INTERNATIONAL CYANIDE MANAGEMENT INSTITUTE

Cyanide Code Compliance Audit
Gold Mining Operations

Certification Summary Audit Report

Ma'Aden Gold & Base Metals Company
Al Amar Gold Plant
Saudi Arabia

21st – 25th September 2014

Name of Operation	:	Al Amar Mine
Name of Operation Owner	:	Ma'aden Gold and Base Metals Co.
Name of Responsible Manager	:	Mr. Saleh A. Al-Tayyar
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Location detail and description of operation

Al-Amar is in Ar Riyadh Province, approximately 250km southwest of Riyadh, in Saudi Arabia. It comprises an underground mine which processes a gold rich polymetallic ore at a rate of 200 ktpa to produce gold in doré and copper and zinc rich concentrates which are sold to third parties for toll smelting. Commercial production was achieved January 2009.

The Process Plant commenced production in January 2008. The design capacity is set at 28 tons per hour (tph), processing a gold-rich polymetallic ore to produce gold in Dore and copper and zinc in concentrates. The processing circuit includes the following main unit operations – crushing, milling, flotation, leaching (CIL), thickening and filtration, elution, electrowinning and smelting. The ore from underground is classified into 5 different categories: super high grade, high grade, high copper, medium grade and low grade. Each grade classification is stockpiled separately on the Run-of-Mine (ROM) pad. The oversized rocks are broken into smaller sizes using a rock breaker. Different grades of ore are then blended to get the optimal crusher feed grade as per design (5.72g/t).

Crushing

Blended ore is fed into the primary jaw crusher which crushes the material to 80% passing 100mm at a capacity of 90tph. From the primary crusher the ore is screened and sent to the secondary and tertiary crushing stages where it is reduced to about 20mm and 6mm respectively with cone crushers. The final crushed product is conveyed to the Fine Ore Bin with a 1200 ton live capacity.

Grinding

Wet grinding takes place in the ball mill. From the Fine Ore Bin, the ore is transported to the ball mill, where grinding water and steel balls are added. The ball mill product is pumped to hydrocyclones for classification, in which the cyclone underflow is recycled back to the ball mill while the cyclone overflow goes to the flotation circuit for treatment.

Copper Flotation
The slurry is conditioned in the copper conditioning tank with suitable reagents before it flows into a bank of 5 rougher cells. The rougher underflow is pumped to 4 scavenger cells. Zinc sulphate is dosed to depress the zinc metal from floating in the copper circuit. The concentrate is pumped to cleaner cells for upgrading and is then filtered into a dry concentrate cake.

Gold Leaching
The leaching circuit comprises of one leach tank and six Carbon-in-Leach (CIL) tanks. From the copper flotation, the copper tails are conditioned with lime before it is pumped to the leach feed thickener. There it is thickened to at least 50% solids before pumping it into the leach tank for the cyanidation process to dissolve the gold.
The slurry gravitates down from one tank to the next while activated carbon is pumped counter-currently up the stream. The slurry leaves the last CIL tank to be pumped to the cyanide destruction tank. The loaded carbon is harvested from the first CIL tank and pumped to the elution circuit.
Copper is worth mentioning, since copper minerals will dissolve in cyanide solutions in preference to gold, and this causes an increased use of cyanide and oxygen. The copper-cyanide complexes formed by the dissolution will tend to inhibit the dissolution of gold in the cyanide solution. Zinc, an element used to precipitate gold from solution, if present in the ore, will bond with the cyanide to form a zinc-cyanide compound. Apart from consuming too much of the cyanide in preference to gold, the dissolved copper will also be adsorbed onto carbon in preference to gold.
To selectively recover gold in this environment, the cyanide concentration needs to be higher for the reasons stated above. Apart from the CIL circuit, cyanide is also used in the elution circuit for both cold stripping and hot stripping. The average cyanide consumption is about 3.45kg/t over a twelve-month period.

Acid Wash and Elution
Loaded carbon is firstly subjected to acid washing to remove acid soluble precipitates on the carbon. The adsorbed copper is then stripped in a cold elution stage. In this stage, a cyanide solution at 1.5% is circulated through the carbon for one hour. After cold elution, the loaded carbon is transferred to the stripping column ready for hot stripping, where a hot caustic-cyanide solution is then circulated through the column to recover a concentrated gold and silver solution.

