

**Golder Associates Inc.**

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**INTERNATIONAL CYANIDE MANAGEMENT CODE  
PRODUCTION SUMMARY AUDIT REPORT**

*Submitted to:*



*CYANCO  
5505 Cyanco Drive  
Winnemucca, Nevada 89445*



*International Cyanide Management Institute  
1200 G Street N.W, Suite 800  
Washington, D.C. 20005*

*Submitted by:*

*Golder Associates Inc.  
44 Union Boulevard, Suite 300  
Lakewood, Colorado 80228*

Rev. 1 October 3, 2006

063-2156

**PRODUCTION SUMMARY AUDIT REPORT  
FOR CYANIDE PRODUCTION OPERATIONS**

Name of Cyanide Production Facility: Cyanco Sodium Cyanide Production Facility

Name of Facility Owner: Cyanco is a joint venture between CyPlus Corporation and Nevada Chemicals, Inc.

Name of Facility Operator: Cyanco

Name of Responsible Manager: John Burrows, General Manager  
Address: 5505 Cyanco Drive, Winnemucca  
State/Province: Nevada 89445  
Country: USA  
Telephone: (775) 623-1214  
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E-Mail: burrows@cyanco.net

Date of Audit: June 26 – 28, 2006

Location detail and description of operation:

Cyanco is a liquid sodium cyanide production facility. Cyanco's liquid sodium cyanide manufacturing facility is located approximately 7 miles west of Winnemucca Nevada. Cyanco owns the agricultural land around the facility and has fenced security to prevent public access into the plant area. The plant produces approximately a 30% sodium cyanide solution using the Andrussow process. Oxygen, methane, and ammonia are combined over a platinum catalyst where they form hydrogen cyanide gas (HCN). The HCN gas is then scrubbed using sodium hydroxide (50% caustic soda) to form liquid sodium cyanide. The product is delivered to gold mining customers in the western US in bulk delivery tankers. Cyanco contracts the delivery of the solution to TransWood Inc. whose transportation terminal is located in close proximity to the Cyanco plant.

The plant has been designed, constructed and is operated as a zero discharge facility using environmentally sound practices. The plant facilities are located within curbed concrete containments to prevent cyanide spills, and potential releases from impacting the environment or worker safety. The plant has been constructed to operate with fail safe systems to minimize the potential for operational spills or releases during emergencies. Cyanide is stored within steel tanks located within concrete containment areas. Loading of specially constructed tankers for offsite shipment is also completed within concrete containment areas.

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Signature Lead Auditor

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**Auditors Finding**

**in full compliance with**

**The operation is**

in substantial compliance with

**International Cyanide  
Management Code**

not in compliance with

Audit Company:

**Golder Associates Inc.**

Audit Team Leader:

Scott H. Miller, CEA

E-mail:

Scott\_Miller@[golder.com](mailto:Scott_Miller@golder.com)

Names and Signatures of Other Auditors:

Erich W. Tiepel, Ph.D.  
Name of Auditor

*Erich W. Tiepel*  
Signature of Auditor

October 3, 2006  
Date

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

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*Scott Miller*  
Signature Lead Auditor

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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.*

**in full compliance with**  
**The operation is**  in substantial compliance with **Production Practice 1.1**  
 not in compliance with


*Summarize the basis for this Finding/Deficiencies Identified:* The Cyanco facilities have been designed and constructed consistent with sound and accepted engineering practices and documented with appropriate quality control and quality assurance procedures. The facilities have been designed and constructed in two phases. Certification reports from the engineering design companies and constructors were reviewed to support this finding. The construction included use of appropriate materials compatible with the reagents and chemical production processes. The facility was constructed and is operated using automatic interlocks controlled from the plant control room to prevent releases during power or equipment failures. All cyanide production and storage is managed on concrete pads to prevent seepage to the subsurface. The facility employs the use of level indicators and high level alarms. Secondary containments for all cyanide process tanks and pipes are provided. All pipelines outside secondary containment are double walled and drained to a sump within secondary containment.

