Cyanide Production Operation
Summary Audit Report

for

Proguigel Camaçari Unit/ 2016

Prepared by NCABrasil Expert Auditors Ltd.
SUMMARY AUDIT REPORT

Instructions

1. The basis for the finding and/or statement of deficiencies for each Standard of Practice should be summarized in this Summary Audit Report. This should be done in a few sentences or a paragraph.

2. The name of the mine operation, lead auditor signature and date of the audit must be inserted on the bottom of each page of this Summary Audit Report. The lead auditor’s signature at the bottom of the attestation on page 3 must be certified by notarization or equivalent.

3. An operation that is in substantial compliance must submit a Corrective Action Plan with the Summary Audit Report.

4. The Summary Audit Report and Corrective Action Plan, if appropriate, with all required signatures must be submitted in hard copy to:

   ICMI
   1400 I Street, NW, Suite 550.
   Washington, DC, 20005, USA.
   Tel: +1-202-495-4020.

5. The submittal must be accompanied with 1) a letter from the owner or authorized representative which grants the ICMI permission to post the Summary Audit Report on the Code Website, and 2) a completed Auditor Credentials Form. The letter and lead auditor’s signature on the Auditor Credentials Form must be certified by notarization or equivalent.

6. Action will not be taken on certification based on the Summary Audit Report until the application form for a Code signatory and the required fees are received by ICMI from the applicable gold mining company.

7. The description of the operations should include sufficient information to describe the scope and complexity of the gold mining operation and gold recovery process.

Name of Producer: UNIGEL – CAMAÇARI UNIT
Name of Producer Owner: PROQUIGEL QUIMICA S/A
Name of Producer Operator: PROQUIGEL QUIMICA S/A
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Location detail and description of operation:

The Proquigel project is focused on the production of sodium cyanide solution at a concentration of 40 – 41% due to the reaction between hydrocyanic acid and sodium hydroxide.

Proquigel Camará Unit has its plant within the petrochemical complex in Camará, an industrial city located in Bahia, in northeastern Brazil. Camará Industrial Complex was the first planned petrochemical plant in Brazil, installed in the municipality of Camará, 50 kilometers far from Salvador the capital of the state of Bahia. As the largest integrated industrial complex in the Southern Hemisphere, it is composed of over 90 chemical and petrochemical plants.

Camará Unit produces sodium cyanide solution with 40-41% concentration resulting of cyanidic acid and sodium hydroxide solution with 44-45% concentration.

The production process of sodium cyanide is divided in the following steps:
- Dilution of soda solution
- Reaction of cyanidic acid with soda

Dilution of sodium solution:

This step has the purpose of dilute, with demineralized water, the 50% NaOH solution, in order to this solution reaches a 44-45% concentration. The diluted soda is stored and then directed to the cyanidic acid reaction.

Reaction of cyanidic acid with soda:

The production of sodium cyanide is performed by direct reaction between liquid cyanidic acid with aqueous solution of sodium hydroxide. The reaction is as follows:

\[
HCN + NaOH \rightarrow NaCN + H_2O
\]

\[(27) \quad (40) \quad (49) \quad (18)\]

This is an exothermic reaction.

Reaction of cyanidic acid with potassium hydroxide:

The production of potassium cyanide is performed by direct reaction between liquid cyanidic acid with aqueous solution of potassium hydroxide. The reaction is as follows:

\[
HCN + KOH \rightarrow KCN + H_2O
\]

\[(27) \quad (56) \quad (65) \quad (18)\]

The cyanidic acid produced at Acrinor (another Proquigel plant) is fed to a mixer in the reactor circulation circuit where the sodium cyanide solution flows with 0,7 - 1,0% p/p soda in excess.

The diluted soda is fed to the reactor, R-8210. Circulation is kept inside the reactor, responsible for the perfect homogenization of the solution.

Due to the heat caused by the reaction, the circulation of the reactor flows through a heat exchanger, which has the function of keeping a 50°C maximum temperature in the solution. Through the reactor's top the soda solution is introduced and flows throughout the absorption column where the possible cyanidic acid vapours released by the solution are retained. The inert gases flowing inside the absorption column are conducted to the chimney by a exhaust system.

Nitrogen is introduced continuously in the reactor in order to carry possible cyanidic acid vapours to the absorption columns and maintain the ambience inert. The extraction of sodium cyanide solution is made continuously.