Electrowinning and Smelting
The concentrated gold and silver solution is pumped to two electrowinning cells. Each cell contains anodes and stainless steel cathodes, which precipitates the gold and silver. The precipitates are filtered and dried. The dried calcine cake is then mixed with flux and smelted into gold bullion bars in an induction furnace.

Zinc Flotation Circuit
The final CIL tails is subject to cyanide destruction using ferrous sulphate before sending it into the zinc conditioning tank – the objective is to lower the cyanide content from 800ppm to less than 100ppm. From the zinc conditioning tank, the slurry is mixed with relevant reagents and flows into the zinc flotation circuit. Like the copper flotation circuit,

the zinc flotation circuit also consists of rougher-, scavenger- and cleaner cells. The final zinc concentrate is pumped to Larox filters to produce a dry concentrate. The final tails from the zinc flotation circuit is pumped into the tails thickener.

Dewatering

The tails thickener overflow water is recovered and re-used as process water. Any excess water flows to the polishing ponds, which are designed to handle water with a WAD cyanide level above 50ppm. These ponds are covered with netting and hexagon tiles to prevent birds or mammals from gaining access to the water. The thickener underflow is pumped to the zinc tails stock tank and then to the disc filters to recover water and produce a filtered cake. The filtered material (the final tails) is collected by trucks and dumped on a safe designated dumping area – the Tailing Storage Facility (TSF).

Tailings Storage Facility

The filter cake produced from the disc filters contains approximately 20% moisture, locked up in the slurry matrix. It is transported to a fully lined containment area and stacked to dry. No return water dams exist due to the low moisture in the filter cake, thus no run-off occurs. There is also no other free standing water in the facility as a result of the extremely low rainfall figures. Annual rainfall average is below 100mm per annum. If rain does occur, it is managed according to the TSF management procedures to prevent environmental release.

Auditor's Finding

This operation is

X **in full compliance**

☐ in substantial compliance

☐ not in compliance

with the International Cyanide Management Code.

Audit Company: Eagle Environmental

Audit Team Leader: Arend Hoogervorst

E-mail: arend@eagleenv.co.za

Names and Signatures of Other Auditors:

Name : Dawid M. L Viljoen Signature _____ Date: 8 April 2015

Dates of Audit: 21st – 25th September 2014

I attest that I meet the criteria for knowledge, experience and conflict of interest for Code Verification Audit Team Leader, established by the International Cyanide Management Institute and that all members of the audit team meet the applicable criteria established by the International Cyanide Management Institute for Code Verification Auditors.

I attest that this Summary Audit Report accurately describes the findings of the verification audit. I further attest that the verification audit was conducted in a professional manner in accordance with the International Cyanide Management Code Verification Protocol for Gold Mine Operations and using standard and accepted practices for health, safety and environmental audits.

Al Amar Gold Plant

Facility	Signature of Lead Auditor	Date
		8 April 2015

Auditor's Findings

1. PRODUCTION: Encourage responsible cyanide manufacturing by purchasing from manufacturers who operate in a safe and environmentally protective manner.

Standard of Practice1.1: Purchase cyanide from 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:
There is a Purchase Order Agreement in place between Ma'Aden Gold and Base Metals (MGBM) and Professional Chemicals & Ind. Equipment Co. Ltd. (Pro-Chemie) for the Supply, Delivery, Customs Clearance & Transport Of Sodium Cyanide. MGBM obtains cyanide on behalf of all of its gold mines, including Al Amar. Cyanide is purchased from producer, AGR/CSBP, which was certified as fully compliant with the ICMC on 13 March 2014.
The agreement confirms that Pro-Chemie and its appointed Sub-Contractors, including the cyanide producer, shall be certified as being in compliance with the International Cyanide Management Code for the manufacture, transportation and storage of cyanide as to be ultimately used in the production of gold.

2. TRANSPORTATION: Protect communities and the environment during cyanide transport.

Standard of Practice 2.1: Establish clear lines of responsibility for safety, security, release prevention, training and emergency response in written agreements with producers, distributors and transporters.

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:
There is a Purchase Order Agreement in place between Ma'Aden Gold and Base Metals (MGBM) and Professional Chemicals & Ind. Equipment Co. Ltd. (Pro-Chemie) for the Supply, Delivery, Customs Clearance & Transport Of Sodium Cyanide. The Purchase Order Agreement specifically covers the responsibilities and requirements for transport, safety, security, unloading, emergency response (spills prevention and clean-up), route planning and risk assessments, community liaison, emergency response resource access and availability, training, and communication.

