



Cyanco Company, L.L.C.

Sodium Cyanide Solution Production Operations

ICMI Cyanide Code Re-Certification Audit

SUMMARY AUDIT REPORT

Submitted to:

International Cyanide Management Institute

1400 I Street, NW, Suite 550

Washington, DC 20005

USA





Name and Location of Operation: Cyanco Company, L.L.C.
5505 Cyanco Drive
Winnemucca, NV 89445

Audit Scope: Production of Sodium Cyanide Solution for the Gold Mining Industry

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Company Background Information:

Cyanco has production facilities in Winnemucca, Nevada and Alvin, Texas; distribution terminal operations in Cadillac, Quebec, Canada, Cheyenne, Wyoming, USA and Hermosillo, Sonora, Mexico. Cyanco also maintains offices in Montreal, Quebec, Reno, Nevada and Sugarland, Texas (corporate office).

Cyanco was originally certified to the International Cyanide Management Code (ICMC) as a Signatory Production Operation in October 2006. Re-certification audits were performed in 2009, 2013 and 2016. This audit is the fourth ICMC re-certification audit of the facility.

Description of the Operation:

Cyanco started producing sodium cyanide solution in 1990 in Winnemucca, Nevada. The plant was constructed for the purpose of providing this strategic chemical to the mining industry in northern Nevada. The plant is a zero-discharge facility. The original plant was designed to produce 28 million pounds of product annually. A second unit came online in 1997. Investments have been made in both units over the years to implement improvements and enhancements that debottleneck and increase production. Today, the two plants have a production capacity of over 240 million pounds annually. In early 2009 the Nevada operations achieved the 1-billion-pound production milestone. This represents approximately 60,000 loads of product delivered to mining customers in Nevada and surrounding states.

Cyanco's liquid sodium cyanide production facility is located approximately 7 miles west of Winnemucca, Nevada. The facility focuses on making 30% aqueous solution sodium cyanide specifically for use in the gold mining sector. The plant ships solution via tank truck and rail throughout North America via ICMC-certified Distribution Terminals in Cadillac, Quebec; Hermosillo, Sonora; and Cheyenne, Wyoming.

Cyanco produces solid sodium cyanide at a production facility in Alvin, Texas. This re-certification audit is limited in scope to the Winnemucca sodium cyanide solution production facility.

The Winnemucca Plant produces 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. The operation also ships product by rail to customers in Canada and Mexico. Cyanco contracts the truck delivery of the cyanide solution to the TransWood Winnemucca Terminal, a certified ICMC Signatory Company. The terminal is located several miles from the production facility.

At the time of the audit, the Winnemucca Plant was expanding its capacity to produce 35,000 metric tons of solid NaCN annually. The expansion is planned to be complete by year-end 2019.

This operation was confirmed to be in FULL COMPLIANCE with the International Cyanide Management Code.

Auditor's Finding

This operation is in full compliance with the International Cyanide Management Code.

This operation has not experienced any significant cyanide incidents, releases, exposures, or problems with ICMC compliance since the previous ICMC audit.

The operation was found to be in full ICMC compliance.

Audit Company:	CN Auditing Group
Audit Team Leader:	Bruno Pizzorni E-mail: ICMC@cnauditing.com
Date(s) of Audit:	July 22 - 23, 2019

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.



Signature of Lead Auditor

Audit Findings

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.

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 1.1?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

During the construction of cyanide production and storage facilities, quality control (QC) and quality assurance (QA) programs were implemented. QC and QA records have been retained, appropriately qualified personnel reviewed the facility construction and provided documentation that the facility was built as proposed and approved.

The Cyanco Plant was built in two phases (West Plant - 1990 and East Plant - 1996). The initial QA/QC records and certifications from professional engineers were evaluated during the 2006 Cyanide Code certification audit. The certification letters from the engineering firms were reviewed during the 2009 audit.

Changes to the operation since the previous ICMC audit were processed through the organizational Management of Change (MOC) process. The auditor reviewed QA/QC records and certifications from professional engineers, including material quality and welding

certificates. QA and QC documentation for the facility construction since the previous ICMC audit in 2016 was sufficient to conclude compliance with the Code requirements.

Materials of construction for the production facilities are compatible with reagents used and processes employed. This was confirmed during the audit. Cyanco maintains documentation showing approved materials for construction and maintenance activities. Records from the facility were reviewed to confirm that construction materials match those called for in the specifications.

Cyanco has automatic shutdown systems that will initiate if any of a series of process conditions is met. The plant interlock system automatically cuts off the flow of raw materials into the system and the equipment shuts down in the event of a process upset. An uninterruptible power supply (UPS) and an emergency power back-up system are maintained for the Distributed Control System (DCS) in case the facility loses power. The control room is manned 24 hours 7 days a week. The system is designed that in the event of a power failure or process upset, the default settings on the process equipment go to a “safe” position to prevent releases.

All process equipment and tanks are built on concrete that minimizes seepage to the subsurface. Each process and tank storage area is also within a secondary containment area and has process sumps that collect rainwater and any spills. The process sumps are either made of stainless steel or are lined with concrete. Loading, production, and storage areas are lined with an industrial engineered polymer material. The concrete surfaces were checked by the auditor and found to be in good condition. Inspection records for the facility confirmed that no concrete deficiencies exist at the facility.

The facility employs methods and devices to prevent the overfilling of cyanide process and storage vessels. Process indicators, ultrasonic high-level indicators and high-level alarms are placed in tanks and monitored continuously in the control room. Multiple interlock systems are in place and were found to be appropriate during the audit.

The operation has implemented procedures for routine testing and maintenance of the instrumentation installed on the cyanide process and storage vessels to ensure that the instrumentation is functioning properly to prevent overfilling.

