by operational staff under the guidance of the cyanide champion. Weekly electrical inspections include testing and cleaning of cyanide storage and mixing tank ultrasonic level sensors and fixed level probes.
Secondary Containments
There is a Daily Inspection of Physical Integrity of the Secondary Containments for all Cyanide Facilities (PM 018), which monitors for cracks and leaks in secondary containment floors and walls in the Mill and CIL cyanide areas. The inspection also checks for leaks in tanks and pipes.
Leak Detection and Collection Systems
The procedure PM 043, “Procedure for monitoring leak detection pipes in the CIL tank(s)’ concrete ring beam foundation”, was sighted. CJGSW (Chifeng Jilong Golden Star Wassa) installed leak collection and recovery systems within the CIL tank ring foundations to allow for the identification of any leakage prior to it entering the environment. These systems are monitored daily. (Daily Monitoring Sheet included in an appendix in the procedure.) The daily inspections for "wetness", indicated using a dipstick, were sighted and sampled.
Pipelines, Pumps and Valves
Pipelines, pumps and valves are inspected as a part of the PM Inspections CIL and Mill Reagent Circuit (PM task 82114 and 82113). Checks are made for leakages and the condition of the equipment. The Daily Inspection checklist for cyanide valves, pumps and pipes (PM No 002) checks for leakage of all equipment in the cyanide areas and prompts for a check of the "health" of other equipment. On the TSF, Pipelines, pumps and valves are inspected as part of the daily inspections, and the TSF is included in the Pronto Planned Maintenance System (PMS).
Ponds and Impoundments
The procedure PM 037: “Monitoring and management water levels at the process pond”, requires, "…5. Record the pond level in the log book and report the level to the day supervisor…" and the procedure specifies action to be taken to maintain level parameters.

On the TSF, ponds and impoundments are inspected as part of the daily inspections. The freeboard is measured by survey for the quarterly inspections.
The combination of Operational and Maintenance inspections undertaken mostly on a daily, weekly and annual frequency is more than adequate to assure and document that they are functioning within design parameters. Sampling of Pronto electronic inspection records and the hard copy source documents indicates that the date of the inspection, the name of the inspector, and any observed deficiencies are documented. The nature and date of corrective actions are also kept and were noted to date back as far as 2007.
The operation's Pronto (proprietary name) computerised PMS (Planned Maintenance System) system was reviewed and sampled electronically. The PRONTO 640 system was upgraded to the PRONTO-Xi 740 system from 1 July 2021. Although this cut off seamless access to the old version data, this was still available to operators who could access all of the data by logging on to the old system, which was maintained. (Access to the old version of Pronto's data was demonstrated by the Senior Maintenance Planner.) The critical cyanide equipment was sighted and sampled for planned and breakdown records which date back to 2007. The bulk of planned inspections are carried out on a weekly basis, but there are also fortnightly, monthly, quarterly and annual planned inspections. The old and new Pronto PMS systems included critical cyanide equipment in the Processing Plant and the TSF. The electronic review of the Pronto system (the 640 and the Xi 760) and the sampled review of the completed hard copy artisan job cards indicates that the systems in place ensure that equipment and devices function as necessary for safe cyanide management.
Approximately 90% of the mine's power requirements (including the Processing Plant) are derived from an on-site power station operated by Gensar Power, who operate and maintain the power station for Golden Star Resources. 10% of the mine power requirements come from the Ghana National Grid. In case of need, the Grid contribution can be increased to whatever level is required. The site also has 15 emergency generators which can run the whole site with the exception of one mill. All of the emergency generators are included in the Pronto PMS system and are subject to weekly electrical and mechanical inspections and test runs. There is sufficient backup power to provide 90% of the mine's power requirements (including the Processing Plant) which are derived from an on-site power station. There is sufficient backup power to run pumps to prevent overtopping. There are also spare pumps and mobile generators which can cater for second or third-level emergencies. Weekly Emergency Generator Inspections and Test Runs were sampled and reviewed. Individual generator services are carried out at 250-, 500-, and 1000-hour frequencies. Generator service records for 2020, 2021 and 2022 were sampled and reviewed.

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

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 4.2**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
Procedure PM 010: Test Work for Cyanide Optimisation" requires, "…Testing for cyanide optimization will be carried out at least weekly according to the laboratory procedure" and also, "…The Plant Senior Metallurgist is to forward complete report to the Plant Operations Superintendent advising on the optimum cyanide concentration to be used based on the findings. Plant Metallurgist/Supervisor receives feedback from the Plant Operations Superintendent if any adjustments are made with documentation. This document is filed for reference purposes…."
Bottle roll test results on different sources for 2020, 2021, 2022 and 2023 were sighted and reviewed. The bottle roll tests are also conducted on the different types of ore to establish leach parameter change requirements as appropriate. Ore is blended to provide optimal feed compositions.
-Sampled 2023:
- January to April 2023 for the current mix of ore
- January Pipe Reactor (PR) at different cyanide concentrations and conditions:
- April Releach tests on tails: Final tails under various conditions confirming the current leach conditions are optimal.
- Sampled 2020 results:
- February Pipe Reactor (PR) at different cyanide concentrations and conditions confirming current conditions are optimal.
Diagnostic tests on a specific pit to characterise the ore from i-zone were also sighted: -
- Results show recoveries for direct cyanidation, Hydrochloric acid, Sulphuric acid and Nitric acid cyanidation, and Fire assay.
- Recovery by direct cyanidation was 89%, 3.1% HCL (Hydrochloric acid) cyanidation.
A gravity gold recovery circuit, including an Acacia intensive leach reactor, was commissioned. Cyanide is added to the CIL hopper at the mill section using positive displacement Bredel hose pumps. A TAC 1000 on-line free cyanide analyser is installed at the receiving CIL tank at the CIL section. The TAC 1000 results are fed to the SCADA system, where the cyanide concentration in CIL tank 1 is set. The cyanide dosing rate is controlled by varying the speed of the Bredel cyanide dosing pumps using a frequency drive.

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

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 4.3**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The Mine migrated from the KP (Knights Piésold) Probabilistic Water Balance (PWB) model to a GoldSim PMB model in December 2019, now expanding from only a TSF to the whole mine coverage. The Knights Piésold PWB model was subsequently decommissioned. GoldSim committed to have the updated, expanded model completed by the end of October 2023, due to software integrating challenges and the change of ownership of Golden Star Wassa. The finalised GoldSim PWB model was further delayed because the Mine decided to change the scope of the model from TSF only to one that was mine-wide. The existing version of the GoldSim PWB model continues to supply sufficient PWB data to meet Cyanide Code requirements covering Plant and TSF.
Input data for the GoldSim model is populated in two spreadsheet databases. These are designed to synchronise with the GoldSim model seamlessly online. The monthly input spreadsheet to the GoldSim PWB model covering January 2021 to March 2023 was sighted. The current spreadsheets cover all inputs for the GoldSim model. The GoldSim PWB model software uses spreadsheet data as inputs. The new TSF 2 was designed with sufficient freeboard to contain the 1:10, 1:100 (wet) and 1:1000 (extreme wet) year scenarios. In the interim, the freeboard of 10 m is more than adequate to cover any excess water balance issue for the next 3 to 4 years, by which time the full mine-wide GoldSim PWB will be fully implemented and operational. The PWBs account for the natural variability and uncertainty of precipitation and evaporation.
The rates at which tailings are deposited into tailings storage facilities were confirmed in the spreadsheets used for the GoldSim model inputs for 2021, 2022, and 2023.
The KP TSF 2 Detailed Design Report stated, "… For long-term modelling, conducted for the Water Balance analysis and for identifying specific storm events, annual rainfall data from the Tarkwa meteorological station was used. The average yearly rainfall at the Tarkwa station between 1939 and 2008 is 1979 mm. A long-term rainfall model for TSF 2 was developed from the long-term Tarkwa data and in combination with the available Wassa site data…This model has calculated long-term average rainfall for the TSF 2 site of 1782 mm…" An onsite weather station is used to capture climatic data, including evaporation and rainfall. Rain gauges were used before the introduction of the automated, modern weather station.
The amount of precipitation entering a pond or impoundment resulting from surface run-on from any upgradient watershed, including adjustments as necessary to account for differences in elevation and for infiltration of the runoff into the ground, was confirmed in the spreadsheets. Stormwater diversion trenches are installed to route stormwater away from the TSF as run-on. Seepage from TSF 2 is collected in a cutoff trench and sump collection system and returned to the TSF to minimise seepages to subsurface. Piezometer levels are reported in the quarterly reports. The supervisor's weekly housekeeping checklist for cyanide and reagent areas (PM007) was sighted, which includes the requirements to inspect the stormwater diversion channels around the plant and ensure they are free from silt and vegetation. Due to the site's tropical location, there are no freezing and thawing effects requiring consideration in the model. The available freeboard of 10.69m would be able to contain all water flowing to the TSF 2 cell in the

case of the design storm events. The current freeboard is 1.51m for TSF 2 cell 1, 10.69m for TSF 2 cell 2 - active cell and TSF 2 mini cell 1.4m. Freeboard is measured monthly and reported in the quarterly and annual reports and the Glocal reports.
Inspections of the TSF are done as per Procedure PM No. 013 – Tailings Storage Facility Operations Manual and Procedure PM No. 037, "Manage Cyanide Process Solutions", addresses the containment of solutions in the process water ponds and collection of water level data. The Engineers of Record review the operating data, including rainfall and make appropriate recommendations regarding revisions of the operating parameters.

