



# ***INTERNATIONAL CYANIDE MANAGEMENT INSTITUTE***

## ***Cyanide Production***

### ***Summary Audit Report Form***

#### ***PROQUIGEL***

##### ***Camaçari Unit - Solid Cyanide***

***November 25<sup>th</sup>, 2009***

## SUMMARY AUDIT REPORT

Name of Cyanide Production Facility: UNIGEL – UNIDADE CAMAÇARI  
Name of Facility Owner: PROQUIGEL QUIMICA S/A  
Name of Facility Operator: PROQUIGEL QUIMICA S/A (Principal)  
Name of Responsible Manager: EDUARDO BARBOSA  
Address: Rua Hidrogenio, 824, Camaçari  
State/Province: BAHIA Country: BRASIL  
Telephone: 71-3602-5540 Fax: -----  
E-Mail: [eduardo.barbosa@unigel.com.br](mailto:eduardo.barbosa@unigel.com.br)

### Location detail and description of operation:

#### Summary

Proquigel - Camaçari Unit is located at Camaçari Complex, Bahia state, Brazil. It is part of the Salvador Metropolitan Region and Camaçari is the industrial city of the metropolis. Several factories and petrochemical plants compose one of largest industrial capabilities in Brazil, the largest of the Northeast region of the country.

Camaçari Unit produces sodium cyanide solution 40-41% concentration from the reaction of Cyanidric 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 cyanidric acid with soda


#### Dilution of sodium solution

This step has the purpose to dilute with demineralized water the 50% NaOH solution to 44- 46%. The diluted solution is stored and then sent to the cyanidric acid reaction.

#### Description of operation

The cyanidric acid produced at Acrinor (another Unigel plant) is fed to a mixer in the reactor circulation circuit where the sodium cyanide solution flows with an excess of 0,7 - 1,0%.

Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor

25/11/09  
Date

## SUMMARY AUDIT REPORT


The diluted soda is fed to the reactor, R-3210. 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 cyanidric acid vapors released by the solution are retained. The inert gases flowing inside the absorption column are conducted to the chimney by an exhaustion system.

Nitrogen is introduced continuously in the reactor in order to carry possible cyanidric acid vapors 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 F-3330 is pumped out to Acrinor, a Unigel Plant and Proquigel's HCN supplier, where after monitored by analysis, is driven via duct to Cetrel, treated and directed to its final destination.