All process instrumentation for the production and storage of cyanide at Cyanco has an annual preventative maintenance (PM) inspection to verify instrument span and functional test at a minimum. Some instruments are tested as frequently as every six months. All PMs are recorded in Cyanco’s database system.

Secondary containment areas for process and storage tanks are constructed of materials that provide a competent barrier to leakage. They are of sufficient size to hold a volume greater than that of the largest tank or vessel within the containment area, any piping draining back to the tank, and have additional capacity to allow for a storm event.

Spill prevention and containment measures are provided for all cyanide solution pipelines. Pipelines are over concrete or are managed with appropriate spill prevention programs. Cyanide-bearing pipelines are made of carbon or stainless steel and are part of the mechanical integrity program with defined intervals of inspection and thickness testing. Cyanide piping that is not over secondary containment areas is double piped with a PVC pipe surrounding the carbon steel pipe which would drain back into the secondary containment area in the event of a leak.

Production Practice 1.2:

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

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 1.2?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

Cyanco has plans and procedures that describe the standard practices necessary for its safe and environmentally sound operation. The procedures address operations and maintenance activities under normal, upset, and emergency conditions. The procedures use an effective tabular single statement format with the action verb bolded to make the document easier to use. Standard Operating Procedures (SOPs) have been developed and implemented in the Plant for those activities requiring risk controls. The auditor reviewed an extensive set of SOPs which included procedures for production and product storing activities.

Procedures for upset and contingency conditions have been developed and are available at the point of use at the operation. Standard operating procedures are used to systematically shut-down the two production plants if there is an upset condition. Operations personnel were interviewed, and their awareness level of emergency and contingency procedures was very good. The control room is manned at all times.

The facility has a Management of Change (MOC) procedure that is used to identify risks when site operating practices change from those of the initial design to any part of the operation. Records are primarily maintained in hard copy with physical sign-offs on any change made to processes or equipment. The Management of Change procedure requires sign-off by environmental and safety personnel, prior to implementation of proposed process and operational changes and modifications. Cyanco's MOC process requires that the Environmental Health and Safety (EHS) Manager approve all changes regardless of scope.

Preventive maintenance programs are implemented at the Plant, all maintenance activities are documented for equipment and devices related to cyanide production and handling.

The Mechanical Integrity Policy and Procedure were reviewed during the audit. Process equipment, tanks, and piping that contain cyanide are included in the mechanical integrity program. Maintenance procedures exist and a database called TabWare is used to manage work orders and maintain records to show that required maintenance and calibrations were completed. Preventive maintenance tasks include (among others) annual inspection of all external pipelines, and periodic tests of pipelines and critical equipment to assess their integrity, corrosion/erosion.

Process parameters are monitored with the necessary instrumentation. Instruments are calibrated according to manufacturer's recommendations. Interviews and a review of records confirmed that the process control equipment is continuously monitored by Control Room Operators and is inspected / calibrated regularly by the maintenance department. The work orders direct users to refer to the equipment manual for proper calibration or to set equipment to a determined point.

Procedures to prevent unauthorized/unregulated discharge to the environment of any cyanide solution or cyanide-contaminated water that is collected in a secondary containment area are in the SharePoint intranet and are implemented. As stated in the 2016 recertification audit reports, the Cyanco facility is designed to be a "zero discharge" facility, meaning that no process water or water collected in the secondary containment areas can be discharged to the environment. All process, loading, and storage equipment is in lined concrete secondary containment areas that are equipped with lined concrete or stainless-steel sump pit systems.

It is highly unlikely that water containing cyanide or cyanide solution will be discharged to the environment at this facility because of the many engineering design safeguards in place, most specifically the design of the facility piping.

The facility has environmentally sound procedures for disposal of cyanide - contaminated solids. The Hazardous Waste Management Policy and the Solid Waste Procedure describe in detail the different disposal methods used for the disposal of contaminated solids. Contaminated dirt and sludge are sent to a gold mine customer as a “product” so that the cyanide can be recycled. Other contaminated solids are treated as hazardous waste and are disposed of accordingly. Contaminated uniforms are laundered on-site.

Cyanco manages any waste streams of cyanide or cyanide contaminated solids in the following manner. Where possible, Cyanco recycle any excess or customer returned cyanide solutions within the production process. This recovery is considered reuse for intended purpose as the solution is part of the inherent process. When cyanide bearing dirt is collected on-site or removed from sumps or tanks, this material is sold to the customer as cyanide product through beneficial use practices established through the US EPA. When cyanide bearing solids are not capable of being sold to the customer, they are disposed of through an US EPA permitted Treatment, Storage, and Disposal Facility (TSDF). Final disposal methods are incineration and landfill using a Land Disposal Restriction approved landfill

All cyanide is stored in outdoor tanks, with atmosphere vents at top and overflow which allow for adequate ventilation to prevent the build-up of hydrogen cyanide gas. The tanks have air vents to the atmosphere. Atmospheric monitoring is done in accordance with permit requirements to ensure that atmospheric levels remain within permitted levels. The pH in the cyanide solution is maintained greater than 12.5 to prevent HCN formation. Rainwater cannot enter the tanks due to the tank construction.

The site has a secure fenced perimeter and access is prohibited. A gate crosses the main access road and visitors must be checked in via an intercom system. A chain link fence surrounds the Plant. Closed circuit TV surveillance cameras are in operation on the perimeter of the Plant.

Packaging is not used by this operation; the cyanide solution is only shipped to customers via Department of Transport (DOT) approved tanker trucks and Federal Railroad Administration (FRA) approved rail cars that are specifically designed for this type of transport. Cyanco has custom engineered tanks and trailers for the safe transport of sodium cyanide solution. The tankers have unique internal valves and safety features to ensure that, in the rare event of a truck turn over, no sodium cyanide solution will be released into the environment. Proper placards are used, and proper weight limits are observed for all jurisdictions through which the trucks must pass.