Standard of Practice 2.2: Require that cyanide transporters implement appropriate emergency response plans and capabilities and employ adequate measures for cyanide management.

X in full compliance with

The operation is □ in substantial compliance with **Standard of Practice 2.2**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
The Purchase Order Agreement confirms that Pro-Chemie and its appointed Sub-Contractors, including the cyanide producer, shall be certified as being in compliance with the International Cyanide Management Code for the manufacture, transportation and storage of cyanide.
AGR/CSBP cyanide road transport from production site to shipping port (Freemantle) is covered in the AGR Western Australian Supply Chain, and was ICMI certified on 13 June 2013. International Shipping from Freemantle, Australia, up to the King Abdullah Port (Saudi Arabia), and the handling of the containers from the vessel onto the wharf and into the designated storage area at the King Abdullah Port (Stevedore Company - National Container Company Limited which is part of the larger Group, International Port Management) is covered by the AGR Ocean Freight Supply Chain covering cyanide transport by ship from Fremantle using MSC and MAERSK Australia to various interstate or international ports. The Ocean Freight Supply Chain recertification was published on the ICMI website on 29th September 2014.
MGBM is a consignor signatory to the Cyanide Code covering the Saudi Arabia Supply Chain from the King Abdullah Port (Saudi Arabia) to the various MGBM mine sites in Saudi Arabia. The Saudi Arabia Supply Chain certification was published on the ICMI website on 9th December 2014.

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:
The cyanide mixing and storage plant was designed by SNC Lavalin of Montreal Canada, according to accepted engineering principles, during 2004. Original design files in archives were reviewed and sampled. The cyanide mixing and storage tanks are placed on impermeable foundations inside concrete bunds. A new cyanide mixing tank has been installed and drawings and designs (tank design according to API 650) including mechanical drawings of the new cyanide mixing tank, the internal rubber lined coating, the Australian specifications for the steel plates, weld specifications, were sighted. All valves are made of stainless steel and the pipes made of mild steel. The new cyanide storage tank drawing indicated an octagonal foundation plan with the foundation of an impervious design including a 200 mm concrete slab and a 50mm concrete blinding. The mixing and storage / dosing tanks are equipped with level indicators for high and High-High level alarms on both the mixing and storage tanks. The redlined Piping and Instrument Drawing was signed by a registered Metallurgical Engineer.
The dry cyanide solid briquette store (a dedicated cyanide store with no other chemicals) is equipped with vents in the upper section of the side walls, and with the side sheeting designed to direct water to the outside of the floor. The floor is equipped with a secondary containment to contain any possible spillages. The cyanide mixing tank is open at the bag cutter area for ventilation, and a ventilation fume extraction system is used on the tanks to ventilate any cyanide gas generated in the tanks. The plant is situated inside an access security controlled area and the dry solid cyanide store is additionally fenced, locked and security staff control any entrance to the store.

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:
Solid cyanide is delivered in briquette form, packed in a plastic bag inside a bulk bag. The bags are packed into 1 ton wooden boxes, and are transported from the manufacturer to the site in sea-tainers. By procedure, the cyanide packaging is destroyed as soon as practically possible after use and the sea-tainers are cleaned out and returned to the shipping company.
There are detailed, procedures covering cyanide mixing and transfer and cyanide packaging disposal which spell out PPE requirements, use of a buddy, and tasks are clearly sequenced to prevent spillages and accidental releases during mixing, packaging disposal, storage and transfer processes.

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 utilizing 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 original Lavalin process design criteria and operating manual documentation are available and used as guidelines in developing and updating Standard Operating Procedures.The site has 11 cyanide Standard Operating Procedures including the appropriate engineering procedures and a Tailings Storage facility (TSF) procedure. The Al Amar TSF is a plastic lined dam with the residue being filtered using disc filters. The residue cake at around 20% moisture (which is bound water and thus no water release other than evaporation takes place) is loaded onto trucks and delivered to the TSF via a tarred road. The filter cake residue is tipped in a manner to evenly distribute the tails onto the TSF. No discharge to surface water takes place, and no open water or return water ponds or TSF pool is present.
A spreadsheet based Planned Maintenance System (PMS) is in place and housekeeping monthly general safety inspections are done which include the Mill Department, Maintenance Department, and Warehouse Section.
An ISO-based change management procedure is in place and operation and is one of the 11 cyanide procedures.