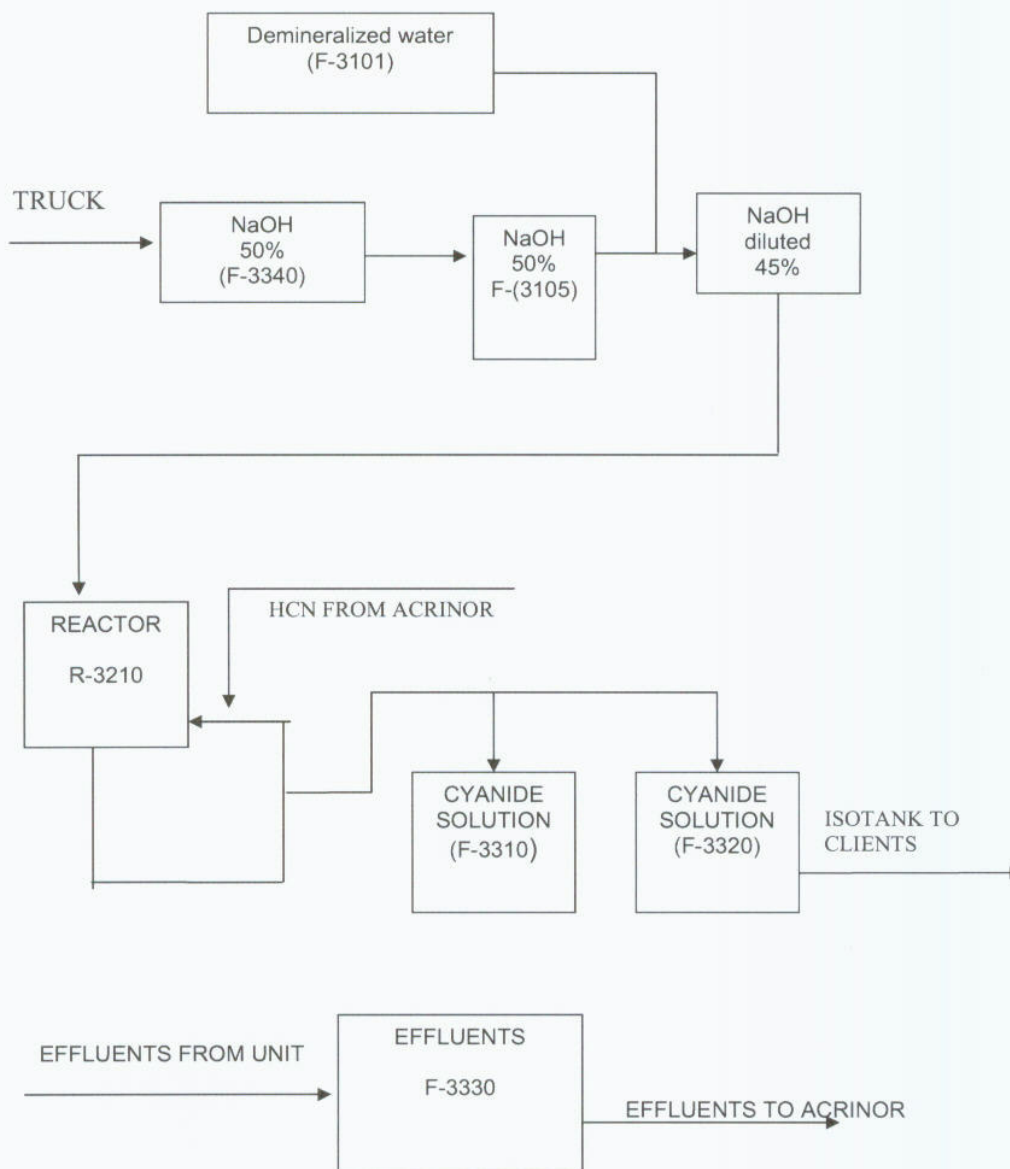
Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor

25 NOV. 09  
Date

## SUMMARY AUDIT REPORT

### Simplified Diagram of the production process of liquid sodium cyanide



Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor

25 MAR 09  
Date



## SUMMARY AUDIT REPORT

### *Auditor's Finding*

This operation is

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

with the International Cyanide Management Code.

\* For cyanide production operations seeking Code certification, 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: NCA-NOSA CERTIFICATION AUTHORITY LTDA, BRAZIL  
Audit Team Leader: JULIO C. M. MONTEIRO, e-mail: juliomonteiro@nosa.com.br  
Other Auditors: EDERCLEY ANTONIO GARCIA MOURA, Auditor.  
LUIZ EDUARDO FERREIRA, Chemical and expert for cyanide production.

Date(s) of Audit: 24, 25 & 26, NOVEMBER, 2008

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

Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor

25 Nov. 09  
Date

## SUMMARY AUDIT REPORT

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

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:*

Appraisal reports demonstrate that the facility has its civil and mechanical structure adequate to work with cyanide and process reagents.

Automatic systems and procedures are in place to prevent releases and overfilling. Containments and pipelines are properly designed and equipped with materials to prevent leakage and spills.

A Maintenance Plan manages inspections and maintenance tasks, according to engineering practices and Brazilian legislation.

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  
   in substantial compliance with      Production Practice 1.2  
   not in compliance with

*Summarize the basis for this Finding/Deficiencies Identified: (Due to the sensitivity of security issues regarding storage of cyanide, no descriptions of substantial or non-compliance with this aspect of the Production Practice should be provided.)*

Procedures related to operation, contingency and changes in operating practices were checked and found in compliance.


Well implement maintenance plan including calibration program were evidenced. The process parameters are under monitoring.

The unit follows a job instruction that describes the interlocking of containment valves against unauthorized/unregulated discharges and the criteria to open these valves.