The effluent of cyanide unit stored in the tank P-3330 is pumped out to Acrinor, a Unigel Plant and Proquigel's HCN supplier, where after monitored by analysis, is driven via duct to Odebrecht Ambiental, treated and directed to its final destination/ disposal.
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Auditor's Finding

This operation is:

X in full compliance
in substantial compliance *(see below)
not in compliance

with the International Cyanide Management Code.
During the previous three years certification cycle, Proquigel Camaçari experienced a significant cyanide related incident during 2014, where a worker had her face and uniform impacted by a cyanide containing process sample, after suffering a bicycle incident. According to the performed interviews and reviewing the incident investigation report and records, it was concluded that response measures to mitigate the impact in the worker as well as the improvements made to prevent another incident of same nature were effective.

* The Corrective Action Plan to bring an operation in substantial compliance into full compliance must be enclosed with this Summary Audit Report. The plan must be fully implemented within one year of the date of this audit.

Audit Company; NCABrasil Expert Auditors Ltd.
Acting Audit Team Leader: Luiz Eduardo Ferreira
E-mail: luizeferreira2015@gmail.com (ICMI qualified lead auditor and TEA)
Names and Signatures of Other Auditors: Celso Sandt Pessoa (ICMI qualified lead auditor and TEA/ IRCA UK qualified Principal Auditor A009245))

Date(s) of Audit: 22–25/08/2016 (on-site) and 20–21/10/2016 (on-site)

I attest that I meet the criteria for knowledge, experience and conflict of interest for Code Verification Audit Team Leader, established by the International Cyanide Management Institute and that all members of the audit team meet the applicable criteria established by the International Cyanide Management Institute for Code Verification Auditors.
I attest that this Summary Audit Report accurately describes the findings of the verification audit. I further attest that the verification audit was conducted in a professional manner in accordance with the International Cyanide Management Code Verification Protocol for Cyanide Producer Operations and using standard and accepted practices for health, safety and environmental audits.

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

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Production Practice 1.1: Design and construct cyanide production facilities consistent with sound, accepted engineering practices and quality control/quality assurance procedures.

The operation is

X in full compliance with
in substantial compliance with Production Practice 1.1
not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

Evidenced that Proquigil established, implemented and maintained a quality control and quality assurance programs for new and existing cyanide facilities and modifications. Standards drawings were reviewed and found duly implemented. It is clearly defined and documented material requirements for each piping system used on the project and specified all applicable standards, codes and technical specifications including piping Material Specifications with ANSI Standard flanges, line identification, index of piping classification, material specification sheets piping. It is defined that all piping materials shall conform to the requirements of the most current applicable Standards and in the material specifications such as NR 13 / API 510 – Pressure Vessel Inspection Code; API 570 – Piping Inspection Code; ASME B31.1 – Power and Process Piping; ASME B31.3 – Process Piping; ASME B31.6 – Training Resources; API 620 – Design and Construction of Large Welded Low Pressure Storage tanks; API 650 – Welded Steel Tanks for Oil Storage; API 653 – Tank Inspection, Repair, Alteration and Reconstruction. Evidenced Specification Materials ENG-C-50-01 duly established, implemented and maintained. During the audit, several QC and QA records related to construction of cyanide production and storage facilities were assessed and found to be in place. Evidenced that Proquigil retains all records of quality control and quality assurance for cyanide facilities as required.

Competence records such as training, education, experience and ability records of personnel involved with QC and QA matters were reviewed and found to be adequate. Proquigil presented all required documentation related to QC/QA documentation and records.

Evidenced that internal documented procedure ENG-C-50-01 clearly defines the materials that shall be used in Cyanide Plant such as for Sulfuric acid – carbon steel; Hydrochloric acid – carbon steel; Sodium hydroxide – carbon steel; Sodium cyanide – 304 L 304 L stainless steel; Sodium hypo chloride – poly vinyl chloride + plastic reinforced with fiberglass; Adipo nitrile – carbon steel; Acryl nitrile – carbon steel; Potassium cyanide – 304 L stainless steel; Potassium Hydroxide - 304 L stainless steel.

Evidenced operational instruction MAN.I.303 rev. 04 – “Maintenance in interlock system in Cyanide Plant” duly established, implemented and maintained. Records assessed provided evidenced that interlocks are adequately implemented. Evidenced that Annex of MAN.I.303 clearly defines the relation of instrument and values of interlocks systems. Observed in the field audit, that all cyanide tanks have containment dikes and are located on a concreted area. All facilities have been constructed with using concrete. “Technical Report” issued by Cooinsp which states that all cyanide areas was constructed in concrete area and is adequate to prevent and minimize seepage to the

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subsurface. The Technical report includes inspections of structures, dikes, floors, basins and pump bases.