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

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 1.3?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

Cyanco Plant operators conduct routine visual inspections of tanks for structural integrity, signs of corrosion and leakage twice a shift (four inspections daily). Every five years tanks' wall thickness is tested. Thickness testing inspections of process equipment, tanks, and piping containing cyanide are performed according to API (American Piping Institute) guidance at defined frequencies as part of the mechanical integrity program.

Secondary containment areas are inspected quarterly for their integrity, the presence of fluids and their available capacity. The inspections also ensure that any drains are closed and, if necessary, locked, to prevent accidental releases to the environment.

Pipelines, pumps and valves are inspected for deterioration and leakage. Like tank inspections, these inspections are conducted by the plant operators twice a shift (four inspections daily). Thickness testing inspections of process equipment, tanks, and piping containing cyanide are performed according to API (American Piping Institute) guidance at defined frequencies as part of the mechanical integrity program.

Inspection frequencies were deemed to be sufficient to ensure that equipment is functioning within design parameters. In addition to regular inspections, equipment shutdowns are conducted at least annually.

Inspections are documented and show the date of the inspection, the name of the inspector, and any observed deficiencies. An overall action list is generated from the quarterly equipment inspections. Issues that are readily resolved are noted as such on the inspection report. Work orders are opened for issues that require corrective maintenance actions.

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.

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 2.1?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

Cyanco has developed an extensive number of procedures to minimize worker exposure during normal plant operations from receipt of raw materials through finished product packaging and shipping. Worker exposure to cyanide is minimized through properly engineered systems, the use of detailed standard operating procedures, and proper use of Personal Protective Equipment (PPE) where necessary. The auditor reviewed a variety of SOPs including the procedures: Sodium Cyanide Tanker Loading Outside Functions and SOP NaCN Railcar Loading. SOPs have actions verbs indicating one step at a time.

The facility has developed SOPs for non-routine and emergency operations to be performed by trained personnel wearing protective gear that is inspected regularly. Emergency procedures are defined in the site emergency response plan. Shut down procedures that are used for emergency and non-emergency situations.

Maintenance procedures exist for repetitive tasks that have the potential for worker exposure to cyanide. PPE requirements and safety precautions are defined. Hazardous and non-routine tasks such as confined space entry require the use of work permits to ensure that they are only performed safely.

The facility implements procedures to review proposed process and operational changes and modifications for their potential impacts on worker health and safety which include the necessary worker protection measures. The Management of Change (MOC) and Pre-Start-Up-Safety Review (PSSR) procedures are used to evaluate the potential safety, health, and environmental impact of proposed and implemented operational changes and modifications. PSSRs are used prior to putting new equipment on-line or in service.

Cyanco solicits and considers worker input in developing and evaluating health and safety procedures. Operators and engineers are involved in the MOC and in the pre-start up safety reviews. During weekly safety meetings and in the information meetings the facility gives the workers the opportunity to provide input on improving work procedures (among other topics). They are also involved in process hazard analyses. Interviews during the audit confirmed this practice.

The facility uses monitoring devices to confirm that controls are adequate to limit worker exposure to hydrogen cyanide (HCN) gas and sodium cyanide dust to 4.7 parts per million or less, as cyanide. Stationary HCN monitors are used in outdoor areas that have the potential for having elevated cyanide levels, for example, near the reactor (2 monitors separate). HCN monitors have an alarm point set at 4.7 and 10 ppm. The alarms are monitored in the control room. Portable HCN multi-gas monitors are also available for use. Additionally, two fixed atmospheric HCN monitors are located on the plant perimeter, one at the northeast side of the plant and the other on the south side. Both are monitored from the control room. These monitors take continuous measurements to ensure adherence to permit requirements and the protection of human health.

At Cyanco's plant all alarm at 4.7 ppm will require personnel to evacuate the area and assess the situation remotely via cameras. If they have to send a human in to evaluate the situation, they would use a self-contained breathing apparatus (SCBA) and enter the area with another person with an SCBA as back-up. The 10-ppm alarm is only for the perimeter alarms that are mandated by Cyanco's operating permit. This requirement states that if 10 ppm is reached at the fence line, they are to alert the Humboldt County Sheriff via automated phone call.

Cyanco maintains, tests and calibrates the HCN monitoring equipment as directed by the manufacturer. The stationary HCN monitors are part of the computerized maintenance system that ensures they are maintained, tested, and calibrated on a monthly basis. In addition, these fixed HCN monitors are calibrated with calibration gas on a quarterly basis. The personal HCN monitors and multi-gas monitors are calibrated every day before use with an automatic bump test calibrator. The calibration program is aligned with manufacturer recommendations.

Operations where the risk of cyanide exposure may be elevated have been identified and PPE requirements have been defined. Exposure risks at this facility are generally limited to potential exposure to cyanide solution, potential exposure to hydrogen cyanide gas during some maintenance activities such as confined space entry, and potential exposure to hydrogen cyanide gas during sampling. PPE requirements are clearly defined for all tasks. Enclosed spaces in which cyanide is handled have stationary HCN monitors that are monitored by the control room operator. Atmospheric levels of HCN gas are tested prior to any confined space entry or similar maintenance activity. Work permits are used for these types of tasks to ensure that the area is safe, and that proper PPE is being utilized.

At Cyanco the buddy system is used for all tasks that are potentially hazardous. Personnel who are in the process area are in radio contact with the control room operator at all times. Truck and rail loading operations use a modified buddy system. The control room operator is in visual contact with the field operator via video camera and is in constant radio contact as well. The control room operator participates actively in the loading of the trucks or rail cars and has the ability to shut down the loading operation and call for help in the event of an emergency.

