GeoEngineers **FINAL** **CORRECTIVE ACTION COMPLETION REPORT** **ICMC Audits**	**Control No.: GSBPL-ICMC-CAR-01** **Date issued:** 9 November 2010

Introduction:

This Corrective Action Completion Report presents the evidence to support the successful implementation of the **GSBPL-ICMC-CAR-01** to correct the deficiency identified in the ICMI Certification Audit of the Golden Star (Bogoso/Prestea) Limited (GSBPL) mine, conducted between 12 to 16 January 2009.

ICMC Standard of Practice Section Reference: 4.1(1); see also 4.1(7)

Description of Deficiency:

Documentation has been provided showing evidence that procedures are in place to address upsets in the operational water balance, prior to and to avoid overtopping of all ponds and impoundments. Nonetheless, there are inconsistencies between the field procedures and associated written procedures concerning the process water pond, which require rectification.

The process water pond overflows into the raw water pond, which in turn overflows to Event Pond 1 via a concrete channel. Event Pond 1 also functions as secondary containment for the CIL tank farms. Written inspection, monitoring and contingency procedures must be updated to accurately reflect this configuration.

Corrective Action Required (describe/attach supplemental information as necessary):

Update Procedure 041, Procedure for Temporary Closure or Cessation of Operations, so that the description for managing and inspecting water management facilities includes the raw water pond and accurately describes its relation to the process water pond.

Corrective Action

GSBPL updated Procedure 041 to include a description for managing and inspecting water management facilities that includes the raw water pond and accurately describes its relation to the process water pond.

Evidence Provided to Verify Completion of Corrective Action

- A copy of modified *Procedure 041 – Procedure for Temporary Closure or Cessation of Operations,*and
- Training records dated 25 February 2010 demonstrating implementation of the updated procedure.

Copies of these documents will be retained in GeoEngineers' internal project records.

Closure Verified:  **Lead Auditor: John T. Lambert**	**Date: 9 November 2010**

GeoEngineers **FINAL** **CORRECTIVE ACTION COMPLETION REPORT** **ICMC Audits**	**Control No.: GSBPL-ICMC-CAR-02** **Date issued:** 9 November 2010

Introduction:

This Corrective Action Completion Report presents the evidence to support the successful implementation of the **GSBPL-ICMC-CAR-02** to correct the deficiency identified in the ICMI Certification Audit of the Golden Star (Bogoso/Prestea) Limited (GSBPL) mine, conducted between 12 to 16 January 2009

ICMC Standard of Practice Section Reference: 4.1(7)

Description of Deficiency:

Documentation was not provided showing evidence that all secondary containment facilities are being inspected on a routine basis. Secondary containment facilities identified by the onsite verification audit include:

- Concrete bunds for all cyanide facilities (i.e., sparge facility, mill, CIL tank farms, and carbon wash and elution circuits);
- Concrete containment channel and culvert for tailings pipelines;
- Geomembrane-lined containment channel for tailings pipelines;
- Event Pond1;
- Event Pond 2;
- Raw water pond; and

Concrete channels linking secondary containment facilities.

Corrective Action Required (describe/attach supplemental information as necessary):

Modify inspection procedures and checklists to include the secondary containment facilities noted above. Inspections of secondary containments must document the physical integrity, presence of fluids and available capacity, and ensure that any drains are closed and locked, if necessary, to prevent accidental releases to the environment.

Corrective Action

GSBPL updated Procedure 044 to include requirements for inspection of secondary containments, and the associated daily inspection checklist for cyanide facilities to include

documentation of inspection of physical integrity, presence of fluids and available capacity of containments, and valve closure and/or lockout, as necessary, to prevent accidental releases to the environment.

Evidence Provided to Verify Completion of Corrective Action

- A copy of the modified *Procedure 044 – Cyanide Equipment Inspection Training Procedure;*
- Record of completion of cyanide equipments inspection training that was completed on 24 February 2010, demonstrating implementation of the updated procedure, and
- A copies of a completed *Cyanide Facilities Daily Inspection Checklist, for* 12, 13 and 14 April 2010.

Copies of these documents will be retained in GeoEngineers' internal project records.