All tanks, bunds, pond, impoundments, pipelines, valves and pumps and other cyanide equipment are on the spreadsheet-based PMS and are regularly inspected. The frequency includes weekly, daily, quarterly, six monthly, and annually. Wildlife inspections are carried out daily and mortalities are reported by exception.
The plant will be stopped if inspections or breakdowns require temporary shutdown of the plant to do repairs or maintenance. The plant is designed and equipped with bund walls, sump pumps and all spillages are returned to the process. No emergency power is required to prevent unintentional releases as rainfall is extremely low with the Mine being situated in a very dry region. Furthermore, the TSF is a filtered cake disposal system with no water being returned to the plant. A freeboard of one metre is maintained on the polishing ponds to prevent the risk of overtopping.

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
- □ not subject to

Basis for this Finding/Deficiencies Identified:
The ore currently mined from the west side of the underground mine is different from the design and highly variable in terms of grade. Thus ore blending takes place to achieve targeted grades. A polymetallic ore is mined and Zinc and Copper recovered in float circuits and Gold in a CIL Circuit. The high levels of copper impacts significantly on cyanide optimisation and usage and soluble copper sulphides similarly are affecting cyanide consumption.
Bottle roll tests are conducted under standard leach conditions and a Mill Department Cyanide optimisation document includes a section on cyanide optimisation laboratory test work. Longer term optimisation may include improved flotation and milling.
The TAC 1000 is operational and used currently to manually control cyanide addition but will, in future, be used as the input signal to control the pump speeds. The new cyanide mixing and dosing system is operational and utilises variable speed Bredel hose pumps to control the cyanide fed to the CIL.
As the Mine uses tailing filtration technology and covered polishing ponds, cyanide optimisation is done for economic reasons as it has no effect on cyanide exposure risks to wild life. Gas risks are managed by the use of fixed and personal monitors at the CIL and identified hotspots. An alternative control strategy is to use a dosing pump instead of the control valve to smooth out large cyanide concentration variations.

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 plant is a water deficit operation located in a very low rainfall area of Saudi Arabia. The two plant process water ponds (polishing ponds) are at a lower level than the plant and separated from plant storm water by cut off trenches and berms. Very small quantities of storm water may enter the dams. These dams are the only potential area of overtopping during rain storms. The dams are lined with no seepage occurring and no run on occurs.
A probabilistic water balance for the polishing ponds is in place. The total live capacity of the two polishing ponds is 15 000m^3. Total freeboard capacity, running the ponds at a 1 metre freeboard, as per procedure, is 5046m^3. Based on the plant layout catchment area, the total pond catchment area 16 500m^2. Assuming a maximum precipitation event of 50mm over the catchment area, including the run on and the dam surface, results in a volume of 823m^3. The worst case scenario of zero infiltration is assumed and thus freeboard volume less precipitation volume gives an excess of 4 200m^3. Maintaining the freeboard of 1 metre will adequately cater for the precipitation volume, as well as process variability.
A filtration test on the TSF tailings material to determine the infiltration rate and thus any run down to the surrounding lined area resulted in a 100% infiltration of 50mm water in 15 seconds. Zero run off is thus assumed and will consequently have no effect in the water balance. The analyses of the rainfall events from 1999 to 2013 showed that no event ever exceeded 50 mm. The TSF is a lined paddock facility receiving a filtered cake at 20% moisture from disc filters and thus no phreatic levels exists or are relevant in the dam design.

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:
Sample results from an independent environmental laboratory from the main Polishing Pond indicate WAD cyanide values results of 0.63 mg/l, 0.145 mg/l, and 7.84 mg/l for August, July and June 2014 respectively. As the site is suspected to be producing WAD cyanide values above 50 mg/l at times, due to the mineralogy including Copper mineralisation, it is in the process of commissioning its own on-site WAD cyanide analyser. The site will commence its own analysis of WAD cyanide using the on-site WAD CN analyser, once it receives analyser reagents, due to arrive in April 2015.
Furthermore, the site is implementing precautionary preventative measures at the polishing ponds. The precautionary measures have included the installation of plastic netting covering the total surface area of the two polishing ponds and the addition of Hexa floating tiles on top of the ponds, underneath the nets, to further prevent any access to the solution in the ponds. The ponds are also fenced in and gated to prevent any access by wildlife.
The TSF is a filter cake (20% moisture) deposition site with no return water going back to the plant. It is lined and the tailings are sun dried before being levelled by bulldozer. There is never a pool on the TSF and no return water ponds exist and no return water goes back to the plant.
The polishing ponds are inspected regularly, including the recording of the maximum level of the ponds. Bird mortality inspections are done routinely and investigated if observed.