The facility evaluates its employees' health upon hire and periodically thereafter. Health exams are used to evaluate the employee general health and confirm fitness for duty. Personnel who may need to wear respirators undergo fit testing to confirm that they can safely do so. An annual spirometry test is performed for who wear respirator protection.

The facility has a clothing change policy for employees, contractors and visitors to areas with the potential for cyanide contamination of clothing. Employees are issued uniforms that must stay at Cyanco. These uniforms are not to be worn home, they are to remain at the facility and be laundered at the Plant. The auditor confirmed clothing is washed on-site. Procedures state that dirty contaminated clothes are a menace and are to be changed and decontaminated. Workers have to take a shower upon removing contaminated clothing before putting on fresh clothing. Visitor PPE requirements are limited to hard hat, side shield safety glasses and safety shoes for general operations areas, procedures call for the washing of hands after being in chemical areas and that any clothing that comes into contact with chemicals must be decontaminated prior to leaving the facility.

Warning signs that advise workers of potential hazards due to the presence of cyanide and that suitable personal protective equipment must be worn are posted in diverse places. There is also signage around the facility reminding personnel that eating, drinking and smoking is prohibited in the process areas. Other signs limit access to the production area and require that visitors enter through the main office.

Eating, drinking, smoking, and having open flames are prohibited at the Plant where there is a potential for cyanide contamination. Employees showed very good awareness of the restrictions and of the potential dangers of not following the rules. Eating is allowed in a designated lunchroom area and in offices. Smoking is restricted to a designated smoking area.

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

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 2.2?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

Cyanco maintains a written Emergency Response Plan. The Plan is reviewed regularly with its most recent revision having occurred in July 2018. It describes Cyanco's Emergency Response Plan for its sodium cyanide production operations located in Winnemucca, Nevada and for emergencies that may occur during the transporting of sodium cyanide solutions from Cyanco to its customers. Transportation related emergencies will be responded to in an advisory manner.

The objective of the Plan is to have systems in place that provide for staffing, communication, training, and equipment to prevent and, if needed, respond to emergencies at Cyanco's Plant and during the transport of sodium cyanide solutions from Cyanco to its customers.

Showers, low-pressure eye wash stations and non-acidic fire extinguishers are at strategic locations throughout the facility. They are maintained and inspected on a regular basis. Industrial combination shower/low-pressure eye wash stations are located throughout the facility (approximately 33 units). The Plant has heated and unheated portable unit shower/eye stations. ABC dry chemical fire extinguishers are located in production areas and any areas that potentially have cyanide in them. Safety showers and eyewash stations are tested weekly. Fire extinguishers and fire suppression systems are tested monthly. Additional emergency response equipment is also inspected on a monthly basis. Records are posted online so that management can monitor the posting of inspection results and ensure that inspections are being performed as planned.

The facility has water, oxygen, resuscitator, antidote and a means of communication readily available at strategic points in the Plant. The antidote on hand is a CyanoKit (hydroxocobalamin) with four doses and is located in the control room. One person on the plant site is trained to administer the antidote. If this person is unavailable, then the Plan calls for the antidote to be administered by an external emergency responder (Humboldt Hospital Ambulance Corps). Oxygen is located in the control room and the emergency response trailer. The antidote and oxygen are checked as part of the monthly inspection. The plant has a primary well and a back-up well which pumps continually to the water line. The back-up well has a propane powered emergency engine in case of a power outage. The Plant has set channel 1 on the two-way radios and cellphones for emergency communication.

Cyanco inspects its first aid equipment regularly to ensure that it is available when needed. Workers in charge of inspections are electronically notified on a tablet when it is time to perform an inspection. First-aid and emergency response equipment is stored and tested as directed by their manufacturers and replaced on a schedule that ensures they will be effective when used. Emergency equipment is inspected on a monthly basis. Emergency response equipment is stored and tested according to manufacturer's recommendations.

Safety Data Sheet (SDS) and first aid procedures on cyanide are available to workers. SDS sheets are available in the control room and on the company SharePoint intranet. First aid procedures are contained in the Emergency Response Plan. All employees speak English.

Storage tanks, process tanks, containers and piping containing cyanide are properly identified to alert employees of their contents. All piping observed during the audit was very well marked and showed the direction of flow.

The facility has decontamination procedures for employees, contractors and visitors leaving areas with the potential for skin exposure to cyanide. Decontamination procedures for employees are outlined in the Emergency Response Plan and Contractor decontamination procedure. The decontamination procedure for skin contamination calls for 15 minutes under a safety shower. This is taught during Cyanide Safety Class.

Cyanco has its own on-site capability to provide first aid or medical assistance to workers exposed to cyanide. The Plant has an Emergency Response Team (ERT) that provides first aid assistance to workers who may have been exposed to cyanide. All employees receive training in cyanide safety which includes first aid procedures for cyanide exposure. All employees in process areas are trained to administer oxygen. All administrative employees and at least 95% of plant personnel are trained in First Aid and CPR. One person on the Emergency Response Team (ERT) is qualified to administer the antidote. If this person is unavailable, then emergency personnel (ambulance) will administer the antidote.

Two complete first aid bags are available. One is in the control room and the other is in the emergency trailer. These bags contain among other items, oxygen, blood pressure monitor, resuscitator and CPR equipment. The ERT has a variety of protective suits available for chemicals emergencies such as encapsulated B type suits.