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

X in full compliance with

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

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The ICMC (International Cyanide Management Code) Compliance point samples are taken and analysed for WAD cyanide at the spigot of the TSF weekly by the Environmental Section. The samples are preserved at GSW (Golden Star Wassa) Mine using pellets of caustic added to the sample bottle, and analyses are done at SGS Laboratories Tarkwa, 1 hour away.
Spigot samples were sighted: -
6 January 2020 to 26 December 2022:
The values were sighted electronically, and all WAD cyanide values were less than 50 mg/l with a spiked maximum of 42.8 mg/l.
A new WAD 1000 online analyser was commissioned in January 2023, taking a sample every 25 minutes from the tailings hopper pumping residue to the TSF. The 2023 graph, to date, indicated no exceedances during the period.
The monthly process water dam data were reviewed, and all values, except two outliers, were below 0.5 mg/l WAD cyanide, and thus the process water pond is not classified as a cyanide facility. The process water pond receives water from the decant at the TSF as well as stormwater. The process pond water is used in the milling circuit, and thus the milling circuit is also not classified as a cyanide facility. The process water pond water is also used for dilution of the tailings to the TSF to control WAD cyanide at the TSF spigot tip, and the tailings transfer tank to less than 50 mg/l WAD cyanide.
The three years of data show that the compliance point at the TSF 2 spigot did not exceed 50 mg/l and was consistently low at less than 10 mg/l WAD cyanide following the implementation of dilution of the tailings slurry. The process water dam open waters samples indicate that the dam's values are less than 0.5 mg/l WAD cyanide. It is concluded that as a result of the WAD cyanide values meeting the ICMI standards of less

than 50 mg/l, no measures to restrict access by wildlife to the TSF and process water dams are required.
The TSF wildlife monitoring inspections were reviewed and sampled for 2020 and 2023 to date. No cyanide-related wildlife mortalities were recorded. It was confirmed during the interview with the TSF superintendent that no cyanide-related wildlife mortalities occurred during 2021 and 2022. It was also confirmed during the interview with the Environmental Section that no cyanide-related wildlife mortalities were reported or investigated. The low WAD Cyanide concentrations and the evidence of no cyanide-related wildlife mortalities indicate that cyanide management practices are effective in preventing mortalities.
There are no heap leach operations at the mine, and therefore there are no measures to control overspray of solutions or significant ponding on the heap leach.

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

X in full compliance with

The operation is
- □ in substantial compliance with **Standard of Practice 4.5**
- □ not in compliance with

Basis for this Finding/Deficiencies Identified:
No direct or indirect discharges to surface water exist at the operation. Samples of the downstream Kumue N&S location, after the confluence, from 1 January 2020 to 26 December 2022, show that all WAD and Free cyanide values are below the limits of detection of 0.005 mg/l. There are no established mixing zones. The operation is not engaged in remedial activity because there is no degradation or need to restore beneficial use.

Standard of Practice 4.6
Implement measures designed to manage seepage from cyanide facilities to protect the beneficial uses of ground water.

X in full compliance with

The operation is
- □ in substantial compliance with **Standard of Practice 4.6**
- □ not in compliance with

Basis for this Finding/Deficiencies Identified
The TSF 2 base is lined with HDPE (High Density Polyethylene), and the subsequent lifts are lined with clay. A cut-off trench and seepage recovery system are installed downstream of the built wall to recover any seepage back to the TSF.

The beneficial use of groundwater is reported as only Mining. The Ghana EPA (Environmental Protection Agency) standard for WAD cyanide is below 0.6 mg/l WAD cyanide.
The SGS Laboratory limit of detection is 0.005 mg/l WAD cyanide.
The downstream borehole values are reported as follows:
- Sample SMB - 01D from 1 January 2020 to 1 December 2022, and all WAD and Free cyanide values are below the limits of detection of 0.005 mg/l (downstream).
- Sample SMB - 01S from 1 January 2020 to 26 December 2022, and all WAD and Free cyanide values, except for 6 outliers, are below the limits of detection of 0.005 mg/l (downstream).
- Sample SMB - 03D from 1 January 2020 to 1 December 2022, and all WAD and Free cyanide values are below the limits of detection of 0.005 mg/l (upstream).
- Sample SMB - 03S from 1 January 2020 to 1 December 2022, and all WAD and Free cyanide values are below the limits of detection of 0.005 mg/l (upstream).
No backfill was used for 2020 and part of 2021.
The paste backfill facility was commissioned in September 2021. The Paste Plant, HAZOP (Hazard and Operability Study) was sighted where no cyanide risk was identified. The GR Engineering Services Paste Plant Operating Manual and the Operating Manual, Revision: A, were sighted. Section 1.1 General, states: " It must be noted that, test works conducted on tailings material to check for WAD cyanide gave results below 0.5 ppm; therefore, this does not make the Paste Backfill Plant a cyanide facility."
No groundwater is reported to be contaminated, and the operation is not engaged in remedial activity to prevent further degradation and restore beneficial use.

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

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 4.7**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
As noted during the previous recertification audit: "…At the process plant, six CIL tanks are also situated on concrete plinths (ring beams) located within a concrete containment. Additionally, CJGSW has constructed two ring foundations for future expansion of the CIL circuit, and the foundations do not currently have tanks mounted on them. Two sumps are located within the CIL containment area, which have automated pumps to return any collected solution back into the process (i.e., CIL tanks or tailings safety screen). As noted in the 2012 recertification audit, design drawings reviewed during the 2009 ICMC verification audit demonstrate that the ring beam foundations do not provide an impermeable barrier between the tank bottoms and the ground. Consequently, CJGSW installed leak collection and recovery systems within the CIL tank ring foundations to allow for identification of any leakage prior to it entering the environment." The report,

"Installation of Cyanide leakage Detection piezometers", Earthtech Engineers, December 2009, Ref: E1/202/09, cover letter signed by Ing. Emmanuel R K Avevor, Civil Engineer, Reg. No 01515 was sighted. It was confirmed that the report is still on record.

Confirmed during the site inspection that the cyanide mixing and dosing tanks are located on ring beams filled with compacted fill. The ring beam is cast onto the solid concrete bund floor, and the tanks placed onto a plastic liner between the tank base and the bitumen top layer. Sighted drawing file and sampled the Milling reagents area foundations concrete details drawing A1 0503-CI-014001 2 June 2003…."

During the site inspection, it was confirmed that the tanks are located inside concrete bunds. In the Wassa Mine Comprehensive Cyanide Management Plan 2023, under section 4.1.2 Design Criteria, it states that, "…Critical parameters and measures include:

- having an impermeable barrier between the tank bottom and the ground, including tanks mounted on ring beams for all tanks constructed after a company has becomes a signatory to the Cyanide Code…"

The condition of the bunds is sound, and no cracks were observed. Furthermore, the CIL tanks, CIL feed sump, pre-leach thickeners and mills are placed inside concrete bunds linked to lined events ponds. It was confirmed that leak detection system inspections are carried out on the CIL tanks.

With regard to secondary containment capacities, it was confirmed during interviews and site inspections that: -

- CIL feed hopper volume: 20 m^3, bund capacity 60 m^3.
- Pre-leach thickener volume 1,447 m^3, bund capacity 390 m^3 - linked to the mill antipollution pond.
- Antipollution pond (mill) capacity: 2460 m^3.
- Antipollution Pond (CIL) capacity: 582 m^3.
- CIL largest tank capacity: 2,500 m^3, bund capacity 3,500 m^3.
- Cyanide mixing tank capacity 17 m^3, and Dosing tank capacity 16 m^3, bund capacity 34 m^3.

It was confirmed during the site inspection that the cyanide mixing and storage tank bunds, CIL bund, CIL feed hopper bund, and pre-leach thickener bund are equipped with sump and pump systems returning any spillage to the process. The Mill antipollution pond: is equipped with a pump returning the water to the CIL feed hopper. The CIL Antipollution Pond is equipped with a pump returning the water to the CIL bund. The procedures for the removal of precipitation and spillage collected in the Anti-pollution Pond include: the "Desilting Anti-Pollution Pond Procedure", PM 034 and Checklist PM No. 003, "Weekly Crusher Gate Anti-Pollution Pond". The Discharge Monitoring Checklist for July and November 2020 and January and March 2023 were sampled. The Procedure PM 012: Detoxification and Discharge of Excess Process Water into Environment was inspected weekly and reported monthly (never pumped out since 2007). There are no process tanks without secondary containment, and this was confirmed during the site inspection.