Evidenced that Proquigel monitors 24 hours/day its processes through a digital system - DCS (Distributed Control System)that controls and alarms levels, temperature, concentration and pressure. Evidenced that Proquigel established, implemented and maintained internal documented procedure PCS.O.04 rev.10 that defines the alarm levels in DCS (distributed control system). Evidenced that all of the control systems at their DCS room were operating adequately. Pertinent records evidence that secondary containments are adequate and are in accordance Brazilian laws such as: NBR 13752, NBR 8800, Lei 5907, Decreto 13251, NBR 9575, NBR 279, NBR 9574, NBR 9689. Evidenced that the storage capacity is defined in internal documented procedure PCS.I.07 and it is in accordance with above-mentioned Brazilian pertinent laws. Evidenced that internal documented procedure PCS.I.07 provides information about capacities of containments. It considers both areas (the NaCN production and the KCN production). Evidenced that all containments are in accordance with ICMI requirements as well as the Brazilian regulation laws.

During field audit, observed that all cyanide storage tanks have over-fill protection. Evidenced that spill prevention and containment measures are provided for all cyanide solution pipelines.

Production Practice 1.2: Develop and implement plans and procedures to operate cyanide production facilities in a manner that prevents accidental releases.

The operation is

\[ X \] in full compliance with

Production Practice 1.2

not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

Evidenced that Proquigel has an extensive system of plans, procedures, instructions and check lists which support management of the integrity of process equipment and its operation in a manner intended to avoid cyanide releases and exposition that are duly established, implemented and maintained.

Evidenced internal documented procedure SG1.NO.13 that defines methodology for MOC – Management on change which is duly established, implemented and maintained.

Evidenced that process parameters are monitored with necessary instrumentation and is the instrumentation calibrated according to manufacturer’s recommendations. During the field audit and reviewing pertinent records evidenced that Proquigel implemented procedure MEA.P.03 that defines methodology for management of liquid effluents. Evidenced that Proquigel has been managed its wastewater in accordance Brazilian regulations laws. Proquigel implemented procedure PGRS.MEA.PL.02 that defines how to manage cyanide-contaminated solids. During the field audit was evidenced that all cyanide-contaminated solids are identified, handled, storage and disposal in accordance Brazilian environmental laws. During the field audit evidenced that all cyanide solution is adequately stored in tanks, which are hermetically closed with adequate ventilation as well as final products have been kept in a proper and secure storage area.

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that are adopted all measures to avoid and minimize potential exposure of cyanide to
moisture. Besides, it is stored in a closed and secure area where public access is
prohibited. All cyanide areas have controlled access. Proquigel has an internal
documented procedure, ITEC03 that defines methodology for inspection of cyanide
tanks. Pertinent records were assessed and provided evidences that are duly
implemented. Evidenced that Proquigel established, implemented and maintained
procedures to ensure that cyanide is packaged as required by the political jurisdictions
through which the load will pass. Evidenced that internal documented procedure
SGI.NO.09 and checklist SGI.Q.12 clearly define that all kinds of leakage and spills
(large or small) are identified, classified and controlled. Record PRO.A.01 and field audit
provided evidences that the above-mentioned are implemented as stated. Proquigel has
been operated in conformance with its operation instructions which were written and
proper to safety and environment according to its basic design. Inspections of the
integrity of pressure vessels, tanks, pumps, valves, pipelines, secondary containments
(addressing structural and corrosion concerns) are undertaken as part of preventive
maintenance. Besides, inspections for leaks and housekeeping are performed too.
Inspection records were reviewed and found to be in place. Evidenced that inspection
frequencies are sufficient to assure that equipment is functioning within design
parameters
Evidenced that Proquigel established internal documented procedures for maintenance
activities, that define methodology for Maintenance System Management; as well as
that defines how to perform metrological confirmation for production equipment.
Evidenced that Proquigel established List of Critical equipment related to cyanide
production and internal documented procedure MAN.Q.02 “Metrological Confirmation
Plan for production equipment”. It is defined that all maintenance activities shall be
preceded by performing pertinent Work Permits. Responsibilities of maintenance
technical planning, maintenance supervisor, instrumentalist and process operator are
clearly defined. It is defined and documented how to remove instrument and how to
decontaminate them in order to avoid workers exposition to cyanide. The maintenance
activities in Proquigel include corrective, preventive and predictive maintenance.
Others internal documented procedures in maintenance were assessed such as:
PCS.I.06 and MAN.NO.01. Evidenced that the documentation identify specific items to
be observed and include the date of the inspection, the name of the inspector, and any
observed deficiencies as well as the nature and date of corrective actions documented,
and records retained.