Closure Verified:  **Lead Auditor: John T. Lambert**	**Date: 9 November 2010**

GeoEngineers

FINAL
CORRECTIVE ACTION COMPLETION REPORT
ICMC Audits

Control No.: GSBPL-ICMC-CAR-04

Date issued: 9 November 2010

Introduction:

This Corrective Action Completion Report presents the evidence to support the successful implementation of the **GSBPL-ICMC-CAR-04** to correct the deficiency identified in the ICMI Certification Audit of the Golden Star (Bogoso/Prestea) Limited (GSBPL) mine, conducted between 12 to 16 January 2009

ICMC Standard of Practice Section Reference: 4.4(1)

Description of Deficiency:

Subsequent to the January 2009 onsite verification audit, GSBPL discovered that elevated thiocyanate concentrations in the tailings slurry had been causing interference with the analytical methods used to measure cyanide concentrations at the spigots and supernatant ponds, and that an analytical pre-treatment of the solution is required to appropriately determine cyanide concentrations. GSBPL concluded that the presence of thiocyanate at these elevated levels is associated with the BIOX® circuit and the oxidation of sulfides in that circuit, which subsequently results in thiocyanate forming in the CIL circuit.

As of late June 2009, cyanide analyses for samples collected at the active tailings discharge spigots and decant ponds are performed with a pre-treatment step to eliminate any interference caused by thiocyanate and to provide a more accurate assessment of WAD cyanide concentrations. GSBPL has presented analytical results for initial samples collected in July 2009 at the TSF II, Cell 2A discharge spigots and decant pond, which demonstrate WAD cyanide concentrations well below 50 mg/l. However, additional data using the revised analytical method is required as confirmation that WAD cyanide concentrations are being consistently maintained at or below 50 mg/l in open process solutions at the TSF and that these levels are protective of wildlife.

Corrective Action Required (describe/attach supplemental information as necessary):

- Continue daily sampling of solutions at the active tailings discharge spigots and all supernatant ponds over a period of three months to establish a dataset confirming that WAD cyanide concentrations are being consistently maintained at or below 50 mg/l in open process solutions at the TSF. This database shall be continuously evaluated as it is developed throughout the three-month sampling period. GSBPL shall implement adaptive management if there is any indication that WAD cyanide concentrations are increasing from the current levels (<5 mg/l) to a point where

wildlife could be endangered.

- In lieu of completing an independent peer review of the 2008 GWS wildlife survey, complete the independent assessment of the GWS study, which is currently being conducted by the outside ecologist.
- Enhance daily wildlife monitoring procedures at the TSF by incorporating the abovementioned ecological assessment findings and by including documentation of wildlife sightings and secondary indicators of wildlife use (e.g., footprints and scat). GSBPL wildlife observers shall attend a training program designed to provide proper instruction for performing the updated wildlife monitoring procedures.
- If ongoing assessment of the abovementioned corrective actions indicate the potential for wildlife mortality due to elevated WAD cyanide concentrations in open process solutions at the TSF, GSBPL must immediately install protective measures (e.g. fencing and netting) to prevent wildlife access to the active beaches and mixing zones in the supernatant ponds.

Corrective Action

GSBPL retained an independent wildlife expert to complete a wildlife study to: assess the use of the various components of the tailings storage facilities (beach, active beach and pond) by wildlife (especially birds); evaluate and gather scientific data on the interaction of birds with the tailings deposition areas (both CN and none CN containing slurries); and assess any differences between CN bearing and none CN bearing slurries in terms of interaction with wildlife. The study consisted of three rounds of field evaluation that coincided with migration north (late dry season), rainy season and migration south (early dry season). The study identified 122 species, 24 of which were defined as water birds. The study concluded that birds continued to use the beaches even where tailings were in active deposition. The report therefore concluded that to maintain compliance with the ICMC, WAD cyanide concentrations in the tailings needed to be less than 50 mg/l.

GSBPL developed and implemented a daily monitoring program to check for wildlife activity and mortality. The daily monitoring schedule was designed to meet migratory bird activity as it varies through the seasons. Designated operators were trained undertake this monitoring program.

Daily sampling and analysis was undertaken of solutions at the spigot discharge and supernatant ponds. Although early results were erratic while GSBPL was adjusting process monitoring and operating procedures to control WAD CN concentrations in the discharge, since April 2010 reported discharge concentrations were relatively stable and generally within the range 15 to 35 mg/l WAD CN. The only exceedance reported during this period was 57 mg/l which occurred on 18 May 2010. This was the result of an operational issue that was quickly rectified to prevent reoccurrence. Analysis results of samples from the supernatant ponds show WAD CN concentrations generally below 1 mg/l.

Due to scheduling and reliability difficulties associated with using external laboratories GSBPL established in-house capability for analyzing samples for CN-WAD, and CN-total to supplement existing capability performing CN-Free analysis. This capability now allows

for faster turn-around on WAD cyanide analysis to give GSBPL the ability monitor and adjust the process as needed to identify and quickly respond to WAD cyanide concentrations upsets if they occur.