With respect to spill prevention and containment measures, reagent Strength cyanide pipelines to the CIL hopper, are routed across concrete bunds from the dosing tank to the hopper. The slurry line from the CIL hopper to the CIL tanks (PR line) are routed inside a plastic-lined trench, draining into plastic-lined antipollution ponds at the CIL and the

Crusher sections. The cyanide line routed to the Acacia Reactor was observed to be a pipe-in-pipe design.
The Tailings lines to the No 1 TSF are placed over an area where leaks will be recovered to the CIL area and further placed within a lined trench to the No. 1 TSF. The Line running across the No 1 TSF is placed inside a lined trench but also placed inside the No 1 TSF Footprint. The tailings line running to the No 2 TSF is placed inside a lined trench and slopes towards the No 2 TSF to direct any spillage into the TSF. The return water lines run inside the lined trench together with the tailings lines.
As noted in the previous audit, "…a short section of the PR pipeline crosses over a natural drainage, which discharges directly to the receiving environment. CJGSW has wrapped the section of the PRF crossing the drainage with a welded HDPE sleeve. By design, the pipeline slopes towards the lined secondary containment basin provided for the lined PRF containment channel. Any leakage collected by the pipe sleeve will report to this catchment basin…." There has been no change to this situation.
CJGSW uses steel, rubber-lined steel, and HDPE pipelines for the conveyance of cyanide solutions and slurries. Cyanide mixing, storage and process tanks are fabricated of carbon steel. All of these materials are compatible with cyanide and high pH solutions.

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.

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 4.8**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The previous re-certification audit noted the following, "…Please also see the 2009 Detailed Audit Findings Report (DAFR) for the initial ICMC verification audit and the DAFR for the quality assurance/quality control (QA/QC) documentation provided for the cyanide facilities in operation at that time. All QA/QC packages referenced in the two previous DAFRs were confirmed to be available on file…."
Modifications to existing cyanide facilities installed or constructed subsequent to the 2012 ICMC verification audit include a reviewed report by Top Sky Francis Mensah PR dated 9 April 2012, "… Inspection/testing of cyanide facilities and QA/QC inspection of the cyanide detox system, process water pond, antipollution ponds, HDPE pipeline, CIL concrete bund walls, floors and foundation in the process plant. The report includes the mill cyanide mixing and dosing tanks…." The site inspection observed the above functioning facilities and noted no further additions.
There is a redundant cyanide mixing and dosing plant at the CIL, which has never been used. This was built as a backup facility in case the pipe reactor system of cyanide dosing was insufficient. The pipe reactor concept includes adding cyanide at the Mill section dewatering cyclone underflow, followed by pumping the slurry to the CIL plant 800m

from the mill. The resulting mixing in the pipe with cyanide results in improved leach kinetics and efficiency. The redundant mixing plant was a contingency, in case the cyanide levels were inadequate at the CIL, and additional cyanide dosing is required at the CIL. This mixing facility was never used, has never had cyanide through it, and therefore is not classed as a cyanide facility in terms of the ICMI Definitions and Acronyms document.

In the TSF 2 Stage 2: raise, monthly construction reports dated October to December 2018, by Knights Piésold Engineers, the Stage 3 raise was done as per "TSF 2 CELL 2 (STAGE 3) Construction Report, April 17, 2023. The report was signed by: Michael Abraham, Senior Civil Engineer, reviewed by Winifred Agbakpe, Project Engineer, and approved by Ama Nketiah, Regional Manager and Principal Engineer.

In the Knights Piésold QA/QC document, section 4.0 QUALITY ASSURANCE AND QUALITY CONTROL, this statement was included, "…Quality assurance and quality control (QA/QC) support for the TSF 2 Stage 3 construction was provided by Knight Piésold, on behalf of GS, as practically possible to confirm that the construction was undertaken to meet the design intent and specification of the project..." The report included the following headings for the TSF 2 Stage 3 raise:

- Borrow Materials Testing, Field Density of Compacted Fill
- Appendix A As-Built Drawings
- Appendix B Material Test Results (Tables)
- Appendix C Material Test Results (Figures)

The detail of the above are available in the TSF project filing system and was sighted and sampled.

The QA/QC Construction Report concluded:

"…5.5 CONCLUSION

The Stage 3 to the Wassa TSF 2 was constructed as practical to design. This is based on the documented observations, inspections, photographic records and test records that have been presented in this Construction report. The overall design intent has been duly satisfied, and the construction deemed acceptable under the standard professional practice. Due consideration was given to applicable codes of practice, design guidelines and regulatory requirements…"

Quarterly TSF Audit reports for 2020, 2021, and 2022 were signed electronically. The reports are prepared by Knights Piésold as the Third-Party Engineers of Record. The report headings include: Field Inspection and TSF Condition, Structural Integrity, Seepage, Tailings Deposition and Process Water Balance, Supernatant Pond, Rainfall Data, Piezometric Levels, Water Quality, Cyanide Concentration, Conclusions and Recommendations. Other reports covering annual safety reports and quarterly Environmental Audit reports were sighted electronically. The 2022 Safety Audit of GSWL TSF Complex by Geosystems Consulting Limited, concluded:

• There were no visible signs of distress in the embankments, such as cracks, bulging or settlement; hence, embankment stability is not deemed compromised.

• Tailings beach freeboard against all embankments, at the time of inspection, was adequate with the supernatant pond generally estimated to occupy less than 30% of the impoundment area of the facility. The facility appears “drier” than was observed during the 2021 audit.

None of the reports sampled and reviewed indicated that the TSF facility is not fit for purpose.
The Process Plant commissions an annual Visual Inspection, "Ultrasonic Wall Thickness Monitoring and Certification of Cyanide Facilities in the Process Plant Report", undertaken by Randolph Abban, a Professional Engineer from Maree Analab Ltd. The objective of the inspection is to ascertain the integrity or otherwise of the cyanide facilities. The Engineer makes observations and recommendations on the condition of the facilities. Sighted Reports from 2020, 2022 and 2023. The 2021 report was not completed due to Covid-19 restrictions. However, an internal inspection was carried out by the operation's Condition Monitoring and Reliability Engineer.

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

X in full compliance with

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

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The operation uses the following procedures covering monitoring activities: -

- Procedure EN 01 – Surface Water Monitoring
- Procedure EN 03 – Groundwater Monitoring
- Procedure PM044 – Monitoring Fauna Mortality
- Procedure EN 08 – Procedure: Sampling of Tailings Slurry

The procedures were developed by Celestina Atsiagli, BSc. Entomology and Wildlife, MSc Environmental Science, and approved by the Minerals Commission to produce and amend monitoring procedures. The reviewer of the procedures, Francis Sefa, has a BSc. Chemistry, and MSc. Environmental Science. The Manager who approved them, James German, has a BSc. Chemistry and MSc. Mining Engineering.
Procedure EN 01, "Surface Water Monitoring", and Procedure EN 03, "Groundwater Monitoring", provide guidance for calibration of field equipment, water level measurement and well purging (for groundwater), sampling procedures and field information, sample identification (including chain of custody procedures), quality control, sample preparation and preservation, sample shipment details, analysis of samples and data management. The Environmental Monitoring Matrix provides the sample locations and frequencies, and monitoring parameters, including cyanide species to be analysed for.
Groundwater and Surface Water Monitoring both require recording field data on data sheets, representative samples of which were provided for review. Field measurements recorded include the date, time, sampling location, stream flow, water colour, rainfall for the previous 24 hours, pH, temperature, conductivity, TDS (Total Dissolved Solids), TSF and general comments (including livestock/wildlife activity, anthropogenic influences).

Procedure PM044, "Monitoring Fauna Mortality", describes documentation of any fauna mortalities observed.
Groundwater and surface water is sampled weekly, bi-weekly and monthly, and wildlife mortality is part of a daily observation at the TSF. The auditors deem the frequencies adequate to characterize the medium being monitored and to identify changes in a timely manner.

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

	X in full compliance with
The operation is	□ in substantial compliance with **Standard of Practice 5.1**
	□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The Golden Star Resources Limited (Wassa Mine) Cyanide Facility Decommissioning Plan, June 2022, was sighted and reviewed.
The plan includes the following: -
- Section 2 - Cyanide Facility Closure Planning
- Section 3 - Tailings Disposal Facilities
- Section 4 - Schedule of Closure
- Section 5 - Closure Cost Estimate

Section 2.3.2, Pre-closure Tank Cleanout, states: -
" …Decommissioning of cyanide facilities will only apply to areas of the plant where cyanide concentrations are routinely in excess of 50 mg/L. Other areas of the processing plant and the tailings disposal facility are covered under the general project closure plan and are beyond the scope of this document.
As indicated above, the following are the main areas that will be contaminated with cyanide at plant closure:
1. Cyanide mixing and storage tanks;
2. Piping and delivery lines;
3. Pumps;
4. CIL tanks
5. Reagent leach tanks;
6. cyanide instruments; and
7. CIL feed hopper and other process vessels…."