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 permanent surface water or rivers exist in the area of the mine. The mine is located in a desert area in Saudi Arabia. It is has a water deficient plant with a closed water system due to the extreme water shortages and does not discharge any water.

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 plant uses a filtration system to produce a low moisture filter cake for deposition to the TSF. The plant equipment containing cyanide is placed inside concrete bunds with sumps and pumps to return spillage to the process and prevent seepage. The plant polishing ponds are fully lined.
The TSF is fully lined to prevent any seepage. The road used by the trucks to transport the filter cake residue to the TSF is tarred to assist with preventing seepage into the soils. The current TSF is equipped with leak detection pipes. A new TSF is in the construction phase and is fully lined. Boreholes are drilled to sample and monitor for any cyanide related leaks.
Ground water is found at 45 m and below. The water is not used for any defined purpose, thus no beneficial uses for the water are identified. Legislation defines water quality parameters, and requires cyanide samples to be taken monthly. Samples from surrounding monitoring wells for June, July and August 2014 show values that were not detectable. The maximum allowed groundwater level, according to legislation, is 0.05 mg/l total cyanide. The mine makes no use of backfill.

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:
All tanks are installed inside concreted bunds and inspections confirmed the bunds are competent. The CIL tanks are placed on solid concrete foundations. The new cyanide storage tank has a hexagonal concrete tank foundation with reinforcement on top forming an impermeable layer between the tank base and the soil.
The bunded areas: zinc tail thickener, CIL Bund, CIL feed thickener, and copper and zinc filtration area, are all linked with a combined capacity of 661.5m^3. The largest tank in the linked bunds is a CIL tank at 265 m^3, thus the bund capacity is 249.6% of the largest tank, well exceeding Code requirements. All bunded areas are equipped with sump pumps from where any spillages and water is returned to the process. All process solution pipelines containing cyanide are routed above competent bunds and/or are inspected as part of spill prevention measures. All reagent strength cyanide pipelines are routed above competent bunds as secondary containment.
Cyanide tanks are constructed of steel and are rubber lined. Valves used are made of stainless steel and pipes are made of mild steel.

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:
Quality Assurance/Quality Control documents dated July 2005 to Jan 2006 for the leach tank, and CIL tanks 2, 3, 4, 5, 6 and 7 were sighted and reviewed. The hard copy mechanical records were reviewed and deemed comprehensive and covered the standard Quality Assurance/Quality Control requirements and records. These were signed off by Engineers as competent persons. The Quality Assurance/Quality Control file including a cover note from SNC Lavalin (plant constructors) and which included the CIL holding tailings tank, process water tank, zinc tailings filter feed tank, zinc concentrate filter feed tank, mill process water tank, fine ore silo, zinc tails thickener, CIL feed thickener which were also signed off by the same Engineers.
There were no civil construction Quality Assurance/Quality Control documents but this was covered in a competent persons report, " Refurbishing of mill plant at AL Amar Mine" "Concrete repairing and structural integrity report" dated 1 April 2014. This included method statements for concrete structural repairs both minor and major and includes a warranty statement of 5 years for the repairs. The repairs are aimed are enhancing the integrity of the concrete. It was estimated during the site visit that 70% of the work required in the cyanide equipment areas were completed. This included the high priority areas. The repairs have subsequently (during the finalisation period of this audit report) been 100% completed.
The Geotechnical inspection for tailings dam at AL Amar Mine" was signed off by the Ma'aden Geotechnical Specialist in Dec 2013. The conclusions includes that no maintenance is required at this time, only the South West requires some support and more compaction.

Standard of Practice 4.9: Implement monitoring programs to evaluate the effects of cyanide use on wildlife, surface and ground water 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 laboratory procedures from the independent Environmental Laboratory are used as they are subcontracted to do all sampling, as well as analyses of all samples, for the Al Amar Mine. A sampling sheet is used which documents sampling conditions.
The laboratory Quality Assurance/Quality Control document containing extracts from various EPA manuals covering taking of samples, sample preservation, chain of custody and sample analyses methodology was reviewed and confirmed. Samples analyses are total cyanide, WAD cyanide and free cyanide. The signature on the QA/QC document is the Laboratory Technical Manager, a Chemistry graduate. Borehole sampling takes place monthly and daily operational wildlife mortality inspections are undertaken and the frequency is deemed adequate considering the specific site and arid circumstances.