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

**in full compliance with**  
**The operation is**  in substantial compliance with **Production Practice 1.2**  
 not in compliance with

*Summarize the basis for this Finding/Deficiencies Identified:* The Cyanco facilities have developed and implemented an extensive set of procedures to prevent the accidental release of cyanide. The facility also has procedures for contingencies during upset conditions to prevent cyanide exposures or releases. The facility has been designed and constructed as “safe shut-down” plant in the event of process upsets. The facility has procedures that require annual review of standard operating procedures and if necessary updating. The facility has a systematic maintenance control program that is tracked on a plant wide computer system. Preventive maintenance activities are identified and tracked by authorized management and maintenance personnel. The entire production, storage and cyanide load-out systems are heavily

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instrumented and the operation automated. Calibration records indicate that the instrumentation is operated per manufacturers' recommendations. The entire facility is designed and operated as a "zero-discharge" facility including procedures to address cyanide contaminated stormwater collected in secondary containments. The facility has procedures for managing and disposing of cyanide contaminated solids that includes offsite disposal at approved facilities. The Cyanco production facility is a secure facility that prevents public access. Sodium cyanide product is stored outside in steel tanks to prevent potential build up hydrogen cyanide gas in confined areas and to prevent exposure of the product. Procedures dictate that the liquid cyanide be transported according to DOT requirements.

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

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

*Summarize the basis for this Finding/Deficiencies Identified:* The facility has an extensive mechanical integrity control program for all process vessels, tanks, piping and valves. Inspection frequency was found to be sufficient to assure the equipment is functioning within the design parameters. The plant and maintenance personnel document inspections of piping and tank vessels. These archived reports indicate inspection dates, inspectors involved and the results.


**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.*

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

*Summarize the basis for this Finding/Deficiencies Identified:* The facility has developed procedures that cover worker safety during product loading, maintenance, non-routine and emergency situations. The facility has procedures that require review of proposed process or operational changes to assure that appropriate worker protection measures are included. The facility does an excellent job of involving worker input to changes at the plant that may affect worker safety. Most SOPs define the role of worker participation in the decision making and evaluation of health and safety procedures. The facility uses fixed hydrogen cyanide monitors in the process area, the lab, and at the boundaries of the site to confirm that worker exposure to

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hydrogen cyanide is below limits. The monitoring equipment is maintained, tested and calibrated per the manufacturers' recommendations and records retained. Areas and activities have been identified for specific PPE requirements. The facility has a strict policy for using the buddy system on all operations that are considered potentially hazardous to assure that workers can communicate for needed assistance. Routine inspections are completed using radio contact with the control room. Other areas such as the cyanide load out area have video camera and radio contact with the control room. All employees are required to undergo an independent medical physical to evaluate their fitness for complete site duties. The facility has procedures that require appropriate clothing for operators, contractors and visitors depending on location and access to contaminated areas. The site has signage posted in appropriate areas to warn personnel of potential cyanide hazards and where protective PPE is required. The facility prohibits personnel from smoking, eating and drinking, and having an open flame in areas with the potential for cyanide exposure.

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


     **in full compliance with**

**The operation is**            in substantial compliance with      **Production Practice 2.2**

     not in compliance with

*Summarize the basis for this Finding/Deficiencies Identified:* The facility has developed a comprehensive emergency response plan and procedures to respond to cyanide exposures. The process and cyanide storage areas have low-pressure eye wash stations and showers in appropriate locations. Non-acidic fire extinguishers are used throughout the process plant and storage areas. The facility has water, bottled oxygen, cyanide antidote kits and radios to communicate emergency situations in the plant and product storage areas. The facility has specific procedures to regularly test and maintain first aid and emergency response equipment. MSDS and other first aid information are available in English for all workers. Inspection of the process plant and storage facilities indicated that cyanide tanks are labeled and piping is labeled to alert workers of flow direct and content. The facility has decontamination policies that apply to workers, contractors and visitors. The facility has trained employees to call for help and provide first responder care in the case of cyanide exposure including first aid, oxygen and if necessary, amyl nitrate. Ambulance personnel would administer additional antidote provided by Cyanco on the way to the hospital. Cyanco has developed procedures, communicated with the local ambulance and offsite medical facilities to assure that exposed workers would be treated during transport and cared for offsite. Cyanco has alerted the local medical facilities of this potential role in an emergency. In addition these local ambulance personnel have participated in exposure response drills. The drills provide valuable information and lessons learned that are incorporated into response planning. The facility has rigorous procedures in place to investigate and evaluate exposure incidents, including near misses.