The Cyanide Facility Decommissioning Plan states, under Section - 4 SCHEDULE OF CLOSURE:
" Planning for the shutdown of GSWL (Gold Star Wassa Limited) processing plant and associated cyanide facilities will be the subject of detailed task lists and associated schedules of activities. The notional schedule for implementing the Decommissioning/Closure Plan is shown in a milestone chart and attached as appendix A."
The plan is reviewed every 3 years by a third party.

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

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 5.2**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The 2022 Golden Star Resources Limited, Decommissioning Plan and Associated Asset Retirement Obligations for Golden Star Wassa Limited, covering the cyanide decommissioning activities based on third-party implementation, was sampled.
Section 1.8.1 Decontamination, states that the following were included: -
- Chemical-contaminated vessels washed down to the paddock/event ponds for pumping to the TSF;
- Cyanide plant washed down in situ prior to demolition, and slurry routed to TSF.
In section 7.4 Tailings storage facility, section 2.3.1, covering TSF 1, TSF 2 Cell 1, TSF 2 and Cell 2, the sum of US$916,355.47 was allocated.
The Golden Star Resources (Wassa Mine) Cyanide Facility Decommissioning Plan dated June 2022 states in Section 5 - Closure Cost Estimate:-
"…In line with company policy, Wassa Mine will carry out decommissioning activities to address issues such as disposal of residual cyanide reagents, rinsing of cyanide facilities such as pipelines and process tanks and installation of measures necessary for the control or management of surface or groundwater such as pumping and treatment systems that would operate during the facility's closure period. The cyanide – related decommissioning estimated cost is incorporated into the site ARO which is updated annually.
Section 6 – Financial Assurance
Financial provisioning is crucial to mine decommissioning. It provides a mechanism to ensure that sufficient funds are available for closure and that closure costs do not become a burden in later years of the mine life when revenues could be diminishing. Assessment of Reclamation and decommissioning cost as per the current Environment Management Plan (EMP) puts GSWL liability at US $10,635,812.00..."

Electronic files for estimates for 2020. 2021 and 2022 are available. CJGSW (Chifeng Jilong Golden Star Wassa) updates the cost estimate every three years. The current version is presently being revised.
The closure financial mechanism consists of a Reclamation Security Agreement, dated 10 May 2022, between the Ghana EPA (Environmental Protection Agency) and CJGSW, and is implemented through a guarantee with CAL Bank and a cash deposit.
The following documents were sighted: -

- Stanbic Bank Ghana Limited: Corporate and Investment Banking note to The Environmental Protection Agency of the Republic of Ghana, P.O. Box M 326, Ministries Post office, Accra, Ghana. Attention: The GH Executive Director, dated 10 May 2022.
- The Bankers Guarantee No, OG20274GH0100708A00005 for the Reclamation Programme of Golden Star (Wassa) Limited (CJGSW) totals US$14,441,629.00. The Guarantee is valid for 12 months from 10 May 2022 and is revised annually. The letter was signed by the Manager: IBC and Payment, and Manager: Global Market Operations, on 10 May 2022.

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.

	X in full compliance with
The operation is	□ in substantial compliance with **Standard of Practice 6.1**
	□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The primary procedures related to the operation of cyanide facilities are listed below and were sampled and reviewed: -

- Procedure PM No. 001 – Cyanide Offloading Procedure.
- Procedure PM No. 002 – Cyanide Mixing Procedure
- Procedure PM No. 003 – Ensuring Right pH During Stock Cyanide Mixing
- Procedure PM No. 004 – Working Inside a Cyanide Mixing/Storage Tank,
- Procedure PM No. 006 – Working on Pumps, Valves, Pipelines and Other Cyanide Equipment
- Procedure PM No. 007 – Procedure for Checking the Limiting pH at which HCN is Generated
- Procedure PM No. 009 – Disposal of Empty Cyanide Boxes
- Procedure PM No. 026 – Operating Plan for CIL and Other Facilities, which Manage Cyanide Process Solutions

- Procedure PM No. 037 – Monitoring and Management of Water Levels at the Process Ponds.
- Procedure PM No. 043 – Procedure for Monitoring Leak Detection Pipes in the CIL Tank Foundations

Also reviewed was: -
Procedure PM No. 013, Tailings Dam Operating Procedures. TSF Wassa Mine.
This includes the following tasks: -
- Deposition of Tailings
  - Pipework and Valves
  - Tailings Pipework
  - Spigotting Process
  - Ring Main Flushing
  - Decant Operation
- Routine Inspections and Maintenance
  - Tailings Lines
  - Decant System

The Comprehensive Cyanide Management Plan also describes how cyanide-related tasks and maintenance should be conducted to minimize worker exposure. The review of the procedures confirmed that the requirement for the use of PPE (Personal Protective Equipment) and appropriate tools and pre-task checks is included.
The operation solicits and considers worker inputs on developing and evaluation health and safety procedures through Health and safety procedure and standards workshops. The workshop on hazardous materials standards finalisation held on 9 March 2021 included 19 attendees in person and via Zoom, owing to Covid 19. The hazardous materials standard and the improvement suggestions originating from the worker participants in the workshop were sighted. Similarly, a space standard finalisation workshop held on 4 January 2021 with 21 Attendees in person and via Zoom, owing to Covid 19, was sighted. Also sighted were the improvement suggestions originating from the worker participants in the workshop.

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.

X in full compliance with

The operation is
- □ in substantial compliance with **Standard of Practice 6.2**
- □ not in compliance with

Basis for this Finding/Deficiencies Identified:
The pH in the CIL feed is controlled by lime addition to the Mill before the cyanide is added to the CIL hopper. The pH is controlled at 10.5, which is the general industry standard for ores not high in other minerals and solutions not high in dissolved solids.

The cyanide mixing procedure includes the requirement to add NaOH to the mixing solution to adjust the pH and prevent HCN gas formation.
An initial HCN Gas risk assessment was carried out, and potential hot spots were identified and fixed alarms were fitted. This was confirmed in evidence from the previous re-certification audit, and there have been no changes since that audit. A Paste backfill plant was constructed since the previous audit, and a HAZOP (Hazard and Operability Analysis) was conducted (sighted), identifying the need for fixed HCN monitors.
The plant uses a variety of personal HCN gas monitors:

- PAC 8000 portable HCN gas monitors - 4 units kept with Metallurgy Department
- Xam 5600 portable multi-gas (incl. HCN) gas monitors - 1 for Paste Plant, 1 for Laboratory, 1 for ERT (Emergency Response Team)
- Xam 8000 portable multi-gas (incl. HCN) gas monitors - 1 unit for confirmed space assessments.

Fixed HCN gas monitors are used at: - Mill cyanide mixing (1 x MSA [manufacturer proprietary name], tank 1), CIL feed hopper (1 x Dräger [manufacturer proprietary name]), CIL Tank 1 CIL (1 x MSA), Tails hopper (1 x MSA), Carbon Recovery screen (1 x Dräger) Paste Plant Filter house (1 x MSA), Paste Plant thickener overflow hopper (1 x Dräger).
The monitors all alarm at a gas value of 4.5 ppm (first alarm) and 10 ppm (second alarm). Action taken for the first alarm (4.5 and 4.7 ppm) is stated in the training procedure, which requires staying away 50m from the work area for 5 minutes and allowing fresh air diffusion before re-entry to the work area. Check for gas levels before occupancy or the start of work. Action taken at the second alarm of 10ppm is to evacuate the location.
Most portable gas monitors were changed from MSA to Dräger in 2021, thus, it is not possible to demonstrate a full 3 years retention of calibration records. However, calibration records were sighted and reviewed. Gas monitoring equipment used is currently manufactured by Dräger and MSA, both of whom require 6 monthly calibrations of units.
The placement of warning signs at the cyanide warehouse and mixing areas requiring appropriate personal protective equipment to be worn was sighted. The plant has dedicated eating areas where eating and drinking is allowed. The induction training stipulates that workers may not smoke, eat or drink in the plant, unless in dedicated areas. The slides in the training presentation where prohibition of eating and drinking or smoking is shown, as well as the statement prohibiting smoking, eating or drinking unless in dedicated areas, were sighted.
Carmoisine red dye is added to the cyanide mixing process. This was confirmed in the Cyanide Mixing Procedure.
During the site inspection, the placement of safety showers, eyewash stations and fire extinguishers at strategic locations on the plant was confirmed. The Mine has a trained Emergency Response Team and Fire Station within 5 minutes of the plant, which are used for any fire or emergency on the plant. Dry powder fire extinguishers' external inspection files and records for 2020 and 2023 to date April 2023, including the plant fire extinguishers, were sighted. The files were sampled, and inspections were confirmed.
Safety showers and eye washes are inspected weekly, as per the Pronto PMS system, and these were sampled in 2020 and 2023.