The facility has developed procedures to transport exposed workers to a locally available qualified offsite medical facility, the Humboldt General Hospital. The Emergency Response Plan (ERP) calls for the decontamination of a cyanide exposure victim prior to transport. The Plant has been in contact with the local hospital, Humboldt General Hospital. The Plant is confident that hospital personnel are capable of treating cyanide exposure victims. The hospital is a ten minute drive away. The operation is located in a mining community and local hospitals and emergency personnel are qualified to treat cyanide exposure victims. The ERP states to call 911 in case of an accident so an ambulance will be dispatched.

The Plant has alerted Humboldt Hospital of the potential need to treat patients for cyanide exposure. The operation is confident that the medical facility has adequate, qualified staff, equipment and expertise to respond to cyanide exposures. Communication and training are done every 2 years with local emergency responders and Humboldt Hospital.

During the recertification period 2016 – 2019 several mock emergency drills were conducted by Cyanco at the Plant. The operation conducts mock emergency drills, holds a drill critique, and evaluates the need for further training or adjustment to the emergency procedures each year. The drill reports were evaluated and were found to be effective. Mock drills conducted during this ICMC recertification period simulated cyanide exposure and cyanide spill incidents.

Cyanco has the “Incident Reporting and Investigation Procedure” implemented in place to investigate and evaluate incidents, including cyanide related incidents, to determine if the facility’s programs and procedures to protect worker health and safety and to respond to cyanide exposures are adequate or need to be revised.

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.

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 3.1?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

The facility does not have a direct or indirect discharge to surface water, the operation is a “zero discharge” facility. The nearest surface water is the Humboldt River which is located about one mile south of the Plant.

WAD cyanide concentrations in groundwater are at compliance points down gradient of the facility and below levels that are protective of identified beneficial uses of the groundwater. Quarterly monitoring of groundwater BWPC permit NEV89024 was reviewed. Three groundwater monitoring wells are located at the site. The auditor reviewed groundwater monitoring analytical records from Western Environmental Testing Lab covering the recertification period, resulting in ND (Not Detected). Tests are for Total Cyanide Method SM 4500 CNC. There are two monitoring points at the production wells and three at the monitoring wells, as required by the water authority.

Cyanco limits atmospheric process emissions of HCN gas so that the health of workers and the community are protected. Stationary atmospheric cyanide monitors CEM (Continuous Emissions Monitoring System) are used to perform air monitoring at the site perimeter, as required by the site air quality permit. The amount of cyanide released to the atmosphere is a calculated value using an emissions factor together with production volumes. Since the previous ICMC audit no air permit excursions have happened. Air and groundwater monitoring is done in accordance with state permitting requirements and was found to be appropriate. Fixed cyanide gas monitors in the process areas are used at the site. All are monitored by the control room operator through alarms that are part of the Distributed Control System (DCS).

The facility monitors for cyanide in ground water up-gradient and down-gradient of the site. Several examples of groundwater monitoring data were reviewed during the audit. Three monitoring wells are located at the site. Monitoring well #1 is up-gradient of the production area, wells #2 and #3 are down gradient of the production area. No cyanide has been detected in the wells. There is no surface water near the site.

Monitoring is conducted at frequencies adequate to characterize the medium being monitored and to identify changes in a timely manner. Groundwater is monitored quarterly. Air is continuously monitored at the site perimeter and is annually measured at the stack. Emission reports are also calculated quarterly based on production volumes. All monitoring is done in accordance with permit requirements.

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.

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 4.1?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

The facility trains its workers to understand the hazards of cyanide and refresher training is conducted periodically. Cyanco has a Training Policy and a formal training program that includes cyanide safety training prior to the start of work, cyanide delivery procedures, incident reporting and investigation, hazard communication, portable HCN gas monitors, first aid, waste management and annual refresher training.

The facility train its workers in the use of personal protective equipment on when and where this equipment is required, as part of the safety training and again during the on-the-job training done by supervisors. Tests are given and employees are observed to determine that they thoroughly understand PPE requirements and the proper use requirements prior to starting work in an area with potential exposure to cyanide.

The facility trains its workers to perform their normal production tasks with minimum risk to health and safety and in a manner that prevents unplanned cyanide releases. Employees are trained to perform normal production tasks on each SOP of their job assignment to minimize risks to personal safety and the environment. Personnel are trained procedure by procedure and tests are given to confirm competence. On-the-job training is also given with supervision by experienced workers. Safe operating procedures and cautionary statements can be found throughout the documents used to operate the Plant.

The training elements necessary for each job are identified in the training materials. A training curriculum exists for each job type. The Safety Technician manages all safety-related training requirements. The Shift Supervisor ensures that personnel are given on-the-job training on specific job tasks and that tests are given. The identification and fulfillment of safety training needs was found to be especially strong.

All employees are trained prior to allowing them to work with cyanide. Training is provided by appropriately qualified personnel. Experienced employees, professional trainers, or supervisors administer training to employees. The supervisor leads the training and then it is continued by an experienced operator. Trainers were found to be appropriately qualified and competent.

The operation requires extensive training prior to allowing employees to work with cyanide. All records reviewed showed that training occurred immediately upon hire. Interviews with operators confirmed this practice.

The facility evaluates the effectiveness of cyanide training by testing and observation by a qualified person. Records reviewed for employees hired between 2016 and 2019 were readily available and showed conformance to internal procedures.

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

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 4.2?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

Cyanco trains its workers in the procedures to be followed in a case of a cyanide release is discovered. This is part of the cyanide safety training and the training on the Emergency Response Plan (ERP). Each SOP indicates the necessary pre-requisite training. The facility trains workers in HAZOP awareness and operation. If a worker were to see something spill, they know they must issue an alert. Emergency response drills are also conducted to ensure that the Emergency Response Team fully understands its responsibilities and refreshes its skills. Interviews were conducted and training materials were reviewed.