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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.*

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

*Summarize the basis for this Finding/Deficiencies Identified:* The facility is designed and operated as a “zero-discharge” facility with no direct or indirect discharges of cyanide to surface waters or groundwater. The facility has down gradient monitoring wells that indicate that the facility is protective of identified beneficial uses of groundwater. Cyanco has a Class I Air Quality Permit that regulates the discharge of hydrogen cyanide to less than 1.0 pound per hour. This discharge limit was established based on modeling performed outside consultants and accepted by the regulatory agency. The facility limits atmospheric releases of hydrogen cyanide through the use of two gas incinerators. Monitoring frequencies are conducted adequately for air emissions and water quality to identify changes in a timely manner.


**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.*

**in full compliance with**  
**The operation is**  in substantial compliance with **Production Practice 4.1**  
 not in compliance with

*Summarize the basis for this Finding/Deficiencies Identified:* The facility provides new employee cyanide hazard training with annual refreshers. Training in the use of PPE and the activities and plant areas where PPE use is required is provided. The facility trains operators to perform tasks with minimal risk to worker health and safety. Over time the facility has revised this training to improve the effectiveness based on lessons learned from near misses or other incidents. The facility has identified and developed training for all necessary operator activities. All training is conducted by appropriately qualified operators and supervisors. The facility evaluates the training effectiveness through testing and task monitoring by supervisors.

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

**in full compliance with**

**The operation is**  in substantial compliance with **Production Practice 4.2**

not in compliance with

*Summarize the basis for this Finding/Deficiencies Identified:* The facility provides training in procedures for response to cyanide releases. The facility provides cyanide exposure first aid training and conducts drills to improve response skills. The results of the drills are evaluated to determine if the training programs are effective. The facility has maintained training records for all operators over the life of the plant operation.

**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.*

**in full compliance with**

**The operation is**  in substantial compliance with **Production Practice 5.1**

not in compliance with

*Summarize the basis for this Finding/Deficiencies Identified:* The facility has developed an emergency response plan to address cyanide releases at the plant, releases to surface water, and releases during transportation. The facility has evaluated potential failure scenarios appropriate for its site specific environmental and operating conditions. The plan addresses potential release scenarios and response actions.

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

**in full compliance with**

**The operation is**  in substantial compliance with **Production Practice 5.2**

not in compliance with

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*Summarize the basis for this Finding/Deficiencies Identified:* The facility has done an effective job with involvement of its workforce and stakeholders in the emergency planning process. The facility has worked extensively with the community on the nature of the risks and appropriate response actions. The facility has involved local emergency responders and medical facilities in the emergency planning and response process. The facility engages in regular stakeholder communication to assure the emergency response plans address current conditions and risks.

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

**in full compliance with**

**The operation is**  in substantial compliance with **Production Practice 5.3**

not in compliance with

*Summarize the basis for this Finding/Deficiencies Identified:* The facility has designated primary and alternate emergency response coordinators and response teams. The facility has provided appropriate training for these individuals. There is formal emergency call out procedures and 24 hour contact information. The emergency response duties and responsibilities have been defined for all coordinators and team members. Emergency response equipment has been listed and is readily available. The emergency response plan includes an inspection/maintenance plan and schedule for all emergency response equipment. The roles of outside responders and medical facilities in an emergency have been defined and the outside responders are aware of their involvement and have participated in mock drills.

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

**in full compliance with**

**The operation is**  in substantial compliance with **Production Practice 5.4**

not in compliance with

*Summarize the basis for this Finding/Deficiencies Identified:* The emergency response plan includes procedures and comprehensive listing of contact information including management, outside emergency responders, medical facilities, and regulatory agencies. Cyanco management is required to coordinate communications with the media and affected communities after the original notifications.

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

**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:* The emergency response plan describes the appropriate remediation methods for the clean up of cyanide spills within the secondary containments, soils, and appropriate response for surface water releases. The plan prohibits the use of chemicals within waterways. The plan addresses appropriate monitoring methods to identify the extent and effects of potential releases.

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

**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:* The emergency response plan is reviewed annually, and if needed, updates included. The facility conducts annual mock drills and considers the evaluation of the drills and lessons learned in the plan review process. Additionally, the plan is updated to reflect lessons learned from real cyanide release incidents.

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