The site inspections confirmed that the tanks are labelled, and the reagent strength cyanide pipes are colour-coded purple, labelled and the direction of flow indicated on the lines. The Plant has a Pipeline Colour Coding Identification system which includes cyanide pipelines and slurry pipelines. The Pipeline Colour Coding Identification display boards around the plant were sighted.
The Cyanide Safety Data Sheets (SDSs) for TaeKwang, TongSuh, Hebei Chengxin and Orica were sighted, and the cyanide emergency contact notice boards at the cyanide mixing area, the cyanide warehouse, Emergency Room and the Office block were reviewed. Also sighted around the plant were signs headed, "First Aid for Cyanide Poisoning" with appropriate instructions. The working language of the mine is English.
The Mine uses the Golden Star Resources Limited Incident Management Standard, and an example of a lost time injury on a drill rig off-sider at the 419 waste dump on 26 June 2022 was sighted. The investigation covered a right-hand thumb that was trapped in a core barrel, ripping the top off the thumb. The report includes investigation, key findings, photographs, route cause, contributing factors and recommendations, as well as being signed off by the Exploration Manager, Safety Superintendent, HSEC (Health, Safety, Environment and Community) Manager and Managing Director and CEO (Chief Executive Officer). This Standard would be used for any cyanide-related incident or accident.

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

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 6.3**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The Emergency Response Plan to respond to cyanide exposures was sighted. As was the Comprehensive Cyanide Management Plan which includes the necessary response to cyanide exposure through ingestion, inhalation and absorption through the skin and eyes.
The Cyanide Awareness Presentation also has a cyanide first aid section which discusses the responses to cyanide exposure through ingestion, inhalation and absorption through the skin and eyes. This was confirmed in a review of the Cyanide Awareness PowerPoint presentation.
It was confirmed during the site inspection that the Mine has: - Radios available for communicating emergencies on Channel 2; audible alarms for mandown emergencies; cell phones, when available, can also be used to call an emergency number; and Life Oxygen kits are available at the plant office, the CIL top titration cabin, Emergency Response Centre, Emergency Response Room, Mill Mixing area, the SCADA control room. Medical Oxygen is available at the Clinic, the ambulance, and the Mine Emergency Rescue Centre (CARvent oxygen resuscitation kit - 2 units). Cyanide antidote

kits (3 Cyanokits, expiring 9 January 2025) at the Clinic. Cyanide antidote is stored according to the manufacturer's recommendations (in the clinic in a tight container at room temperature of 25°C). Orders are placed 3 months before expiry to ensure timely delivery.

The ISOS (previous medical contractor) checklists were sighted, and April 2020 and October 2020 were sampled. The Care Flight (current medical contractor) checklists for April and March 2023 were sighted and sampled. The pharmacy uses a software package called "Stock check" for managing consumables and drugs, which is managed by the pharmacist, and new stock is re-ordered 3 months before expiry, according to the manufacturer. The Ambulance, LV (light vehicle) 176 inspection checklist was sighted, and daily checklists for January and October 2020 and January and March 2023 to date were sampled. The Weekly (clinic) checklists for January and October 2020 and January and March 2023 to date were sampled. The Ambulance LV 101 inspection checklist was sighted, but checklists were not available due to maintenance from October 2020 to 17 December 2020. Sample daily checklists for January 2020, 1 to 4 October 2020, 18 to 31 December 2020 and January and March 2023 to date. The Weekly (clinic) checklists for January 2020, 18 December to 11 February 2021, and January and March 2023 to date were sighted. In the plant cyanide emergency cabin, the checklist for the mill emergency response inventory was sighted, and 2020 and 2023, to date, were sampled.

The mine has a fully equipped medical clinic with nursing staff and two on-site doctors, operated by International SOS (Ghana) on contract (sighted), which can provide first aid or medical assistance to workers exposed to cyanide. The contract was replaced by a contract with Care Flight in January 2023. The Care Flight (contract is in place and sighted) clinic was visited, and it was confirmed that it can provide first aid or medical assistance to workers exposed to cyanide. The clinic has an emergency room equipped with oxygen and Cyanokit antidotes (3 kits, expiry date in July 2025, with access to a further 3 from Iduapriem Gold Mine, by agreement, if required.) It also has a two-bed ward which can provide overnight observation of cyanide patients, if required. The clinic is situated approximately 1.5 Km from the process plant and has trained medical staff and equipment to respond to cyanide medical emergencies. The clinic can handle 4 cyanide patients with space for additional numbers as necessary.

The Plant security operations procedure, dated 20 October 2021, section 12, instructs that sick people in ambulances will be joined by security personal at the gate to the clinic, and section 13 states that search protocols are non-applicable to all emergency vehicles and equipment: Fire Tender and Ambulance during emergencies. Ambulance transport of patients on the mine site is practiced during emergency drills.

It was noted during the previous re-certification audit that the ISOS Medical Evacuation Response Plan (MERP) was used to evacuate all medical emergencies, including cyanide, to any specialist hospitals (local, national or international) depending upon the specialist requirements. Air Ambulance was contracted to ISOS if air evacuation was required. ISOS had identified the Cape Coast Teaching Hospital, the Takoradi Effia Nkwanta Regional Hospital, and the Tarkwa Government Hospital as having adequate, qualified staff, equipment and expertise to respond to cyanide exposures. The Care Flight Medical Evacuation Response Plan (MERP) was sighted, and air ambulance arrangements were

made by their Corporate Office in Accra. The Accra University Hospital will be used. The facility has adequate facilities and Medial staff to handle cyanide patients.

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.

X in full compliance with

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

□ not in compliance with

Basis for this Finding/Deficiencies Identified:

The Emergency Response Plan Golden Star Wassa Limited, Revision Date: 31st December 2022, Revision Number: 02, was sighted and reviewed. Section 3, Part Two - Emergency Response Procedures, includes the emergency scenarios on cyanide. The following are sampled relevant scenarios and responses: -

- **3.2.18 Hazardous Chemical Release (Cyanide) – HCN Gas Threat**: Hydrogen cyanide gas (HCN) is released in an uncontrolled manner from the Wassa operations and is at a concentration that poses risk to people (TLV [Threshold Limit Value] 5 ppm, TLV-C [Threshold Limit Value Ceiling] 10 ppm). (Note, whilst in transport, cyanide emergency response is the regulated accountability of the supplier).
- **3.2.6 Transport/Road Accident**. Threat: A serious vehicle incident or interaction involving a company vehicle, i.e., heavy equipment, light vehicle, company bus etc. Employees are killed and/or seriously injured on/off-site. The Mine uses three suppliers transporting cyanide to site: - Samsung. The Africa supply chain of Samsung, which is a certified supply chain and, as such, is responsible for the emergency response to the Mine Site. Orica's supply chain and production is certified under the ICMI and, as such, is responsible for the emergency response to the Mine Site. Hebei production and supply chain is certified under the ICMI and, as such, is responsible for the emergency response to the Mine Site.
- **3.2.16 Hazardous Chemical Release (Cyanide) at mine-site (land release).** Threat: Dry cyanide is released in an uncontrolled manner to land from the Wassa operations and poses risk to the external environment, communities or mine-site operations. (Note, whilst in transport, cyanide emergency response is the regulated accountability of the supplier).
- **3.2.19 Hazardous Chemical Release (Liquid Cyanide) at mine-site.** Threat: Liquid cyanide is released in an uncontrolled manner within the Wassa operations and poses a risk to the workforce and/or mine-site operations.

- **3.2.4 Major Fire/Explosion (surface).** Threat: Fire or explosion causing injury to personnel and/or damage to assets or facilities.
- **3.2.20 Cyanide Poisoning**. Threat: A person has been exposed to or ingested or is suspected of having been exposed to cyanide at the Wassa operations.
- **3.2.24 Process Water Pond Failure**. Threat: The lined process water pond has failed and poses a risk to the external environment, communities or mine-site operations.
- **3.2.5 Prolonged Loss of Utilities.** Threat: The site loses power, water, computer links/computer database or telecommunications facilities for a prolonged period.
- **3.2.24 Process Water Pond Failure.** Threat: The lined process water pond has failed, and poses risk to the external environment, communities or mine-site operations.
- **3.2.23 Tailings Storage Facility Failure**. Threat A tailings storage facility failure has occurred that poses risk to the external environment, communities or mine-site operations.
- **3.2.15 Hazardous Chemical Release (Cyanide) during transport**. Threat: Cyanide is released in an uncontrolled manner during transport to the Wassa operations and poses risk to the external environment and/or communities. Whilst in transport, cyanide emergency response is the regulated accountability of the cyanide transporter. Accordingly, in the event of notification of any cyanide release in transportation, the following response should occur. Initiate notification of cyanide supplier. (In the Plan, there follows a table of contacts and contact details which includes: - Samsung Managing Director, Samsung Safety Health & Environmental (SH&E) Coordinator, and Samsung Operations Supervisor.)
- There are no cyanide treatment, destruction or recovery systems at the operation so these are not covered in the Plan.