Production Practice 1.3: Inspect cyanide production facilities to ensure their integrity
and prevent accidental releases.

The operation is

X in full compliance with

Production Practice 1.3

in substantial compliance with

not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

Inspections of the integrity of pressure vessels, tanks, pumps, valves, pipelines,
secondary containments (addressing structural and corrosion concerns) are undertaken
as part of preventive maintenance. Besides, inspections for leaks and housekeeping are
performed too. Inspection records were reviewed and found to be in place. Evidenced

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that inspection frequencies are sufficient to assure that equipment is functioning within design parameters. Evidenced that documentation identify specific items to be observed and include the date of inspection, the name of inspector, and any observed deficiencies. Evidenced that inspection frequencies are sufficient to assure that equipment is functioning within design parameters. The nature and date of corrective actions are documented and pertinent records retained.

2. WORKER SAFETY: Protect workers' health and safety from exposure to cyanide.

Production Practice 2.1: Develop and implement procedures to protect plant personnel from exposure to cyanide.

The operation is X in full compliance with Production Practice 2.1
not in compliance with Production Practice 2.1
in substantial compliance with Production Practice 2.1

Summarize the basis for this Finding/Deficiencies Identified:

It was observed that the operation developed, documented, implemented and maintains a SHEQ (safety, health, environmental and quality) management system, in order to adequately manage the identified hazards and evaluated risks. There is a formal hazard identification and risk evaluation procedure (SGI-NO-09 (4)/ corporate), which triggers the necessity to develop, document and implement (through operational training) the standard or safe operational procedures (SOP) for normal or routine activities or tasks, including planned maintenance ones. It was observed during the interview with operators that they actively participate in the development of such SOPs. The same approach is used and was evidenced for the development, document and implementation of emergency response procedures. For non routine tasks or activities (including maintenance ones), it is mandatory the realization of a pre-task hazard identification and risk evaluation (APR), which must be reviewed and approved by an assigned safety officer before the non routine task is allowed/ released (PTS/ safe work permit). During the field audit were evidenced several SOPs and APR.

It was evidenced that the operation developed, documented, implemented and maintains a change management system. In the last three years only one process change was identified (increase in the production capacity of NaCN solution capacity). It was reviewed in detail during the audit and all planned steps to adequately manage the proposed change were adequately performed, including the evaluation of potential associated risks. The status of the change request is in final review and approval of the top management (Production Director).

The operation utilizes fixed and portable HCN detectors, all set to alarm at 4.5 ppm HCN or NaCN dust. The fixed ones are installed at specifically assigned points were the potential to expose workers above 4.7 ppm exists. They are installed in line and interconnected with the interlock system. Once alarmed, the entire operation shutdown. The fixed and portable detectors are calibrated every six months, by an authorized dealer (TecSonic is a MSA authorized/ qualified representative in Bahia/ Brazil). It was also observed that the portable detectors are systematically calibrated.

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(every six months) and the associated records are kept on file. The operation identified all points were workers could be exposed to HCN or NaCN dust above 4.7 ppm. SOP # EXM-I-01 (11) defines the necessary PPE that are mandatory to be used in such areas such as full mask breather, Tyvec overall, chemical resistant gloves and boots. Safety signage is available in such areas. All operational activities in the process plant are monitored through CCTV system from the main control room and all the operators are equipped with radios. HCN detectors are also placed in critical points at the plant, connected to alarms and the interlock system. Evidenced during the field audit that such controls seems to be effective. Beyond that, the process plant is equipped with emergency response resources such as antidotes, fire extinguishers, autonomous breathing apparatus, low pressure showers and eye washers, water, absorbent materials.

It was evidenced that the operation designed, implemented and maintains a comprehensive health monitoring system for all workers of the operation on an annual basis. Specific monitoring of urine (tiocianate control) is performed for process plant workers every six months. According to the Brazilian law (NR7), the operation must issue an occupational health certificate (ASO), retaining one copy and delivering another copy to the worker. These certificates states if the worker is able to work in its function or not. In the last three years there were not any case of worker not able to work in the production process.