Cyanco trains its workers to respond to worker exposure to cyanide, and routine drills are used to test and improve their response skills. The Plant performed several mock drills during the recertification period to test and improve their response skills. Employees are trained on how to respond to a worker exposure to cyanide and drills are conducted annually to ensure that the Emergency Response Team refreshes its skills.

Emergency drills are evaluated from a training aspect to determine if personnel have the knowledge and skills required for effective response, and training procedures are revised if deficiencies are identified. Critiques are conducted after each drill. All deficiencies are discussed, including training needs. Emergency procedures are revised as necessary.

Detailed training records are retained in each employee file documenting the training they have received and including the names of the employee and the trainer, the date of training, the topics covered, and how the employee demonstrated an understanding of the training materials. Training tests records were sampled during the audit.. Records are maintained for at least as long as the employee works at the site. All records pertaining to cyanide safety were sufficiently detailed to be found compliant to Cyanide Code and internal requirements.

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.

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.1?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

The facility has developed an Emergency Response Plan (ERP) to address potential releases of cyanide that may occur on site or may otherwise require response. Cyanco maintains a detailed emergency preparedness program, ERP, and the Safety Manual Emergency Response Team Handbook SM-23 to address the potential release of cyanide during an on-site or off-site incident. The plan is revised biennially. The ERP is available on the company's intranet, in hard copy on-site and is also maintained in the truck of the On-Call Manager and with TransWood, the transportation company.

The Plan considers the potential failure scenarios appropriate for its site-specific environmental and operating circumstances, including catastrophic release of hydrogen cyanide. Liquid sodium cyanide soda may be released from the primary containment area due to leaks or failures of storage or process tanks, piping or related valves and pumps. Releases of sodium cyanide solution could also be released during loading of tankers or rail cars. Cyanco has engineered its plant and maintains its facilities to minimize the potential for such releases and to contain them if they do occur.

As stated in Cyanco's ERP, a release of a significant amount of gaseous hydrogen cyanide from the production unit is extremely unlikely because the production process is designed to shut down if the integrity of the reactor is compromised. If this were to occur, evacuation alarms would sound, and personnel would be advised to move upwind of the release. No impact on the local community would occur because the small amount (less than 2 to 7 pounds per plant) of gaseous hydrogen cyanide within the system at any given time would quickly disperse to safe concentrations before it could reach the nearest human receptors.

Liquid sodium cyanide may also be released during loading and transportation operations. Such releases could occur on the plant site after loading a truck or railcar, or along the delivery route due to equipment failure or accident. Releases during transport would generally be to the road surface and/or to soil; it could also be to surface water if the event occurred near a surface water body.

Systems at Cyanco designed for producing, loading or offloading, storing, or transporting cyanide have been engineered to prevent corrosion or other types of deterioration that could result in a release. Ongoing preventive maintenance is performed on chemical handling systems to prevent and/or detect leakage. Cyanide truck loading stations are equipped with emergency break-away devices designed to stop the release of product if a trailer is moved from the station while being loaded/unloaded.

Secondary containment systems are in place at the East and West Plants, the product storage and handling area, and loading/offloading terminals. Containment systems typically include catchment systems constructed of concrete or other appropriate materials and engineered sumps with pumps to transfer any chemicals to storage tanks. Active fixed gas monitors are present where the potential for HCN gas is greatest.

Regarding releases during fires and explosions, the ERP states that any fire or explosion that threaten the process areas or supporting utilities constitutes an emergency. Employees are trained in the use of portable fire extinguishers and they will respond within their capabilities as outlined in the training. In most cases, if a fire or explosion directly affects the process, an automatic process trip will ensue.

Potential failure scenarios due to pipe, valve and tank ruptures, appropriate for its site-specific environmental and operating circumstance, area also considered in the Emergency Response Plan. The ERP states that liquid sodium cyanide soda may be released from primary

containment due to leaks or failures of storage or process tanks, piping or related valves and pumps. As noted in Section 13.2 of the Plan, systems at Cyanco have been engineered to prevent corrosion or other types of deterioration that could result in a release. Ongoing preventive maintenance is performed on chemical handling systems to prevent and/or detect leakage.

Storage systems include properly designed and constructed piping systems, storage tanks, and primary and secondary containment. Environmental monitoring is ongoing to detect potential leakage under on-site storage systems. Secondary containment systems are also in place at the East and West Plants, the product storage and handling area, and loading/offloading terminals. Containment systems typically include catchment systems constructed of concrete or other appropriate materials and engineered sumps with pumps to transfer any chemicals to storage tanks.

For power outages and equipment failures, the criteria for emergency response in the ERP, states that, in most cases, a power outage will not constitute an emergency. The Plant is designed to fail to a safe operating condition when the incoming power is disrupted. In the event of evidence indicating ongoing process upset conditions following a disruption of power the Board Operator should consider “punching out” either or both effected processes.

Overtopping of ponds, tanks and waste treatment facilities area considered in the Emergency Response Plan. At the Plant, sodium cyanide may be released from primary containment due to leaks or failures of storage or process tanks. Due to the plant’s design, any releases of liquid sodium cyanide from process and storage facilities in the plant (i.e., tanks, pipes, valves or pumps) will be within secondary containment areas. Once the release was halted, and any victims within the affected areas have been removed to a safe location and given first aid, plant personnel wearing the necessary personal protective equipment would wash the released solution into a sump inside the containment for recovery back to the production circuit or appropriate storage tank.

The Plan describes specific response actions, as appropriate for the anticipated emergency situations, such as evacuating site personnel and potentially affected communities from the area of exposure, the use of cyanide antidotes and first aid measures for cyanide exposure, control of releases at their source, containment, assessment, mitigation and future prevention of releases.