The Plan includes a procedure for evacuation of site personnel, detailed instructions for the use of cyanide antidotes, and containment, assessment mitigation and future prevention guidance for the Emergency Response Team.

Seepage Management is covered in section 4.5.1 of the Golden Star Wassa Comprehensive Cyanide Management Plan.

Both the Event Pond and Process Water Pond have two HDPE liners and soil liners to protect against seepage to groundwater.

The TSF1 has been designed with a 300mm thick full basin soil liner specified in the design as 1 x 10-8 m/s. It is comprised of in-situ soils scarified and re-compacted throughout the basin area to form a soil liner 300mm thick.

The TSF 1 Extension and TSF2 dam is lined 1.5mm smooth HDPE geo-membrane liner. Beneath the supernatant pond area there is a composite liner comprising both the compacted soil liner and 1.5mm smooth HDPE geomembrane liner with an under-drainage system. The composite liner has a permeability of 1 x 10-11 cm/s and covers the average supernatant pond area plus the 1:25 year/24-hour storm event. An underdrainage system has been installed under the synthetic liner to reduce seepage from the TSF basin.

An under-drainage collection pump is installed to pump solution collected from the sumps back into the TSF. Also, any seepage escaping from the TSF via the embankments

collects in a sump located outside the facility, further south, and is pumped back into the TSF. Samples are taken for monitoring and testing purposes by the Environmental Department.
In addition, there are several monitoring bores located downstream that can be converted to recovery bores if a containment plume is detected. These bores are monitored on a weekly/monthly basis and/or as specified in the Environmental Monitoring Plan.

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

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 7.2**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The external stakeholders were involved extensively in emergency response drills, meetings and presentations and have received appropriate training. The workforce is briefed on emergency response during cyanide induction and refreshers. The ERT (Emergency Response Team) and Medical Clinic form a part of the emergency drills and are kept abreast of the Plan.
There are no external entities that have a role in the Cyanide Emergency Response Plan. External stakeholders are kept informed on parts of the ERP relevant to them.

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

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 7.3**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
Primary and alternate emergency response coordinators who have explicit authority to commit the resources necessary to implement the Plan are addressed in Section 2.5 Corporate Crisis and Emergency Management Structures, Section 2.6 Declaring an Emergency, and the Emergency Flowchart in the Plan.
Emergency Response Team Lists are posted on all notice boards and are updated regularly. The lists were sighted during site inspections. The Mine rescue brigade lists include name, residential address and telephone numbers. The duties and responsibilities of the coordinators and team members are found in the Plan in Section 2.5 Corporate Crisis and Emergency Management Structures, Section 2.6 Declaring an Emergency, and

in the Emergency Flowchart. Appendix 4 contains the Emergency Management Team Duty Cards, which detail duties and responsibilities.

Training for emergency responders is covered in the Plan in Section 1.4, Training and Awareness, and Section 2.3, Plan Implementation and Training. Call-out procedures and 24-hour contact information for the coordinators and response team members are covered in the Plan in Section 1.2 Emergency Notification and Communication System. Abbreviated call-out procedures were also sighted on notice boards.

A list of emergency response equipment, including personal protection gear, available on-site, can be found in Section 1.3, Emergency Equipment and Resources, in the Plan.

Inspections of emergency response equipment are carried out as routine, and this was confirmed during the review of inspections:

- The ISOS checklists were sighted, and April 2020 and October 2020 were sampled.
- Similarly, Care Flight checklists were sighted, and April and March 2023 were sampled.
- Ambulance inspection checklists were sighted, and 2020 and 2023 inspections were sampled.
- Plant cyanide emergency cabin inspection cabin - Sighted mill emergency response inventory (emergency response room) checklist and sampled March 2020, January 2023 and April 2023.
- The Oxygen 4 resuscitator units' monthly inspection checklists for February 2020, November 2020, January 2023 and April 2023 were sampled.
- The ERT emergency equipment inspections for the ambulance and SCBA (Self Contained Breathing Apparatus) daily inspections for 2020 (8 and 9 November and 23 April) and 2023: (13 January, 9 March, and 19 April) were sampled.

The ERT (Emergency Response Team) Mine Rescue Coordinator position description was reviewed, and a primary role states that he/she" …Plans, organises, schedules and conducts inspections of emergency and mine rescue facilities, work areas and equipment…."

ISOS was managing the medical clinic, and their role is described in the contract with the Mine. Similarly, Care Flight has been managing the clinic since February 2023, and their role is described in their two agreements.

It was sighted during the previous re-certification audit that the ISOS Medical Evacuation Response Plan (MERP) is used to evacuate all medical emergencies, including cyanide, to any specialist hospitals (local, national or international) depending upon the specialist requirements. Air Ambulance is contracted to ISOS if air evacuation is required. ISOS has identified the Cape Coast Teaching Hospital, the Takoradi Effia Nkwanta Regional Hospital, and the Tarkwa Government Hospital as having adequate, qualified staff, equipment and expertise to respond to cyanide exposures. ISOS was responsible for the Clinic till January 2023.

The Care Flight Medical Evacuation Response Plan (MERP) and air ambulance arrangements were covered in the Local Services Agreement W23C001 dated 1 February 2023 and the services agreement W23C002 dated 18 January 2023 with Care Flight (ISOS ended service January 2023 and Care Flight started service February2023). It was reported that in discussions prior to contract preparation, Care Flight was made aware of

the hazardous chemicals that were used on the mine site and that they, potentially, have to deal with cyanide, amongst other chemicals.

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

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 7.4**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
Procedures and contact information for notifying management, regulatory agencies, external response providers and medical facilities of the cyanide emergency are covered in the Plan in Section 2.6 Declaring an Emergency and in the Emergency Flowchart. Activation of the EMT (Emergency Management Team) is in Appendix 4. Appendix 4, Emergency Management Team Duty Cards, detail specific duties of identified key job owners, including notifying management and regulatory agencies, and affected communities. Media communications are the responsibility of the Senior Manager: Corporate Affairs, who will be engaged during the course of the activation of the emergency response structures. Appendix 2 is an internal telephone directory which details all the contact positions, names, mobile numbers, office numbers and e-mail addresses of those persons, internal and external, who may need to be contacted in the event of an incident.
No significant cyanide incidents have occurred since the revision of the ICMC in June 2021. The Golden Star (WASSA) Limited, International Cyanide Management Code Implementation Heading: Procedure to notify ICMI of any significant cyanide incident - PROCEDURE PM No. 045, states,
" …- The occurrence of the alleged "significant cyanide incident" is reported to the Plant Manager or identified senior mine official who will consult with the Operation's Cyanide Champion of Cyanide Code Compliance Coordinator and affirm that the incident is confirmed as a "significant cyanide incident" that needs to be reported to the ICMI within 24 hours of occurrence.
Significant Cyanide Incident: Significant cyanide incidents are considered to include any of the following confirmed events;
a) Human exposure that requires an action by an emergency response team, such as decontamination or treatment.
b) An unpermitted release which enters natural surface waters, on or off-site.
c) An unpermitted release that occurs off-site or migrates off-site.
d) An onsite release requiring action by an emergency response team.
e) A transport incident requiring emergency response for cyanide release;
f) An event of multiple wildlife fatalities where cyanide is known or credibly believed to be the cause of death; and
g) Theft of cyanide…."

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.

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 7.5**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
In the Plan, Section: 3.2.19 Hazardous Chemical Release (Liquid Cyanide) at the mine site, the following recovery, prevention, decontamination, remediation and monitoring task steps and actions are identified: -
- ERT (Emergency Response Team) determine specific response plan, including:
o PPE requirements Note: SCBA (Self-Contained Breathing Apparatus) to be worn at all times when HCN level is above 40 ppm.
o Rescue activities as advised by EMT (Emergency Management Team) following mustering.
o Gas testing for HCN (Hydrogen Cyanide) gas.
o Stop spillage at source (i.e., turn off pump/valves serving the source vessel)
o Contain spillage movement.
o Risk of chemical interactions.
o Secure unsafe or at risk areas to limit access.
o Repair vessel/source of the spillage.
o Recover spilt material into containers for disposal, including excavation of contaminated soils.
o Undertake sampling as directed by EMT.
o Dispose of spillage to the tailings storage facility, another plant bund or detoxification circuit as directed by EMT.
o Decontaminate all tools and equipment.
o Advise EMT on location, extent and implications to response.
Section 3.2.19 Hazardous Chemical Release (Liquid Cyanide) at mine-site: Note: Cyanide detoxification chemicals are not to be used where water has or can reach a surface water body as the chemicals are toxic to aquatic life. Communities that might have been affected were trans-located and, as such, the provision of an alternate drinking water supply is not applicable.
In Procedure PM 008: Wet Sodium Cyanide Decontamination Procedure (Section 3.2.2 - Task Step 4), and Procedure PM 015: Dry Sodium Cyanide Decontamination Procedure, (Section 3.2.2 task step 4), it states, "…Alert Health, Safety and Environment department to sample the area, to check and ensure that residual cyanide traces in the soil meets the (Ghana) EPA (Environmental Protection Agency) statutory requirement which states that the total cyanide should be 1.0mg/l, WAD cyanide 0.06 mg/l and free cyanide 0.0…"

Procedure EN 01, Surface Water Monitoring and Procedure, and EN 03 Groundwater Monitoring; provide guidance for calibration of field equipment, water level measurement and well purging (for groundwater), sampling procedures and field information, sample identification (including chain of custody procedures), quality control, sample preparation and preservation, sample shipment, analysis of samples and data management. The Environmental Monitoring Matrix provides the sample locations and frequencies and monitoring parameters, including cyanide species. The Emergency Management Team will advise on sampling locations to be used, based upon the event, the location, the extent of the incident, and associated risks.