Steps for adequate disposal of cyanide and cyanide-contaminated solids are described in a procedure.

The cyanide solution is stored in closed tanks and the entire plant is outdoor, which provides total ventilation and avoids the exposure of cyanide to moisture. These tanks were constructed under international standards and have its regular inspections signed by qualified engineers.

Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor

25 NOV. 09  
Date



## SUMMARY AUDIT REPORT

The cyanide plant is fenced and the gate is locked, with warning signs prohibiting the access of non-authorized people. Only authorized people is allowed to enter the plant, and this is controlled by the electronic identification cards.

Cyanide solution is safely transported in trucks with isotanks in accordance with Brazilian Legislation and Standards.

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

The operation is                      X in full compliance with  
   in substantial compliance with      Production Practice 1.3  
   not in compliance with

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

The cyanide production facilities are regularly inspected by engineers registered in a reliable regional cooperative of inspectors.

Inspection parameters and frequencies complying with Brazilian legislation and standards API and ASME are properly documented.

Any identified deviation in the inspections is documented and generate a service order.

**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  
   in substantial compliance with      Production Practice 2.1  
   not in compliance with

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

Procedures for normal operation, non-routine and emergency operation and maintenance are implemented to minimize worker exposure.

A document includes criteria to ensure that formal analysis will be performed prior to new or temporary design in the plant.

Procedures are previously sent to the leaderships to be analyzed by the work teams.

Camaçari has fixed HCN detector and all cyanide plant operators carry portable HCN detectors (altair pro) during the work shift.

The maintenance plan manages the periodic calibration of hydrogen cyanide monitoring devices.

The facility identified areas and activities where workers may be exposed to hydrogen cyanide gas and sodium, calcium or potassium cyanide dust.

A electronic device is used by all operators to inform immediately the control in case of

Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor

25 Nov. 09  
Date

## SUMMARY AUDIT REPORT

the operator to collapse while in the plant.

There is a document that determines procedures and behaviour to be adopted by the company based on risks that workers may be exposed on work area.

A procedures determines the clothing change procedure for employees, contractors and visitors to areas with the potential for cyanide contamination.

Warning signs advising workers that cyanide is present and that suitable personal protective equipment must be worn are available in the plant.

In areas where there is the potential for cyanide contamination, procedures and signs are in place to inform people that eating, smoking and drinking are prohibited.

*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  
   in substantial compliance with      Production Practice 2.2  
   not in compliance with

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

An Emergency response plan and procedures are in place to respond to cyanide exposures.

Equipments, information material and first aid kits are located and readily available in the plant and inspected accordingly, including radios and telephones.

Facilities containing cyanide are well signalized.

A decontamination policy is in place.

The Unit of Camaçari has qualified Medical Team and Responders to act in case of cyanide intoxication and a adequate infrastructure. There is an adequate time for transportation between the facility and the PAME (Emergency Medical Assistance Plan) installations.

Medical Team of PAME attends periodically cyanide response trainings.

There are procedures to manage Emergency Drills and its continuous improvement by the use of lessons learned.


A procedure is implemented to determine if programs and procedures are effective to protect worker health and safety and to respond to cyanide exposures.

**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.*

The operation is                      X in full compliance with  
   in substantial compliance with      Production Practice 3.1  
   not in compliance with

Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor  
Page 7

25 May 09  
Date



## SUMMARY AUDIT REPORT

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

Although Camaçari Unit has no direct or indirect discharge to surface waters, monitoring programs are implemented to monitor cyanide contamination.

The monitoring of underground water has a 6-months interval and it is performed by specialized companies.

No contamination of the underground waters was recorded by the Unit of Camaçari.

A procedure establishes the management and control of atmospheric emissions, punctual and fugitive emissions of activities of Proquigel – Camaçari, focusing in the mitigation, control and monitoring.

Frequencies for effluents and underground waters monitoring follow the best criteria.