The ERP includes instructions for the evacuation of site personnel and for notifications to the community and/or State agencies, depending on the type of emergency. There are no communities immediately adjacent to the site that would require evacuation.

The use of the cyanide antidote and first aid measures for cyanide exposure are addressed in the Plan. Although all employees are trained to decontaminate the victim and administer oxygen, just one person is trained to administer the antidote. The site relies on emergency response personnel from the local hospital (7 miles away) if this person is unavailable.

To control a release at the source, the Plan discusses the role of the Control Board Operator who has the ability to shut down the operation using an emergency switch in the event of a significant release event.

Containment and mitigation measures are also described in the plan in the event that the cyanide spills out onto the ground an earthen dike is to be constructed if possible. The contact information for a remediation firm is also in the plan if there is a release which cannot be managed internally.

In the event of a cyanide release than cannot be managed by site personnel, Patriot Environmental Services is contracted to provide remediation assistance to Cyanco. Generally, cyanide releases outside of containment can be recovered by the remediation firm and the contaminated solids cans be sold to a customer as product. The off-site releases would also be managed very similarly as the on-site releases however the contaminated solids would have to be disposed of at a Hazardous Waste Treatment, Storage and Disposal Facilities (TSDF) since they would likely be contaminated with debris that a mine site cannot manage such as trash, vegetation, roadbed, etc.

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

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.2?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

The facility has involved its workforce and stakeholders, including potentially affected communities, in the emergency response planning process. Cyanco Environmental, Health, and Safety (EH&S) staff are involved in the Local Emergency Planning Committee (LEPC) in Winnemucca. The EH&S Manager regularly meets with stakeholders. Records of community and emergency planning activities were available for each year since the previous ICMC audit. Stakeholders included people from Humboldt General Hospital, mining customers, Humboldt County School District, Humboldt County Commission, Bureau of Land Management, and the City of Winnemucca.

The facility has made potentially affected communities aware of the nature of the risks associated with accidental cyanide releases, and consulted with them regarding the communication and response actions. Cyanco Safety and Health Staff are involved staff are involved in the LEPC in Winnemucca. The EH&S Manager regularly meets with stakeholders.

The facility has made potentially affected communities aware of the nature of the risks associated with accidental cyanide releases, and consulted with them regarding the communication and response actions. Cyanco Safety and Health Staff are involved in the LEPC in Winnemucca. The EH&S Manager regularly meets with stakeholders. Records of community and emergency planning activities were available for each year since the previous ICMC audit.

The operation is in regular communication with stakeholders to ensure that the Plan addresses current conditions and risks. Cyanco Safety and Health Staff are involved in the Local Emergency Planning Committee (LEPC) in Winnemucca. The EH&S Manager regularly meets with stakeholders. Records of community and emergency planning activities were available for each year since the previous ICMC audit.

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

The Emergency Response Plan designates primary and alternate emergency response coordinators with explicit authority to commit the resources necessary to implement the Plan.

The Control Board Operator is the Incident Commander during any emergency until relieved by a Lead Operator or an authorized member of management. The Plan identifies the

Emergency Response Team members which are designated in a red font on the Quick Reference contact list sheet that is part of the ERP binder.

The Plan requires appropriate training for the emergency responders. Training requirements for the Emergency Response Team are defined in a training matrix document entitled “Safety Training Requirements” and in the “Emergency Response Team Handbook.” All Emergency Responders receive formal hazardous materials training and training in the Cyanco Emergency Response Plan. For chemical releases, the Hazardous Materials Technician would play a primary role (reference page 16 of Handbook). This individual is required to take a 24-hour certified training course. Safety training at Cyanco was found to be very well organized and records were readily retrievable in a computer database and in hard copy files.

The Plan includes call-out procedures and 24-hour contact information for the coordinators and response team members. Call-out procedures are detailed in the Plan and 24-hour contact information is on the Quick Reference sheet. Emergency Response Members also stated that all emergency numbers are programmed into their cell phones.

The duties and responsibilities of the team members and the emergency coordinators are clearly defined in the ERP. Cyanco’s safety manual section 23 outlines the requirements and defines how the emergency response team will respond to emergencies outlined in the ERP. Team members were interviewed, and awareness of roles and responsibilities was very good.

Emergency Equipment that is necessary is listed in general terms in Section 18 of the ERP and in more detailed terms in the Emergency Preparedness Plan and the Monthly Checklist that is used to inspect the equipment.

The Emergency Response Plan lists all emergency response equipment that should be available. The Emergency Equipment is inspected regularly, at least monthly. Most of the equipment is maintained in two trailers that can be used either on or off-site. Equipment was found to be well organized and in excellent condition.

The Plan describes the role of outside responders, medical facilities or communities in emergency response procedures. Call numbers for outside responders are contained within the Plan, but roles are not stated in detail. Cyanco does, however, participate in combined drills with the transportation company, mine sites and local responders to ensure that roles between organizations are understood.

Drills are performed with the transportation company, mine customers, and outside responders to ensure that all entities understand their role in responding to an emergency.

Cyanco has requested that local emergency response agencies be called upon in an emergency onsite. Since these agencies have specialized training in fire, medical response transportation and law enforcement, they will be utilized to respond according to their training. If an offsite emergency requires Cyanco's personnel expertise, those personnel will be made available in a support/liason role pursuant to their level of training.

The Plan states that Plant personnel should meet non Cyanco emergency responders at the plant battery gate and provide information and assistance as necessary. At no time should non-essential personnel be admitted to the facility or non-emergency response personnel. When necessary, a plant employee should be stationed at the entrance gate to screen response personnel and communicate with them where they should proceed if their response is necessary.