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

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 7.6**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
In Section 1.6, Review of Emergency Response Plan, it states,
"The HSEC (Health, Safety, Environment and Community) Manager will be responsible for initiating annual reviews of the ER (Emergency Response) Plan and associated procedures and integrating up-to-date information as it becomes available. In addition, a review of the ER Plan must be undertaken after the occurrence of an accident or emergency incident. Again, a review of the ER Plan must be undertaken when structural or physical alterations or layout changes and finally, when a new technology, process, equipment or training methods become available to the mine." No evaluations have been necessary or have taken place as a result of learning points from mock drills. No drills were conducted in 2020 due to the Covid 19 regulations. The ISOS clinic (until January 2023) and Care Flight clinic (since February 2023) were involved in cyanide mock drills and also conducted their own internal medical drills to test readiness.
The cyanide drill for 16 November 2021 was sighted: -
- Scenario: A cyanide delivery truck was involved in a road accident in Accra Town which led to a cyanide spill at the edge of the road and in a nearby stream. A schoolboy became unconscious as a result of drinking from the stream.
- Observations and improvements:
1. There was no on-scene commander when the incident occurred.
2. Casualty did not receive attention from community members.
3. Handling of cyanide-contaminated casualty needs improvement.
4. Continuous gas survey conducted. 5. Gas survey did not capture the entire exposure area.
6. Some bystanders found their way to the casual treatment area.
7. One driver drove into the barricaded area whilst ERT was working.
The cyanide drill for 2022 was sighted: -

- 22 December 2022: Scenario: A cyanide truck crashed into a motorbike which jumped traffic at a junction, the motorbike rider was severely injured, major traffic jam at the junction and chemical spillage.
- Learning points: Vehicles from the town blocked the access road to the clinic, the vehicle carrying the spill kit broke down, and an alternative was sourced.
- Corrective actions: communities were educated to park safely to allow emergency vehicles access during accidents, and consideration was given to equipping the Team with a strong vehicle to carry out rescue or emergency activities.

A drill for 2023 has not yet been conducted and is planned for 2023.
The operation has not experienced any cyanide-related incidents since the last recertification audit

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.

X in full compliance with

The operation is

- ☐ in substantial compliance with **Standard of Practice 8.1**
- ☐ not in compliance with

Basis for this Finding/Deficiencies Identified:
All employees that may come into contact with cyanide receive "Introduction to Cyanide" training which includes a presentation on "cyanide awareness". The course includes: -

- forms of cyanide,
- solid white briquettes and red coloured liquid after mixing,
- Solid cyanide packaging,
- Where can I find cyanide on site,
- cyanide levels in common food,
- Hazards, Hazard signs,
- safe handling guidelines,
- exposure route to the body,
- HCN gas control,
- symptoms of cyanide poisoning,
- first aid treatment,
- what I must know as a welder,
- explanation of fire signals,
- chemical hazard, explosion hazard,

- firefighting information,
- sections of processing plant and
- on cyanide fires.

The training matrix was sighted, which includes process staff, laboratory staff, community trainees, paste plant, national service personnel, senior staff, security, contractors, plant maintenance, powerhouse staff, emergency response team, and clinic staff.

Employees are assessed after training, with a pass mark of 70%. If the trainee fails, he/she is put through the training again. English is the language of the course. The course is supported by explanations in Twi, the local language.

Refresher training on induction is undertaken when employees return from annual leave. The General Secretary prompts the plant when staff goes on leave so the person can receive refresher induction upon returning from leave. Hard copy records and electronic records were sighted. The Training Department issues the plant with refresher training schedules. Refreshers on specific topics are also undertaken during the Pre-Shift Information (PSI) shiftly meetings.

Training records go back to 2019 electronically.

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.

X in full compliance with

The operation is

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

□ not in compliance with

Basis for this Finding/Deficiencies Identified:

All employees are given general plant induction, including the main hazards in the areas. Detailed cyanide awareness is then given to all employees working with cyanide, including process, engineering, warehouse, and security. The induction includes: forms of cyanide, packaging, pH and gas generation, where cyanide is found, cyanide dosing points, no drinking, no eating, hazard signs, PPE, exposure routes, cyanide action in the body, cyanide first aid and antidotes, symptoms, emergency response and first aid.

The cyanide awareness training is followed by an assessment which was sighted. The Plant task training matrix was sighted. A matrix is in place for all different jobs and includes the training module (based on procedures) required for the job. The matrix includes the dates of completion of the training and refresher dates. Annual refresher is done for each module. Sighted the matrix for: -

- CIL/Desorption - all shifts
- reagent matrix - all shifts
- Tailings matrix - all shifts
- Plant maintenance - working on cyanide pumps, valves, pipelines and tanks and cyanide dosing pump or any pump operation concerning cyanide.

The training elements necessary for each job involving cyanide management identified in training materials were confirmed during the review of the task training matrix.
Trainers and training qualifications and experience:

- Gifty Bilson – Gold Star Resources Training Coordinator- BEd., Technology-Mechanical & Construction Options, MEd. Administration, SCP – SHRM (HR Qualification).
- Ellis Amenlemah, Process plant trainer / Cyanide awareness / On-the-job task training (7 years' experience). BSc. Chemistry – UCC (University of Cape Coast), Ghana, Certificate of competence, Snr Processing Officer- Mincom Exams, Pg. Studies, MSc Minerals Engineering.
- Samuel Kojo Ansah, 2 years in the position as Safety Training Officer, 6 years in the position as a Senior Emergency Response Trainer. BSc. Mechanical Engineering – KNUST (Kwame Nkrumah University of Science and Technology) Ghana, MSc. Environmental Engineering – KNUST, St. John Ambulance First Training certificate.
- Anthony Intarmah, 6 years in the position as Cyanide Champion/ Plant Health, Safety and Training Coordinator (including Cyanide Awareness Trainer). BSc. Minerals Engineering – KNUST, MSc. Minerals Engineering, St. Johns Ambulance First Training certificate, Certificate of competence, Snr Processing Officer- Mincom Exams.
- Augustina Yaa Quartey - BSc Minerals Engineering, First aid training - St John's Ambulance, 2 years plant experience.

Detailed cyanide awareness is given to all employees working with cyanide, before being allowed to start working on the plant. The detailed training includes the following modules: Introduction to Cyanide, safe handling guidelines for Cyanide, Health Effects of Cyanide, the Procedure to follow in the event of cyanide exposure, HCN gas monitor Operation, OxyPac Usage, risk assessment of cyanide workstation. Evaluations are done using the Orica test template and internal tests.
Task observations are done on different jobs using safe working procedures. The Foreman declares the person competent to do the job safely, using PTO (Planned Task Observation) system. Pictures are used extensively in the training modules. The language used is the local language, Twi. Cyanide Refresher training is done on returning from leave to enforce cyanide awareness on the plant. Cyanide Mixing and Offloading Operators are given refresher task training on return from leave, due to the criticality of their tasks. CIL / Desorption Operators also receive refresher task training on return from leave.
The operation evaluates the effectiveness of cyanide training by observation. PTOs (Planned Task Observations) are conducted on operators. A minimum of three PTOs in a 6-day shift cycle must be done by the shift supervisors.
PTOs sampled: -
2020
- PTO on Cyanide Offloading, Observed by Anthony Intarmah on Emmanuel Cudjde, Ali Yakubu, and Kenneth Baulen on 7th March 2020 – Outcome – satisfactory.
- PTO on Cyanide Offloading, Observed by Anthony Intarmah on Emmanuel Cudjde, Ali Yakubu, and Kenneth Baulen on 20th September 2020 – Outcome – satisfactory.

- PTO on Cyanide Mixing, Observed by Anthony Intarmah on Emmanuel Cudjde, Ali Yakubu, and Kenneth Baulen on 27th June 2020 – Outcome – satisfactory.
- PTO on Breaking of Empty Cyanide Boxes, Observed by Anthony Intarmah on Kenneth Baulen Jackson and Maxwell Boatang on 25/10/21 – Outcome – satisfactory.
- PTO on Cyanide mixing, Observed by Anthony Infarmah on Kenneth Baulen dated 10/7/2020 - satisfactory
- PTO on Cyanide mixing, Observed by Anthony Infarmah on Ali Yakubu dated 4/7/2020 – satisfactory.