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 and livestock.

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 site has a cyanide decommissioning procedure which includes an implementation schedule for 12, 6 and 3 months prior to closure, including specific tasks to be undertaken during each period. The procedure is revised annually.

Standard of Practice 5.2: Establish an 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:
A provision for mine closure and reclamation (section 21 extracted from the notes to the interim financial statements for the quarter and six months ended 30 June 2014 for the Ma'aden Gold and Base Metals Company) was sighted and confirmed. There is no specific line item covering cyanide related, third party estimation and implementation, decommissioning measures but it is reported that this has been included.
A Statement of Financial Strength from PWC dated 9 February 2015, signed by Auditor, Ali A Alotaibi (Licence No 3790), is in place, confirming MGBM's ability to implement cyanide-related decommissioning activities for Mahad, Al Amar, As Suq, Sukhaybarat and Bulgah gold mines.
It is reported that reviews will be undertaken at least once every five years.

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 or 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 original Lavalin process design criteria and operating manual documentation are available and used as guidelines in developing and updating Standard Operating Procedures.The site has 11 cyanide Standard Operating Procedures including the appropriate engineering procedures and a Tailings Storage facility (TSF) procedure. The Al Amar TSF is a plastic lined dam with the residue being filtered using disc filters. The residue cake at around 20% moisture (which is bound water and thus no water release other than evaporation takes place) is loaded onto trucks and delivered to the TSF via a tarred road. The filter cake residue is tipped in a manner to evenly distribute the tails onto the TSF. No discharge to surface water takes place, and no open water or return water ponds or TSF pool is present.
A spreadsheet based Planned Maintenance System (PMS) is in place and housekeeping monthly general safety inspections are done which include the Mill Department, Maintenance Department, and Warehouse Section. An ISO-based change management procedure is in place and operation and is one of the 11 cyanide procedures. All tanks, bunds, pond, impoundments, pipelines, valves and pumps and other cyanide equipment are on the spreadsheet-based PMS and are regularly inspected. The frequency includes weekly, daily, quarterly, six monthly, and annually.

The site conducts daily toolbox talks and weekly safety meetings are held in the plant. The Monthly Central safety meetings are organised by the Safety Department. Departmental weekly toolbox talks are also held.

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 copper pH is controlled at 9.5 which is the optimum for copper flotation, the leach pH is controlled above 10.5 to prevent HCN gas formation, and the electrowinning is done at high pH above 12. On line pH meters are used in the leach circuit, backed up by manual pH meter readings.
Fixed cyanide gas monitors are in installed in the Gold room (NH3 and HCN), carbon stripping, CIL (2), and the zinc thickener area. There are 10 Portable Monitox cyanide gas units in use, with 6 issued to operators working in the cyanide areas and 4 units as spare units. There are also Two Multigas monitors in use. The equipment currently used was recently delivered and issued with factory calibration certificates on delivery (certificates calibrated 5 Aug 2014). (Monitor alarms are set at 10 parts per million on an instantaneous basis and 4.7 parts per million continuously over an 8-hour period.) The personal monitor indicates when calibration is required (6 monthly) and it takes approximately two weeks off-site to calibrate the units.(The spare units are used during the calibration period and the fixed monitors are calibrated in-situ and were calibrated on 20 July 2014. Hot spot cyanide gas surveys are done monthly. Records since January 2014 to date indicate that no values above 1 ppm HCN were noted.
Monthly safety inspections monitor and check facilities and emergency response equipment functioning. Safety equipment such as safety showers, low pressure eye wash stations, and fire extinguishers are numerous and adequately signposted. The language of the workforce is English and Arabic. Full 16 point MSDSs in Arabic and English for Sodium Cyanide are available.
Warning signs on the plant includes no eating and drinking, cyanide hot spots, no smoking, cyanide warning signs, and PPE requirements and are in English and Arabic. Tanks are colour coded and/or labelled to indicate that they contain cyanide. Pipelines are labelled and show direction of flow. Accident and incident reporting and investigation procedures, based upon the site safety reporting requirements, were found to be in place and effective.