**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      |                         |
|                  | in substantial compliance with | Production Practice 4.1 |
|                  | not in compliance with         |                         |

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

After all training elements necessary for each job are identified, qualified personnel train workers to understand the hazards of cyanide and prior to work with cyanide. Prevention of releases and correct use of personal protective equipment are addressed in the training.

The training is provided by occupational physician, occupational hygiene officer, cyanide plant supervisor, process engineer, safety officer and SHE coordinator and is evaluated by testing, interviews, observation and simulation.

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

|                  |                                |                         |
|------------------|--------------------------------|-------------------------|
| The operation is | X in full compliance with      |                         |
|                  | in substantial compliance with | Production Practice 4.2 |
|                  | not in compliance with         |                         |
|                  | not subject to                 |                         |

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

All operators are trained in procedures in case of releases and worker exposure and tested in drills.

Drills according to the scenarios established in the Emergency Response Plan are

Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor

20mm.09  
Date

## SUMMARY AUDIT REPORT

conducted, as well as the evaluation of effectiveness of internal training in the preparation of emergency responses.

Attendance lists include the names of the employee and the trainer, the date of training, the topics covered, and the employee grading.

A procedure establishes the time of retention of document training throughout an individual's employment.

**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.*

The operation is                      X in full compliance with  
   in substantial compliance with      Production Practice 5.1  
   not in compliance with

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

A procedure addresses potential releases of cyanide and establishes the procedures to be followed in case of an emergency with sodium cyanide. The Plan considers the potential failure scenarios appropriate for its site-specific environmental and operating circumstances, as well as specific response actions, first aid measures and prevention measures.

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

The operation is                      X in full compliance with  
   in substantial compliance with      Production Practice 5.2  
   not in compliance with

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

The involvement of site personnel and stakeholders in the planning process is implemented, and the community was made aware of risks related to cyanide. Outside responders are involved in the emergency planning and response process and they are regularly consulted, as checked in records, programs, media material and interviews. Monthly meeting with the communities are conducted to assure that the Plan addresses current conditions and risks and PAME (*Emergency Medical Assistance Plan*) performance is evaluated at a 2 months interval by the companies of Camaçari Industrial Complex.

Production Practice 5.3: *Designate appropriate personnel and commit necessary equipment*

Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor

25 Nov. 09  
Date



## SUMMARY AUDIT REPORT

*and resources for emergency response.*

The operation is                      X in full compliance with                      Production Practice 5.3  
   in substantial compliance with  
   not in compliance with

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

The operation has designated appropriate personnel and committed necessary equipment and resources for emergency response, with appropriate training, call out procedures and 24 hour contact information. Equipments are listed and its availability is provided by regular inspections. Outside responders, medical facilities and communities are aware of their responsibilities and duties and have participated of mock drills and its implementation.

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

The operation is                      X in full compliance with                      Production Practice 5.4  
   in substantial compliance with  
   not in compliance with

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

The facility developed procedures and provided contact information for internal and external emergency notification and reporting, including agencies, outside response providers and medical facilities and communities.

Production Practice 5.5: *Incorporate into response plans and remediation measures monitoring elements that account for the additional hazards of using cyanide treatment chemicals.*

The operation is                      X in full compliance with                      Production Practice 5.5  
   in substantial compliance with  
   not in compliance with


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

The facility incorporated into the Emergency Response Plan monitoring elements that account for the additional hazards of using cyanide treatment chemicals.

Methods for recovering, neutralization, decontamination, management and disposal of contaminated media, and provision of an alternate drinking water supply are part of the Plan.

Prohibition of using of chemical into surface areas is established and the Plan addresses the need of environmental monitoring to identify the extent and effects of a

Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor

25/11/09  
Date



## SUMMARY AUDIT REPORT

release.

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

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

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

The Plan includes provisions for reviewing and evaluating its adequacy on an established frequency according to a procedure.

Mock emergency drills are conducted periodically as part of the Plan evaluation process, evidenced by the results of simulations.

Provisions to evaluate the Plan after any emergency that required its implementation as well as for revising it as necessary were found in a procedure.

Proquigel Quimica S.A  
Camaçari Unit  
Name of Facility

  
Signature of Lead Auditor

25 MAR 09  
Date