



# ***INTERNATIONAL CYANIDE MANAGEMENT INSTITUTE***

## ***Cyanide Production Summary Audit Report Form***

### ***PROQUIGEL Candeias Unit – Solution Cyanide***

*November 28<sup>th</sup>, 2009*

## SUMMARY AUDIT REPORT

Name of Cyanide Production Facility: UNIGEL – UNIDADE CANDEIAS  
Name of Facility Owner: PROQUIGEL QUÍMICA S/A (Branch)  
Name of Facility Operator: PROQUIGEL QUÍMICA S/A  
Name of Responsible Manager: EDUARDO BRABOSA  
Address: Fazenda caroba, s/n. Candeias  
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 – Candeias 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.

Candeias Unit produces solid sodium cyanide with 97,5% minimal concentration, with sodium cyanide solution with 40% concentration produced at Camaçari. This solution is below saturation point to prevent crystallization.

The production process of solid sodium cyanide is divided in the following steps:

- Discharging and storage of solid sodium cyanide
- Evaporation and crystallization
- Centrifugation
- Drying and transportation of powder cyanide
- Packing of solid cyanide
- Treatment of Effluents

### Description of operation

The sodium cyanide solution produced at Camaçari Unit is transported via road, in isotanks, by Concórdia Transportes to Candeias Unit. The transporter Concórdia is in process of certification under ICMI requirements.

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The cyanide solution is discharged and stored in the storage and feeding tank, TQ-220-05 B, kept circulating by pumps and then is transferred to the evaporator, VP-230-01. The evaporator operates with steam in the tubular set, where saturation occurs by evaporation of excess of water, and then to the crystallizer, CR-230-01, and the growing phase of crystal is processed.

There is a circulation stream between CR-230-01 and VP-230-01, through B-230-07. The solution is pumped from the crystallizer to thickening tank (settler), where the concentration of crystals that feed the centrifuge CT-230-01 e CT-230-02 rises, existing, besides, a returning overflow to the crystallizer.

Inside the centrifuges, the liquor-mother crystals separate and the wet powder is transported by helicoidal transporters to the dryer, SC-230.-01. The powder cyanide is dried inside this equipment, through the air heated in a gas furnace. From the dryer, the powder cyanide is taken, through a pneumatic transporter, to the briquette maker machine, where the powder is pressed, producing the briquette cyanide that is taken to be packed in 1000kg big -bags and then weighed. As a way of protecting the big-bags, they are protected by plastic bags, and finally, for more safety during transportation, they are put inside wooden boxes which are entirely closed and ringed.

The drying, pneumatic transport of powder, briquette-making and cyanide weighing circuits have exhaustion systems, connected to washers (scrubbers), with re-using of process washing water, by dispatching to the recycling tank, TQ-230-05. The washed air is taken to the chimney CH-230-01 that is periodically monitored was a way of controlling the gases released to the atmosphere.

All effluents of the unit that contain cyanide are directed to a tank placed in the inferior level of the unit, TQ-230-14. From there, they are transferred by pumping to the treatment of effluents section.

The treatment of effluents section consists of a relief tank, TQ-230-28, which receives the effluent of tank TQ-230-14. The treatment has two different phases: draining is the first one, where most of the contaminants are removed of aqueous phase by heated air fed in the bottom of column T-22-07. In the second phase, oxidation, sodium hypochlorite is added to the reduction of ion CN- in the final effluent of the unit, to the levels required by the current legislation. After

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treating, the effluent is dispatched to the tank TQ 220-12, and after analytical control, is pumped to the balancing pond, that is the final effluent reservoir of Proquigel. As a way of ensure the product quality, periodical draining are performed to the tank TQ-230-03. For dilution, a solution less concentrated of the tank TQ-230-17 is used (tank for collecting cleaning solution of the unit). The concentration is adjusted to the range 30 - 35%, and sold to the clients, via road transportation, using Isotanks.