It was clearly evidenced that the operation defined, implemented and maintains a clothing change policy for all workers, contractors, visitors (like auditors). It was evidenced during the field audit that in the exit of the production area there are specific drums for potentially or really contaminated clothing (tyvec overall, gloves, jackets) must be disposed in this drum and sent to final disposal (incineration). It is mandatory before you leave the production area to wash your boots in a place specifically designed for this purpose. Non contaminated normal production clothing (cotton) are not allowed to leave the operation with workers and are sent to a specific qualified laundry.

The production plant site and surroundings are richly identified with safety and warning signals about the presence of cyanide and showing the necessary PPE to be used. It was evidenced during the field audit that here are in place comprehensive safety and warning signals and placards, including the ones that is forbidden to eat, drink smoke or have open flames in that area.

Production Practice 2.2: Develop and implement plans and procedures for rapid and effective response to cyanide exposure.

The operation is X in full compliance with

Production Practice 2.2

in substantial compliance with Production Practice 2.2

not in compliance with Production Practice 2.2

Summarize the basis for this Finding/Deficiencies Identified:

It was evidenced that the operation established, implemented and maintains internal documented procedures in order to address potential releases of cyanide that may occur on site or may otherwise require response such as: SEG.P.19 - “Emergency response Plan for Cyanide Plant”; SEG.P.16 – “Emergency Plan and Crisis Control; SEG.P.18 – Communication during Emergency; SEG.P.17 – Emergency Response Plan; NS.007/95 – Camaçari Petrochemical Pole Contingency Plan.

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It was evidenced during the field audit that the operation maintains (as part of preventive maintenance program) low pressure showers and eye washers in the plant, with specific water line for these installations, which were tested during the audit and worked accordingly. It was also evidenced in the process plant seven non-acidic fire extinguishers, adequately maintained and up to date inspected (monthly inspections) by the occupational safety process. It was clearly evidenced during the field audit that the operation made available all necessary and mandatory resources for use in the plant like water, oxygen, resuscitator (life pack 500 AED), breathing apparatus, antidote (e.g: amyl nitrate, cyanokit 5 gr), radio, CCTV.

According to SMP (standard management procedure) SOC-I-02-R-03(2), all first aid equipment (FAE) must be reviewed and inspected on a monthly basis. There are seven points where these FAE are available, including control room Acinor (HCN supplier), control room Proquigil (production plant), purification process unit, production plant (south corner), medical center Proquigil, ACH plant (south corner) and analytical laboratory. The inspection is performed by an occupational nurse or by a safety technician that is in charge in the programmed inspection day. Records of such inspections were promptly available.

It was evidenced, during the field audit that all environmental, safety and health related information (SOP, SMP, MSDS, signage, first aid posters) available are written in Portuguese.

It was evidenced during the field audit that cyanide containing installations and equipments are clearly identified and as well as the flow in the piping. Evidenced that process tanks, storage tanks, reactor, containers and piping containing cyanide are duly identified in accordance Brazilian Standards NBR 7197 and NBR 6493, as well as the direction of cyanide flow in piping.

It was evidenced in the system and field audit that the operation has a decontamination operational procedure consisting of strategically placed low pressure showers, eye washers and water hoses. In the event of any suspicious of skin contamination the person must unvested and abundantly washed with water. The access to the production plant is made through a personal magnetic card. Visitors, suppliers and workers are not allowed to stay alone in these areas. Mandatory PPEs must be used in such areas. It is also mandatory, when exiting the process plant area to wash your boots in a specifically designated area. During the field audit, all these procedures were checked and found in conformance. Also evidenced that the medical center of the operation has its own facility to decontaminate any suspicious case and, if necessary, the PAME (Camaçari Complex Medical Center), has also its own facility to perform decontamination procedures, as evidenced during the audit at PAME.

The operation has a well equipped medical center, with all the necessary resources (including an expert doctor in chemical intoxication and a team of qualified nurses), such as AED, all sort of antidotes, O2 installations, decontamination area, among others. If necessary, the operation may use the Camaçari Complex Medical Center (PAME) or the Sào Rafael Hospital downtown Salvador city. Depending on the grade of intoxication, the exposed worker may be transported by ambulance or by helicopter. The operation developed and implement operational procedures to transport potentially or really intoxicated workers to external medical facilities, such as PAME and Sào Rafael Hospital.

The operation’s expert doctor in chemical intoxication) developed partnership with the Camaçari Complex Medical Center and the Sào Rafael Hospital, which are fully

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equipped and with expert medical team to respond to cyanide intoxication. The Doctor also developed response procedures to cyanide intoxication and trained the partners medical team (doctors and nurses) in such procedures. It was evidenced that they work as emergency response team, as evidenced in the field audit at PAME facilities and the operation medical center. The PAME is a branch of the São Rafael Hospital at the Camaçari Complex Medical Center.