Evidence Provided to Verify Completion of Corrective Action

- A copy of *Bogoso Tailings Disposal System Wildlife Study*, dated June 2010 and prepared by Dr. B.R. Neal, University of Saskatchewan and Dr. M.B. Thorpe, Golden Star Resources*;*
- WAD CN analysis results for solution discharges at the tailings spigots and the supernatant ponds, covering the period 5 February 2010 through 31 July 2010;
- Procedure – *TSF Wildlife Monitoring Procedures;* and
- Wildlife Monitoring Training Records dated 28 May 2010 for three operators.

Copies of these documents will be retained in GeoEngineers' internal project records.

Closure Verified:  **Lead Auditor: John T. Lambert**	**Date: 9 November 2010**

GeoEngineers **FINAL** **CORRECTIVE ACTION COMPLETION REPORT** **ICMC Audits**	**Control No.: GSBPL-ICMC-CAR-05** **Date issued:** 9 November 2010

Introduction:

This Corrective Action Completion Report presents the evidence to support the successful implementation of the **GSBPL-ICMC-CAR-05** to correct the deficiency identified in the ICMI Certification Audit of the Golden Star (Bogoso/Prestea) Limited (GSBPL) mine, conducted between 12 to 16 January 2009

ICMC Standard of Practice Section Reference: 4.7(1); see also 4.7(4)

Description of Deficiency:

The Oxide CIL tanks are situated on concrete plinths (ring beams). As-built drawings or construction documentation does not exist for these tank foundations, and design drawings reviewed during the onsite audit do not include foundation details for the tanks. Therefore, it is not conclusive that an impermeable barrier exists between the tank bottoms and the ground.

Corrective Action Required (describe/attach supplemental information as necessary):

- Provide documentation confirming that the foundation construction for the Oxide CIL tanks provides an impermeable barrier between the tank bottoms and the ground. A professional engineer or other qualified person involved in the construction of the tank foundations must certify the documentation. The documentation must present the materials and construction methods used to create an impermeable barrier between the tank bottoms and the ground.
- If GSBPL concludes that an impermeable barrier does not exist for the CIL tank foundations, then leak collection and recovery systems within the CIL tank ring foundations to allow for identification of leakage prior to entering the environment; or alternatively, a combination of environmental monitoring (e.g., groundwater or vadose zone monitoring) and a risk-based inspection program must be implemented.

Corrective Action

GSBPL commissioned an independent engineering contractor to review engineering drawings and inspect the construction of the Oxide CIL tank farm. The base of the tanks was cut open so the underlying construction could be inspected. The lining below the laterite bedding was found to be a durable and highly impermeable geomembrane. The edges were securely glued to the concrete edges of the basement to prevent leakage. Weep holes had been constructed beneath and above the geomembrane for leak detection.

Evidence Provided to Verify Completion of Corrective Action

- A copy of the inspection report signed and stamped by a mechanical engineer registered in Ghana, certifying that the base of the Farm Tanks of the Oxide CIL is leak proof.
- Photographs showing the exposed membrane.

Copies of these documents will be retained in GeoEngineers' internal project records.

Closure Verified:	**Date: 9 November 2010**
	
Lead Auditor: John T. Lambert	

GeoEngineers **FINAL** **CORRECTIVE ACTION COMPLETION REPORT** **ICMC Audits**	**Control No.: GSBPL-ICMC-CAR-06** **Date issued:** 9 November 2010

Introduction:

This Corrective Action Completion Report presents the evidence to support the successful implementation of the **GSBPL-ICMC-CAR-06** to correct the deficiency identified in the ICMI Certification Audit of the Golden Star (Bogoso/Prestea) Limited (GSBPL) mine, conducted between 12 to 16 January 2009

ICMC Standard of Practice Section Reference: 4.7(2); see also 4.7(4)

Description of Deficiency:

The Oxide CIL and BIOX®CIL secondary containment bunds are interconnected and provide a cumulative secondary containment volume, which is 50 percent of the largest tank volume (Oxide CIL tank) within the linked containment area. Consequently, in the event the sump pumps fail or cannot remove spillage to the tailings hopper quickly enough, the CIL bund drain valve is opened allowing the slurry to flow by gravity via a concrete a channel to the concrete containment basin (Event Pond 1) located near the crushed ore stockpile. Including the capacity of Event Pond 1, the cumulative secondary containment volume provides 130 percent of the largest CIL tank volume. However, due to the relatively large drainage area collected by Event Pond 1, GSBPL must provide documentation demonstrating that the 30 percent surplus secondary containment volume provides adequate capacity to contain the design storm event and any solution draining back to the CIL bund area.