Emergencies occurring during transport may require the involvement of outside agencies and response personnel. Cyanco has a contract in place with Patriot Environmental Services specific to sodium cyanide response. Cyanco management will determine if a given incident requires activating the Patriot plan. Patriot contact information is included in Appendix A of the Emergency Response Phone List. If a cyanide tanker is involved in an accident, the Cyanco management staff will determine the level and extent of the response. The level of response will be determined by many factors including availability of Patriot Environmental Services.

Cyanco may contract with Patriot Environmental Services or another commercial remediation or waste management contractor for remediation services.

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

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.4?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

The Plan includes procedures and contact information for notifying management, regulatory agencies, outside response providers and medical facilities in the case of an emergency. The ERP has a list of internal and external stakeholders that need to be notified depending on the nature of the emergency. The call lists include numbers for management, regulatory agencies, outside responders, and medical facilities. Appendix B of the ERP – Media Relations and Crisis Communications – gives additional guidance and information with regards to communications with external stakeholders.

The Plan includes procedures and contact information for notifying potentially affected communities of the incident and response measures and for communication with the media. The ERP has a list of external stakeholders that need to be notified depending on the nature of the emergency. The call list include numbers for regulatory agencies in Winnemucca, Nevada, and surrounding states. Appendix B of the ERP – Media Relations and Crisis Communications – gives additional guidance and information with regards to communications with external stakeholders.

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

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.5?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

The Plan describes specific remediation measures for recovering and neutralization of solutions, decontamination of soils or other contaminated media, management and disposal of spill clean-up debris, and provision of an alternate drinking water supply. Section 13.4 of the ERP discusses the steps to be taken in the event of a cyanide release to ground or water. Neutralization of soil is discussed, although the plan also lists the name and telephone number of a commercial remediation management contractor who would be called to assist with any large-scale remediation effort. The hazards experienced with a cyanide release to water are also discussed in the Plan.

When hydrogen peroxide is chosen for treatment, this solution is stored in chemical storage areas away from the production process to prevent inadvertent mixing in the field. These are stored in 55-gallon quantities to limit potential significant releases from inadvertent mixing.

The treatment chemicals are to be prepared to the appropriate concentrations – hydrogen peroxide when used for decontamination is diluted from 30% to 15% by mixing 1 to 1 in spray bottles or garden sprayers.

Regarding the end point of the remediation – nothing specific is listed in Cyanco’s ERP for this activity, however as stated the EH&S Manager, they would target meeting drinking water standard for final concentration in the soil. Grab samples would be taken from the area using a grid pattern found to have a wetted front. Each soil sample would be leached with de-ionized water and they would be analyzed using Hach CY3 analytical method with a spectrophotometer. Final concentration in residual soil as evidence that the release has been completely cleaned up – would target the drinking water standard of <0.2 mg/l.

Contaminated materials that cannot be recycled within the process or sold as beneficial use would be sent to a Hazardous Waste Treatment, Storage and Disposal Facilities (TSDF) for treatment using incineration and land disposal restrictions (LDR) landfill disposal. A certification from the TSDF would be provided proving the wastes were treated properly. Typically, Cyanco would not deactivate cyanide solutions when released from containment on-site. Cyanco’s ERP (PO-01) Section 13.4 outline that they would attempt to recover all liquids and return to the process and send any soils to customers through beneficial use. It does cover language about sending the material to a TSDF as an alternative to recycle when necessary. As for treatment chemicals, they would store those chemicals remote from the cyanide storage areas however they do have some treatment chemicals available to spot clean tools when contaminate during remediation. They have specific language in their ERP that forbids use of hydrogen peroxide when cyanide gets into water systems unless confined in a specific location. They do not specifically call out the final concentration for remediation however their previous practice is to ensure the concentration that is leached from the soil

would meet the drinking water standard of <0.2 mg/L. They could not find a specific standard perhaps because any present is considered hazardous from the perspective of the EPA.

Section 13.4 of the ERP prohibits the use of sodium hypochlorite and other treatment chemicals in surface water. The plan does allow consideration of chemical detoxification if the water body is contained. Interviews clarified that this was meant to allow for the decontamination of water in a ditch or similar situation.

The Plan prohibits the use of chemicals such as sodium hypochlorite, ferrous sulfate and hydrogen peroxide to treat cyanide that has been released into surface water. The Plan addresses the need for environmental monitoring to identify the extent and effects of a release, and includes sampling methodologies, parameters and possible locations. Section 13.4 of the Plan explains the methods that would be used to determine the extent of contamination in soil. Additional details regarding monitoring and sampling methods are noted in the Safety Manual Emergency Response Team Handbook.

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

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.6?

- Full Compliance
- Substantial Compliance
- Non-Compliance

Explain the basis for the finding.

The Plan includes provisions for reviewing and evaluating its adequacy on an established frequency. Section 6 of the ERP calls for the plan to be reviewed biennially to evaluate its adequacy, however they will make revisions when necessary since the plan may become obsolete when systems are changed.

Mock emergency drills area conducted periodically as part of the Plan evaluation process. Cyanco conducts periodic emergency drills, holds drill critiques, and evaluates the need for further training or adjustment of the emergency procedures. Records were available to show that drills with external stakeholders were conducted during the recertification period. The emergency plans were evaluated and revised as necessary in response to drill critiques and incidents since the previous ICMC audit.

There are provisions to evaluate the Plan after any emergency that required its implementation, for revising it as necessary and such reviews have been conducted. The Plan is to be evaluated and revised, if necessary, after any emergency that required its implementation. Cyanco conducts emergency drills, holds drill critiques, and evaluates the need for further training or adjustment to the emergency procedures. Records were available to show that drills with external stakeholders were conducted. The emergency plans were evaluated and revised as necessary in response to drill critiques and incidents.