It was evidenced that the operation plan, perform, review and implement improvements related to emergency drills. Was reviewed a drill related to the transportation of an intoxicated worker to the PAME Medical Center. All planned objectives were achieved, and it was not necessary to change the emergency response procedure for this scenario.

The operation developed, documented, implemented and maintains management procedures (SGI-NO-03 and SEG-NO-03) in order to record, investigate, define and implement improvement actions (corrective and / or preventive) and verify if they were effective or not. In the last three years the operation faced one case of HPI (high potential incident), dated 04/01/14, where a worker collected (with a Becker) a cyanide solution sample from reactor R3210, and during the transportation of the sample to the process lab control room, by bicycle, the worker lost balance, fell in the floor and his face and uniform was impacted by part of the cyanide solution the was being transported. Emergency response procedures (decontamination with water + diphoterin) were promptly implemented and the worker was transported first to PAME and then to São Rafael Hospital. No major consequences were observed. This real incident was investigated by an independent team, in accordance with defined procedures. The root cause was determined and corrective actions were defined and implemented. The effectiveness of the implemented corrective actions were monitored between 2014 and 2016, and both actions were considered effective and the process was considered closed-out.

3. MONITORING: Ensure that process controls are protective of the environment.

Production Practice 3.1: Conduct environmental monitoring to confirm that planned or unplanned releases of cyanide do not result in adverse impacts.

X in full compliance with

The operation is in substantial compliance with Production Practice3.1 not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

The operation does not have any direct discharge to surface waters. All the effluents produced by the operation are sent to CETREL (Odebrecht Ambiental), which is the operation responsible to treat all the effluents generated at the Camaçari complex. The operation manages its effluents in accordance with two documented procedures MEA-P-03(4) and PCS-I-05(3).

The operation has indirect discharge to surface water (Atlantic ocean). Contaminated,

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non contaminated and organic effluents are sent to CETREL to be treated. The cyanide contaminated effluent is previously treated at Proquigel, then sent to ACRINOR tank TQ-428, were it receives a second treatment, then sent to CETREL to final treatment. The legal requirement IMA 12064 (29/12/2009) does not defines acceptance criteria for CNI (free cyanide) neither for CNt (total cyanide) for final disposition in the ocean. Then the acceptance criteria of 0.022mg/l is assumed by the operation. After CETREL final treatment, the CNI (free cyanide) content in the discharged to the ocean (through specifically designated underwater pipeline for this purpose) stood below 0.001 mg/l, according to the reviewed CETREL reports (that are sent also to the local EPA), generated between 2014 and 2016.

The management of groundwater quality is made in accordance with SMP # MEA-P-01(4). There are no acceptance criteria for CNw (WAD cyanide), CNt (total) and CNI (free), in the applicable Brazilian legislation. Anyway, the operation installed 21 (twenty one) monitoring wheels up and down gradient in order to monitor the underground water quality. CETREL take samples every six months and performs the analytical tests. Reviewed monitoring reports shows typical results as:

- CNw less than 0.005 mg/l
- CNt less than 0.013 mg/l
- CNI less than 0.005 mg/l

During the last three years there was not any reported seepage that could negatively impact the beneficial use of underground water.

All the HCN pipeline circuit is monitored through HCN sensors and alarm at 4.5 ppm HCN. This system is connected with the interlock system that shuts down the hole operation. This basically a standard operational control. Beyond that and in order to satisfy the Camaçari Complex escape emissions monitoring program, which defines maximum of 1112 g/ year of volatile organic compounds leaks, the operation performs annually its emissions monitoring to the atmosphere. The used method is EPA 21 (Determination of Volatile Organic Compounds Leaks). Reviewed monitoring reports and the maximum value observed was 320 g/ year.

As previously mentioned, the operation has a solid monitoring program for surface and underground waters, and for air emissions.

The monitoring frequencies are in accordance with criteria defined in the environmental permit issued by INEMA, the local EPA. Several monitoring reports and results were reviewed, and found in conformance, and based on that, the established frequencies seems to be adequate to characterize the medium being monitored. Any changes on the monitoring frequencies (air and water), must be reviewed and approved by the local EPA. No cases were evidenced.

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

Production Practice 4.1: Train employees to operate the plant in a manner that minimizes the potential for cyanide exposures and releases.