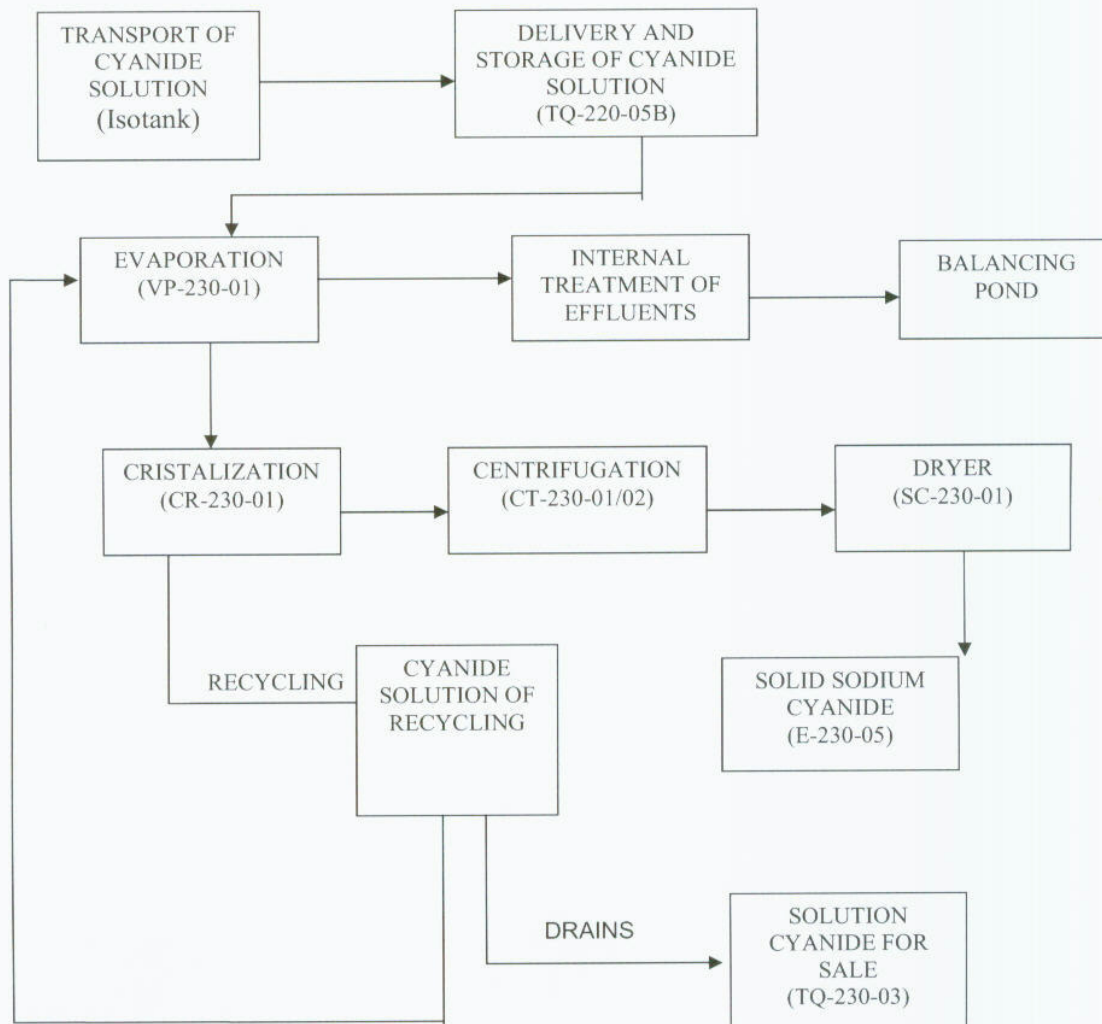
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Diagram simplified of production process of solid sodium cyanide



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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.

\* 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.

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### 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.*

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 normal operation, contingency and changes in operating practices were checked and found in compliance.*  
*Well implemented maintenance plan including calibration program was evidenced by the auditor.*  
*Process parameters are defined in a Plan and monitored by instruments, regularly calibrated according to the manufacturer's recommendations.*  
*A job instruction describes the locking of containment valves against unauthorized/unregulated discharges and establishes criteria to open valves only after analyze the product and then the lead operator authorize the discharge of solution or water collected in a secondary containment area.*  
*A procedure exists for disposal of cyanide and contaminated solids.*  
*Packaging process is regulated in the Brazil by the Navy and has a valid certificate and is properly signaled according to Brazilian resolutions and standards.*  
*Storage facilities are ventilated, have restricted access and practices were found in compliance by the auditor.*

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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 (Cooinsp).*

*Inspection parameters and frequencies complying with Brazilian legislation and standards API and ASME are properly documented. Any identified deviation in the inspections generates a service order.*

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### 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*

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

*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.*

*An electronic device is used by all operators to inform immediately the control in case of the operator to collapse while in the plant.*

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

*A procedure 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 the 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.*

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*Facilities containing cyanide are well signalized.*

*A decontamination policy is in place.*

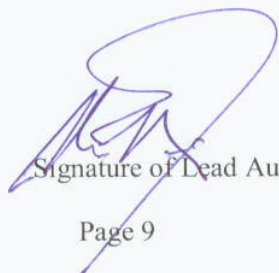
*Candeias Unit has qualified Medical Team and Responders to act in case of cyanide intoxication and a adequate infrastructure. There is an adequate time for transportation between the facility and the PAME installations.*

*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*

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### 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

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

*The audit team found this Production Practice in full compliance.*

*Although Candeias Unit has a direct discharge to surface waters, a procedure and 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.*


*There are no indirect discharges to surface waters.*

*No contamination of the underground waters was recorded by the Unit of Candeias .*

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

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

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### **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  
in substantial compliance with  
not in compliance with

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

*After identify all training elements necessary for each job, 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, including when and where the equipment is required.*

*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      Production Practice 4.2  
in substantial compliance with  
not in compliance with  
not subject to

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

*Operators, medical team and Brigade 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 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 20 year of retention of document training throughout an individual's employment.*

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**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:*

*The Audit Team confirmed that 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 was evidenced, 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 and resources for emergency response.*

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

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

*The operation was found in full compliance with this Production Practice.*

*The auditor concluded that the operation has designated appropriate personnel and committed*

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*necessary equipment and resources for emergency response, with appropriate training, call out procedures and 24 hour contact information. Equipments are listed and means of its availability is provided by inspections. Outside responders, medical facilities and communities are aware of their responsibilities and duties and have participated of mock drills and its implementation, as checked in records.*

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 Practice 5.4  
   not in compliance with

*Summarize the basis for this Finding/Deficiencies Identified:  
The Audit Team has concluded that the facility developed procedures and provided contact information for internal and external emergency notification and reporting.*

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  
   in substantial compliance with      Production Practice 5.5  
   not in compliance with

*Summarize the basis for this Finding/Deficiencies Identified:  
The facility incorporates 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 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*

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*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.*

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