Corrective Action Required (describe/attach supplemental information as necessary):

Provide documentation demonstrating that the cumulative concrete bund capacity for the Oxide CIL and BIOX® CIL tanks, in combination with Event Pond 1, provides adequate secondary containment capacity (i.e., the volume of the largest tank within the bund plus any piping draining back to the tanks and additional capacity to contain the design storm event). Due to the relatively large drainage area (stormwater runoff) collected by Event Pond 1, GSBPL must provide documentation demonstrating that the 30 percent surplus secondary containment volume is equal to or greater than the volume of the design storm event collected by Event Pond 1 and the bunded area, and any solution draining back to the bunded area.

Corrective Action

GSBPL modified the total capacity of the concrete secondary containment area by constructing over flow channels to interconnect the containments for the Oxide CIL Bund, BIOX CIL Bund, Grinding Bund, Flotation bunds 1, 2, 3 and 4, Carbon Recovery Bund and the Gravity Circuit Bund. An independent engineering contractor was retained to confirm that the total containment volume of the bund areas was sufficient to contain the solution of the largest tank as well as the volume of rainfall from a design storm event without the use of Event Pond 1 which remains available as a tertiary containment, if needed.

Evidence Provided to Verify Completion of Corrective Action

- A copy of the modified *Procedure 039 – Managing Solution Collected in the Secondary Containment;* which describes the interlinked secondary containment and operation of sump pumps;
- A copy of modified *Procedure 045 – Managing Solution Spills within CIL Bunded Walls;* which details bund capacities for the various secondary containments and the interconnections between these bunds;
- A copy of report *Measurements and Computation of Volumes of the Bund Wall Areas in the Processing Plant – Golden Star Bogoso/Preastea Ltd.* This report provides the results of bund capacity measurements and calculations of bund volumes, construction of the bunds and interlinks to allow flow between bunds, and the calculation of rainfall volume based on a design storm event using a maximum measured rainfall records (2002 – 2010). The report was signed by an engineer registered in Ghana and certifies that the Bund Wall Areas can contain any spilage due to tank failure in addition to the highest rainfall event, and that the bund construction is competent, QA/QC is good, and the bunds can serve the intended purpose.
- Copy of the rainfall records collected since 2002.

Copies of these documents will be retained in GeoEngineers' internal project records.

Closure Verified:  **Lead Auditor: John T. Lambert**	**Date: 9 November 2010**

GeoEngineers **FINAL** **CORRECTIVE ACTION COMPLETION REPORT** **ICMC Audits**	**Control No.: GSBPL-ICMC-CAR-07** **Date issued:** 12 November 2010

Introduction:

This Corrective Action Completion Report presents the evidence to support the successful implementation of the GSBPL-ICMC-CAR-07 to correct the deficiency identified in the ICMI Certification Audit of the Golden Star (Bogoso/Prestea) Limited (GSBPL) mine, conducted 12 to 16 January 2009.

ICMC Standard of Practice Section Reference: 4.8(5); see also 4.8(1)

Description of Deficiency:

Original QQ/QC documentation for all cyanide facilities was not available for review during the onsite verification audit. Therefore, to supplement the original QA/QC documentation that was available, GSBPL commissioned Topsky Ventures and Knight Piésold Consulting to conduct inspections of various additional cyanide facilities, including the Oxide and BIOX® CIL tanks, cyanide pipelines, the original tailings storage facility (TSF I), and the concrete secondary containments for the mixing, storage and CIL tanks. These inspection reports identify issues and provide recommendations that GSBPL must address.

Corrective Action Required (describe/attach supplemental information as necessary):

- Provide documentation verifying and certifying that the recommendations made in the February 13, 2008 Topsky Ventures inspection report, the March 2009 Knight Piésold inspection report for TSF I, and the March 24, 2009 Topsky Ventures inspection report, have been properly implemented; and
- Provide clarification regarding the scope of the inspections documented in the addendum to the March 24, 2009 Topsky Ventures inspection report (i.e., items G through J).

Corrective Action

Deficiencies identified in the March 2009 Knight Piésold inspection report for TSF I were addressed and an inspection conducted by Knight Piésold in August 2009 confirmed that piezometric levels were acceptable within the embankment and water within the impoundment was being managed and within optimum levels. Knight Piésold conducted another inspection in August 2010 and confirmed that piezometric levels continued to be acceptable and that the facility was being acceptably managed.