The operation is X in full compliance with Production Practice 4.1
not in compliance with

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Summarize the basis for this Finding/Deficiencies Identified:

The Human Resources process developed, documented, implemented and maintains a management system focused on the integration and training of all workers (doc ref: ADM-NO-03(23) and ADM-NO-06(17)) that have the potential to face cyanide. The system also defines the refresh training frequency (yearly), for certain subjects (safety basic training, cyanide basic training, PPE basic training). All training is provided through "e-learning" approach, or at class room (no longer usual, but still happens) and the attendees are submitted to tests after the training.

The Human Resources process, in conjunction with the SHE process developed a specific training program focused on the use and maintenance of PPE. This training is part of the integration of new workers and also is refreshed for the work force on a yearly basis. Basically through the e-learning platform or at class room. Tests are performed in the end of the training session, in order to ensure that the worker learned and maintain the knowledge about the subject being trained.

The Human Resources process in conjunction with the Production process developed an "on the job training program" for beginners and a refresh session for experienced workers. The initial program takes approximately 3 (three) months and are consisted of technical operational training. The trainee worker is only allowed to work in the production after being approved (by testing and observation) in the on the job training. The technical-operational training is based on the developed and implemented SOPs. The training elements are clearly identified in the training materials. Occupational health and safety and environmental training materials are developed by the SHE process.

All the assigned training instructors are master supervisors which are working in the operation since its start-up (37 years of experience). Some of the operational training (e.g: pump sealing failure) is provided by the pump manufacturer instructor. SHE related training are provided by SHE technicians, engineers and doctors.

The introductory training effectiveness is evaluated by testing. The on the job training effectiveness is evaluated by testing and on the job observation. After that, the operator performance is evaluated by the master supervisor and he decides if the trainee operator is approved or not.

Experienced operators are evaluated (performance) every two years, in order to evidence if they retained the necessary knowledge to perform their planned tasks.

Production Practice 4.2: Train employees to respond to cyanide exposures and releases.

The operation is x in full compliance with Production Practice 4.2

Not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

All plant / process operators are trained and qualified to be emergency responders. The emergency responders training takes around 33 hours of training which scope includes: first aid, fire fighting, chemical emergencies, emergency hardware use, drills. This

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The performance of the participants is determined through testing (theoretical and practical). Annually they participate in a refreshing training session and participate in emergency drills. All the emergency drills are reviewed in terms of performance to confirm if the personnel did act adequately and the emergency response plan is correct. Reviewed intoxication drill report, carried out during 2016 where the results were adequately reviewed. The operation (Human Resources process) retains all training records, which address the trainee name, instructor name, scope of training, date of training, duration of training, and the performance of the trainee.

5. EMERGENCY RESPONSE: Protect communities and the environment through the development of emergency response strategies and capabilities.

Production Practice 5.1: Prepare detailed emergency response plans for potential cyanide releases.

X in full compliance with

The operation is in substantial compliance with Production Practice5.1 not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

Proquigel established, implemented and maintained procedures in order to address potential releases of cyanide that may occur on site or may otherwise require response such as: SEG.P.19 - “Emergency response Plan for Cyanide Plant”; SEG.P.16 - “Emergency Plan and Crisis Control: SEG.P.18 – Communication during Emergency: SEG.P.17 – Emergency Response Plan; NS.007/95 – Camaçari Petrochemical Pole Contingency Plan which include scenarios such as: Catastrophic release of hydrogen cyanide, releases during loading and dissolution operations, releases during fires and explosions, pipe, valve and tank ruptures, power and equipment failure, outages and overtopping of ponds, tanks and waste treatment facilities. They describe Specific response actions, as appropriate for the anticipated emergency situations, such as evacuating site personnel and potentially affected communities from the area of exposure, use of cyanide antidotes and first aid measures for cyanide exposure, control of releases at their source and containment, assessment, mitigation and future prevention of releases.

Production Practice 5.2: Involve site personnel and stakeholders in the planning process.

X in full compliance with

The operation is in substantial compliance with Production Practice5.2 not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

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Internal documented procedure SEG.P 19 item 5.1.1 defines methodology that Proquigel uses in order to involve its workforce and stakeholders. Evidenced duly implemented.

Evidenced that the Health, Safety and Environmental Manager Mr. Delviti Caetano performed a presentation about "Sodium Cyanide Manual" for all Companies of Camaçari Beta Area.