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:
Telephones and 15 radios are used currently to raise emergency alarms. A portable oxygen cylinder is available in the clinic, and large medical oxygen bottles are also located at the clinic The cyanide emergency equipment is located in the clinic close to the plant. Oxygen cylinder bags are available at the CIL floor and at the mixing area emergency cabins and Oxygen and an Ambu bag is kept in the mill office. Tri-pak antidotes are available in the Mill office (2) and the clinic (1). The cyanide antidote is stored and as directed by its manufacturer in a fridge and is replaced on a schedule. The current antidote expires in February 2017. Monthly inspections check cyanide emergency equipment, including cyanide antidote and oxygen bottles.
A clinic is established at the mine site and there is formal cyanide treatment protocol flowchart in place. The resident Doctor has indicated that the clinic is equipped to stabilise the cyanide patient before transporting him by mine ambulance to the local hospital. The patient would, after stabilisation, be taken to Quwayiyah hospital, half an hours' drive (50km) away. The mine doctor will accompany the patient to the hospital, if the situation so requires, and the required cyanide emergency equipment, including antidote, will also accompany the patient.
The Doctor has made the local hospital aware of the need of cyanide treatment. A cyanide presentation in Arabic was made to the Hospital Head of Emergency Department and two emergency Doctors.
A full cycle emergency drill to the hospital, including an injury and a dry solid cyanide spill was undertaken. The report was signed off by the Emergency and Fire Fighting Specialist, the Mine Manager and the Safety and Environmental Specialist. The Drill report includes a time line, observations and comments, and corrective actions.
There is an MGBM Emergency and Management Response Standard (EMRS) and an Emergency Response Team Manual (ERTM) in place and a site specific Al Amar Emergency Response Plan (ERP) in place.

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:
There is an MGBM Emergency and Management Response Standard (EMRS) and an Emergency Response Team Manual (ERTM) in place and a site specific Al Amar Emergency Response Plan (ERP) in place to deal with cyanide accidents and incidents. The Plan combines existing documented responses and emergency provisions to deal with the various scenarios and includes and identifies the emergency response team and coordinators who are on all shifts. The tailings is stored in a lined impoundment and consists of filter cake, dried out and flattened following tipping. Rainfall is insignificant in terms of TSF stability risk. The failure scenario was thus not identified as a potential emergency scenario. Transport cyanide scenarios are covered in the Ma'Aden Consignor Cyanide Transport Emergency Response Plan.
The EPR includes the clearing site personnel from the area of exposure but there are no potential affected local communities that need to be catered for. The use of cyanide antidotes and first aid measures for cyanide exposure are covered in the Corporate procedure "Cyanide First Aid & Medical Treatment"

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 EMRS involve the workforce in the evaluation, testing and updating of the plan using mock drills. Local communities are outside the zone of influence of the mine and evacuation is thus not an issue. The government hospital and mine ambulance are involved in mock drills.

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:
The ERP details roles and responsibilities of the emergency response team. The emergency equipment inventory was checked and site inspections confirmed availability and readiness. The Plan includes contact references (telephone, cell phone, etc) of internal and external resources for the various scenarios, particularly with detail on where external resources and skills might be needed. Periodic drills involving stakeholders ensure that roles and responsibilities are understood and clearly implemented. No outside responders are used during emergency situations. Communities do not take part in the emergency responses, but are given information on cyanide.

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:
The Emergency Preparedness and Response Plan includes details for appropriate emergency notification and reporting (internal and external) and the call-out procedure and contact information lists which are updated regularly. Internal and external communication is dealt with in the Plan.

Standard of Practice 7.5: Incorporate into response plans and remediation measures monitoring elements that 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:
The ERP covers clean-up, remediation and a neutralisation methodology and cross references to the appropriate site procedures. The use of neutralization processes and materials is clearly covered, as is disposal of contaminated materials.

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:
The ERP includes the requirement for review and revision annually or after an actual cyanide emergency or a mock drill which identified deficiencies. Mock drills are scheduled at least annually. The Ma'aden Emergency Drill Schedule for 2015 indicates the Al Amar 2015 drill is scheduled for June. Drills incorporate identification of problems, action and follow up on completion.

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 personnel that may come into contact with cyanide including Operators, security, warehouse, laboratory, Ex Pats are trained in cyanide awareness. Training course material used is based upon the cyanide producer's training material and has been translated into Arabic. A Training matrix is in place which documents training records and identifies training modules required by various job types. The training is done in Arabic for the staff not understanding English. Refresher training is done 6 monthly. Training records are kept for three years.