GSBPL retained Topsky Ventures to report on facility inspections and provide sign-off that recommended repairs in the March 24, 2009 report had been completed. Topsky also completed rebuilds and subsequent, ultra-sonic testing, and engineering sign-off of the five operating BIOX CIL tanks (tanks #01 through #05). The stand-by BIOX CIL tank (tank #06) was in the process of being rebuilt at the time of preparing this report.

Evidence Provided to Verify Completion of Corrective Action

- A copy of August 5, 2010 Knight Piésold inspection report – *Site Visit 3-4 August 2010 – TSF Operations Management;*
- A copy of August 17, 2009 Topsky Ventures report – *Verification and Certification of Recommendations of Previous Inspection Report "Technical Report on Ultrasonic Thickness Monitoring of Cyanide Facilities and QA/QC Inspection of Cyanide Detox System, Process Water Pond, Cyanide Sparge Facility and HDPE Feed Lines, March 2009;*
- A copy of Topsky Ventures letter received September 1, 2009 regarding the August 17, 2009 inspection;
- A copy of September 15, 2010 Topsky Ventures report – *Visual Inspection, Ultrasonic Wall Thickness Monitoring and Certification of BIOX and OXIDE CIL Tanks in the Process Plant and Verification of Recommendations of Previous Inspection Report;*
- A copy of November 11, 2010 Topsky Ventures report – *Clarification to a Technical Report Dated 24th March, 2009 and Sign-Off of the BIOX Tank 06 Construction.*
- GSBPL Memorandum dated August 3, 2010 regarding approval for BIOX CIL Tank 06 Rebuild;
- Photographs of the concrete ring-beam foundations for the BIOX CIL tanks, showing installation of a geomembrane liner between the bottom of the tanks and the underlying compacted soil.

Copies of these documents will be retained in GeoEngineers' internal project records.

Closure Verified:	**Date: 12 November 2010**
	
Lead Auditor: John T. Lambert	

GeoEngineers **FINAL** **CORRECTIVE ACTION COMPLETION REPORT** **ICMC Audits**	**Control No.: GSBPL-ICMC-CAR-08** **Date issued:** 9 November 2010

Introduction:

This Corrective Action Completion Report presents the evidence to support the successful implementation of the **GSBPL-ICMC-CAR-08** to correct the deficiency identified in the ICMI Certification Audit of the Golden Star (Bogoso/Prestea) Limited (GSBPL) mine, conducted between 12 to 16 January 2009

ICMC Standard of Practice Section Reference: 6.2(4)

Description of Deficiency:

Fixed "D-Guard" ambient HCN monitors located at the sparging plant, CIL tails hopper, and BIOX® CIL were recently fitted with audible and visual alarms. The monitors have also been connected via the SCADA system to provide readouts on the plant control room screens. In addition, GSBPL has committed to install a fixed HCN monitor at the Oxide CIL plant prior to start up of that plant. The modified units have yet to be calibrated using a method recommended by the manufacturer. GSBPL has ordered a calibration test kit and will calibrate the monitors once the kit is received. In the interim the monitors are being tested by comparison with the readout from calibrated portable HCN units.

Corrective Action Required (describe/attach supplemental information as necessary):

- Calibrate each fixed HCN monitor as recommended by the manufacturer and develop a program to maintain records for at least 1 year. Develop a program to test the alarms on a periodic basis.

Corrective Action

GSBPL installed alarms on the D-Guard fixed HCN monitors located in the BIOX CIL, CIL Tails Hopper and Sparge Plant areas. GSBPL's Instrument Superintendent was trained in HCN monitor calibration by Barbex Technical Services in October 2009 so that calibration could be performed internally. GSBPL set up a six month calibration schedule for the HCN fixed HCN monitors as recommended by the manufacturer. The monitor readout was connected to the control room via SCADA allowing constant HCN readings to be viewed and recorded to ensure HCN levels are below 4.7 ppm. This system replaces the

manual hourly recordkeeping of HCN concentrations previously being performed. The monitors are set to alarm at 10 ppm. When an alarm triggers all personnel are trained to evacuate the area. Operators also provided with personal HCN monitors which are set to alarm at 4.7 ppm.

Evidence Provided to Verify Completion of Corrective Action

- Calibration records for units DG070397, DG070393 and DG070392 for February 2010*;*
- Screen shots of SCADA showing HCN plots for the BIOX CIL, CIL Sparge and CIL Tails Hopper areas;
- Example biweekly alarm test records sheets; and
- Copy of a section of the manufacturer's manual showing the recommendation for calibrating the fixed HCN units every six months.

Copies of these documents will be retained in GeoEngineers' internal project records.

Closure Verified:  **Lead Auditor: John T. Lambert**	**Date: 9 November 2010**