2023

- PTO on Breaking of Empty Cyanide Boxes, Observed by Anthony Intarmah on Samuel Yeboah, Isaac Ansah, and Augustina Quartey on 1st February 2023 – Outcome – satisfactory.
- PTO on Breaking of Empty Cyanide Boxes, Observed by Augustina you Quarten on Ali Yakubu Jackson and Maxwell Boatang on 4th April 2023 – Outcome – satisfactory.
- PTO on Cyanide mixing, observed by Anthony Infarmah on Emmanuel Cudjul dated 3/3/23 - satisfactory
- PTO on Cyanide Offloading, Observed by Anthony Intarmah on Kenneth Baulen, on 4/4/2023 – Outcome – satisfactory.
- PTO on Cyanide Offloading, Observed by Anthony Intarmah on Ali Yakubu, on 4/1/2023 – Outcome – satisfactory.

Electronic records are recorded in the training matrix. The records include the name of the employee and the date training was completed. Hard copy attendance registers were sighted and sampled. The register includes the name of the trainer. The electronic matrix is updated using the hard copy attendance registers. Assessment after task training is carried out by PTOs conducted by the trainer. Records are available from 2019.

Standard of Practice 8.3

Train appropriate workers and personnel to respond to worker exposures and environmental releases of cyanide.

X in full compliance with

The operation is

- ☐ in substantial compliance with **Standard of Practice 8.3**
- ☐ not in compliance with

Basis for this Finding/Deficiencies Identified:

First Responders are trained in cyanide first aid, including patient decontamination, who work in the plant, and who will respond first in case of cyanide emergencies on the plant. A full-time Mine Emergency Response Team (ERT) is in place, which will respond to emergencies in the plant. The ERT includes members working in the plant, and all ERT members are trained in cyanide response. Currently, 16 full-time members are trained and are available on Day (06:00 to 18:00) and Night (18:00 to 06:00). A minimum number of around five members per shift are available. 26 First responders trained for the Mine. The ERT training matrix, including all the members and the required training courses and

elements, as well as indicating training completed, was sighted. All training is completed. The 52-week training schedule for the full-time ERT was sighted.
Weekly training sessions are held, including the use of necessary response equipment and emergency responses, including confined space training. The weekly training schedule was sighted. Plant First Responders received SCBA and Firefighting training, which was sighted in the Plant training matrix.
A number of Community members were briefed/informed about emergency response procedures in case of potential emergencies. Medical Responders are updated through drill involvement refresher training. The weekly training schedule includes refresher training. First aid and cyanide awareness refresher training are done annually.
Records are retained in soft and hard copy format, and include the name of the employee, and trainer, date of training, topics covered and how understanding was demonstrated. It was confirmed that the records are up to date in the training matrix. Hard copy records are available from 2019.

9. DIALOGUE AND DISCLOSURE
Engage in public consultation and disclosure.

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

	X in full compliance with
The operation is	□ in substantial compliance with **Standard of Practice 9.1**
	□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The Mine's main catchment communities are Akyempim, Kubekro, Old Subri, Nsadweso, Accra Town, Juabeng, Togbekrom and Akosombo. These communities have monthly meetings with the Community Department where a variety of issues, including cyanide, are discussed. Sometime after the topic has been introduced at the monthly meeting, a recap is undertaken at a subsequent meeting to check understanding and to answer any questions that may arise. The members who attend the meetings are opinion leaders and representatives of the community, such as the Chief, Youth (Male and Female), Farmers Representative, Women's Group of Community, Religious Group, An Appointed influential person, Chairman of the Local Unit Committee and an Elder.
Notes on meetings and minutes were sighted.

- Sampled Meeting with Togbekrom: date 25 October 2022. 9 community members attended, and 5 Mine Community Department staff. Topic Ground water protection as a result of safe TSF dam construction. The meeting discussed the deposition of tailings waste on the tailings dam, which includes cyanide, continuous monitoring of the dam, decommissioning and rehabilitation. Cyanide

on the dam was also discussed. The palm plantations as part of the rehabilitation were also discussed.

- Similar meetings were held at Nsadweso (9 committee members) dated 26 October 2022, and at Akyempim and Juabeng on 20 October 2022 (7 community members). - The topic of the meetings was cyanide spillage management in a community. Akyempim 18 May 2021 (5 community members), Old Subri (9 community members) held on 11 May 2021, Akosombo (7 community members held on 19 May 2021, Kubekro (5 community members held on 12 May 2021, Togbekrom (5 community members held on 20 May 2021, Nsadweso (6 community members held on 19 May 2021.

Those communities and stakeholders that are outside the main catchment areas, but along the cyanide transport routes are: - Accra Town, Ateiku, Togbekrom, Sarponso 1 and 2, Abaasa, Anyinase and Praso, a separate forum has been established to communicate appropriate information including cyanide awareness.

- A community drill of a transport incident was sighted. It was a Mock drill and training event at Accra Town on 16 November 2021. The scenario was a cyanide spill resulting from the truck transporting the cyanide being involved in an accident. The drill was attended by community members, emergency services representatives, local government representatives and other interested persons, students, and the police. The drill was preceded by a presentation on cyanide, the ICMC, the Mine cyanide precaution and response measures and general cyanide awareness training. A series of demonstrations were showcased on how cyanide was transported to the Mine, and the necessary safety measures put in place in case an environmental incident occurs, e.g., spillage of the chemical in a stream and a schoolboy, after playing football, drank some of the polluted water. There were a series of questions asked, including clarification on cyanide spillages, affecting food crops, how the cyanide containers are disposed of, the symptoms of cyanide, and community emergency response team training.

The Community Mine Consultative Committee, whose membership consists of representatives of the catchment communities, Divisional Chiefs, District Assembly representatives, Members of Parliament, and the Chief Farmer of the area (representative of farmers in the area), meets quarterly.

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

X in full compliance with

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

□ not in compliance with

Basis for this Finding/Deficiencies Identified:

Leaflets on cyanide, which include procedures to report cyanide incidents, solid cyanide spill control, cyanide exposure routes to the body and contact telephone numbers, are always available on request.

Most of the Community is illiterate, and most of the presentations are made in Twi, the local language. Sighted a cyanide presentation in English describing the chemicals used in the Mine, including cyanide, their hazards and first aid, what the chemicals look like, including pictures of Sodium Cyanide briquettes and cyanide packaging. Copies of the presentation are available on request.

It was reported by the Mine staff interviewed that there were no changes to the evidence as per the previous re-certification audit:

The GSR (Golden Star Resources) Incident Management Standard, Ver 2, dated 2020, defines and classifies incidents with respect to injuries and assigns a level of 1 to 5 depending on the impact severity to health or safety. In the case of environmental incidents, incident notification to GSR Management is required for Level 3 to Level 5 classified Health and Safety Incidents. The standard also requires that all fatalities, serious injuries and dangerous occurrences (including Level 3, 4 and 5 environmental incidents) are reported to the Chief Inspector of Mines to meet the requirements of Section 26 of the Ghana Mining Regulations (2012).

GSR has an environmental incident classification and reporting procedure (GSR EMS Procedure 02 A02), which defines and classifies incidents on the basis of five levels. GSR has committed to reporting any level 3 (e.g. tailings spill, exceedance of water quality standards, limited groundwater pollution, persistent groundwater contamination), level 4 (e.g. groundwater pollution with potential for serious biological damage, contamination of potentially potable groundwater sources) or level 5 incidents (major tailings dam failure, contamination of potable groundwater sources and discharge of tailings or cyanide contaminated water to uncontrolled surface water systems) to the relevant regulators (Environment Protection Agency and the Inspectorate of Mines) and at a GSR Corporate level.

Monthly environmental monitoring data are submitted to the Ghana EPA as part of the EPA AKOBEN programme, which evaluates CJGSW's environmental performance. The performance data is still published on the Ghana EPA website.

In addition to the lines of communication established through GSR's outreach programme and established lines of communication with regulatory authorities, GSR has also committed to publishing annual reports on environmental and safety performance. Information on health and safety (Lost Time Injury Frequency Rates), and environmental performance indicators (e.g., percentage of water samples within guidelines) is provided within the sustainability report. Other information contained in the sustainability report includes a summary of GSR's goals and progress, environmental initiatives, community relations and development, health and safety initiatives, local employment and content initiatives and economic development initiatives. There have been no cyanide releases or exposures, but it was indicated that should they occur, they would be reported in the company's sustainability report.

The latest sustainability report available is: https://unglobalcompact.org/what-is-gc/participants/4413-Golden-Star-Resources-Ltd-

At the time of the audit, the post-ownership sustainability reports were in preparation and had not yet been published.