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:
A Ma'aden Head Office trainer for the group is in place, and he does task training for the Group, attending the Al Amar Mine approximately twice per year. On the Job task training is done through the Shift Bosses but not currently through any structured system. Cyanide specific task procedures are done as per the training matrix and training schedule. The training matrix specifies the elements required for each job. Currently, cyanide specific task training is performed by the Senior Plant Metallurgist who has Completed a certificate in training assessment and is a BSc (Engineering) trained at the University of Dar es Salaam. The Head Office Trainer comes to site to train other operational tasks and is an Ex-shift Boss, experienced with the operations of process plants and effective in communicating in English and Arabic.
Attendance records are kept and records include the name of the trainer, the date of training, the topics covered and assessment scores are included.

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:
A fully trained Mine wide ERT is in place on the mine which includes cyanide release as well as exposure scenarios. The person discovering the emergency will communicate the emergency to the ERT by calling 3333 or use the radio to report the emergency. All other personnel that may come into contact with cyanide receive cyanide hazard awareness training covering emergency response in case of cyanide incidents. The ERT receives cyanide first aid training which includes decontamination and applying oxygen. Training records include the name of the trainer, the date of training, the topics covered, and how the employee demonstrated an understanding of the training materials. The site Doctor is either at the clinic next to the process plant or on standby in the village 5 minutes away

from the site. He is trained to treat cyanide emergencies in the clinic. The patient is taken to a triage point where medical staff will administer additional medical attention. This point depends on where the emergency and patient is.
Training drills are used to train the ERT and the ERT are given additional training, including basic first aid, introduction to breathing apparatus, and stretcher training. Refresher training is required in the EMRS through testing of the ERP annually using desk top as well as mock exercises. Mock drills are currently also used for refresher training.
A full cycle emergency drill to the hospital, including an injury and a dry solid cyanide spill was undertaken. The report was signed off by the Emergency and Fire Fighting Specialist, the Mine Manager and the Safety and Environmental Specialist. The Drill report includes a time line, observations and comments, and corrective actions. The person responsible for ERT was present at the drills to evaluate the training perspective.

9. DIALOGUE: Engage in public consultation and disclosure.

Standard of Practice 9.1: Provide stakeholders the opportunity to communicate issues of concern.

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:
Dialogue meetings are two-way dialogue sessions involving both dissemination of information and the answering of questions on cyanide.
The mine has organised a number of cyanide presentations and meetings including presentations to Al Amar Village school teachers, representatives of local Red Crescent, and at the local Quwayiyah Government Hospital.
The presentation to the local Al Amar Village was to educate the local community about transportation, dangers, possible environmental impact and first aid treatment from cyanide, civil defence awareness and fire-fighting and fire prevention in the local communities. The program also covered the Cyanide Code, effect of cyanide and the transportation of cyanide using public roads.

Standard of Practice 9.2: Initiate dialogue describing cyanide management procedures and responsively address identified concerns.

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:
Dialogue meetings are two-way dialogue sessions involving both dissemination of information and the answering of questions on cyanide.
The mine has organised a number of cyanide presentations and meetings including presentations to Al Amar Village school teachers, representatives of local Red Crescent, and at the local Quwayiyah Government Hospital.
The presentation to the local Al Amar Village was to educate the local community about transportation, dangers, possible environmental impact and first aid treatment from cyanide, civil defence awareness and fire-fighting and fire prevention in the local communities. The program also covered the Cyanide Code, effect of cyanide and the transportation of cyanide using public roads.

Standard of Practice 9.3: 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 9.3**

□ not in compliance with

Basis for this Finding/Deficiencies Identified:
It is reported that most of the local population can read and write, mostly in Arabic. The mine has, therefore, taken its cyanide producer's cyanide awareness presentation and translated this into Arabic.
The Ma'aden annual report 2013, p 52 includes a section on the Cyanide Code and the gap audits. Al Amar reported on cyanide code standard procedures and cyanide code awareness. Cyanide incidents requiring reporting under legal requirements will be reported on in the annual report. No such incidents occurred during 2013. This report is available publically on the Ma'aden website. The mine is obliged to report accidents to the Ma'aden Gold Corporate Office in Jeddah. They will decide on further reporting to Government as per the Higher Commission of Industrial Security requirements and the Government Social Insurance System and/or Presidency of Metrology and Environmental Protection.