Evidenced records of training provided by Proquigel for all direct or indirectly persons involved with cyanide like PAM – Mutual Aid Plan, PAME – Medical Emergency Plan, COFIC and COSIMA.

Evidenced that Proquigel has a program named "Ver de Dentro" in order to integrate Proquigel with the communities.

Proquigel has a contract with SOS Cotec for support in occurrence of accidents during cyanide transportation.

Production Practice 5.3: Designate appropriate personnel and commit necessary equipment and resources for emergency response.

The operation is X in full compliance with
In substantial compliance with Production Practice5.3
not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

Evidenced that Proquigel Emergency Plans designate primary and alternate emergency response coordinator. It is clearly identified the Emergency Response Team and individual responsibilities and authorities. Training requirements are defined. Evidenced that Proquigel Emergency Brigade has been trained in accordance Brazilian legislation laws. During the field audit, evidenced all emergency response equipment were available on-site as stated. Pertinent checklists provided evidence that emergency response equipment has been inspected as stated. Observed a list containing 24-hour contact information for the coordinators and response team members. Role of outside responders, medical facilities and communities in emergency response procedures are clearly describe such as PAM, PAME, COFIC, COSIMA, Militar Fire Brigade, Area Beta Camaçari Brigade, Camaçari Brigade, Bahia Militar Police, Bahia Civil Police, Camaçari Civil Police, SOS COTEC, Concordia Transportes, Niquini Transportes, Hospital São Rafael, Organized Civil Society.

Records assessed were reviewed and provided evidences of adequate aware of outside entities.

Production Practice 5.4: Develop procedures for internal and external emergency notification and reporting.

The operation is X in full compliance with
In substantial compliance with Production Practice5.4
not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

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Internal documented procedure SEG.P.16 item 5 and Annex II clearly identify procedures and contact information for notifying management, regulatory agencies, outside response providers and medical facilities of the emergency, as appropriate as well as clearly identify procedures and contact information for notifying potentially affected communities of the incident and/or response measures and for communication with the media. Evidenced that the above-mentioned procedure is duly established, implemented and maintained.

**Production Practice 5.5**: 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 Production Practice 5.5
not in compliance with

**Summarize the basis for this Finding/Deficiencies Identified:**

Evidenced that internal documented procedures SEG.P.19 – “Emergency Control in Cyanide Plant”, SEG.P.16 and MEA.P.08 clearly describe: a) appropriate remediation measures, such as recovery or neutralization of solutions or solids, decontamination of soils or other contaminated media and management and/or disposal of spill clean-up debris, and provision of an alternate drinking water supply, as appropriate; b) Clearly prohibit the use of chemicals such as sodium hypochlorite, ferrous sulfate and hydrogen peroxide to treat cyanide that has been released into surface water as well as procedures SEG.P.19 – “Emergency Control in Cyanide Plant”, SEG.P.26 and SEG.P.20 item 6.2.31q and item 6.2.12 clearly address the potential need for environmental monitoring to identify the extent and effects of a release, and include sampling methodologies, parameters and, where practical, possible locations Evidenced that the above-mentioned documented procedures are duly established, implemented and maintained.

**Production Practice 5.6**: Periodically evaluate response procedures and capabilities and revise them as needed

X in full compliance with
The operation is in substantial compliance with Production Practice 5.6
not in compliance with

**Summarize the basis for this Finding/Deficiencies Identified:**

Evidenced that internal documented procedure SEG.P.19 Emergency Plan in Cyanide Plant item 5.5 include provisions for reviewing and evaluating its adequacy on an established frequency. Evidenced that mock emergency drills are conducted periodically as part of the Plan evaluation process. Sampled examples were: Records of mock emergency drills such as: August 08, 2014 – HCN emissions in Cyanide Plant; October 21,2015 HCN emission during transportation of cyanide.

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solution (performed with Concordia Transportes); June 06, 2016 – HCN leak in cyanide tank, evidenced that since the last Cyanide Code audit recertification that did not occur accidents or incidents cyanide related. Evidenced records of accidents and incidents simulation dated on August 08, 2014 – HCN emissions in Cyanide Plant; October 21, 2015 HCN emission during transportation of cyanide solution (performed with Concordia Transportes); July 14, 2016 – HCN leak in cyanide tank. All of these records clearly demonstrate – Objectives of simulations such – Review of Emergency Plans, Review of check emergency Procedures Training of Emergency Response Brigade, Review of stakeholders involvement, Review of Communities Involvement, Measuring of Communication effectiveness, Review of Internal resources, Review of PAME and PAM.