



# ***INTERNATIONAL CYANIDE MANAGEMENT INSTITUTE***

## ***Cyanide Production***

## ***Verification Protocol***

### ***For The International Cyanide Management Code***

[www.cyanidecode.org](http://www.cyanidecode.org)

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## INTRODUCTION

This Verification Protocol is used by a third-party auditor in assessing whether a cyanide production operation of a Signatory to the International Cyanide Management Code is adhering to the Code. It may also be used to demonstrate that the cyanide production practices of a non-Signatory operation are conducted in a safe and environmentally protective manner.

The specific facilities to be reviewed under this protocol are those that produce the cyanide product(s) used in the gold mining industry; solid and liquid sodium cyanide, calcium cyanide or potassium cyanide. Production of precursor chemicals such as hydrogen cyanide is to be evaluated only when they are produced primarily as part of the manufacturing of alkaline metal cyanides for use in gold mining. Facilities where hydrogen cyanide is stored prior to its use in the production of alkaline metal cyanides, and where alkaline metal cyanides are packaged, stored, loaded or off-loaded, dissolved or otherwise managed prior to their delivery to a gold mine are the subject of this Protocol.

Facilities that produce and sell hydrogen cyanide to other chemical manufacturers, or which produce hydrogen cyanide as a precursor primarily for their own production of other chemicals, are not the subject of this Protocol.

In order to be certified, a gold mining operation undergoing an International Cyanide Management Code audit must purchase cyanide from a producer that has demonstrated that it operates in a safe and environmentally protective manner. The cyanide producer can make this demonstration by becoming a Code signatory and having the operation certified under the Code. The cyanide production operation is certified if an independent third-party auditor meeting the International Cyanide Management Institute's criteria and using this Cyanide Production Verification Protocol (or otherwise addressing all the questions and issues included in this Protocol within an audit) finds that it is in Full Compliance with the Code. A cyanide production operation found in substantial compliance with the Code is conditionally certified subject to implementation of a Corrective Action Plan to correct the deficiencies, as discussed below.

A cyanide producer that is not a Code signatory also can make the necessary demonstration through a third-party audit of its operations. For such an audit to be acceptable as evidence that the cyanide production facility is operated in a safe and environmentally protective manner, it must be conducted by auditors meeting the International Cyanide Management Institute's criteria for third party auditors and must follow or otherwise address all the questions and issues included in the Cyanide Production Verification Protocol.

This Verification Protocol is not meant to limit the inquiries made by an auditor in the conduct of an audit or any cyanide producer's safety, health or environmental activities or their efforts to implement the Principles and Standards of Practice of the Code. It also is not intended to suggest, with respect to any of the Principles or Production Practices or specific measures identified in the questions, that there is only one way for a producer to meet the goals of the Code. While the questions posed in the Protocol are based on the measures typically appropriate to meet the Principles and Production Practices, a cyanide producer may have used alternative means to meet a particular Code expectation. Further, some of the approaches described in this

Protocol may not apply for a site specific reason. A Review of the Code's Implementation Guidance, (although developed specifically for gold mining operations), can help the auditor to understand the audit questions' intent and expectation of performance and aid in evaluating the measures taken by an operation to meet the Production Practices. Local conditions and regulatory requirements may play a significant role in determining the approaches used by a producer. The auditor's detailed descriptions of the evidence that supports a finding is particularly important to demonstrate how alternative methods have satisfied the objectives of the Code.

A cyanide production operation is expected to develop and implement a number of management systems or written plans or procedures such as emergency response plans. The Code does not require any particular format for these plans and procedures, nor does it require that they be specific to the production or management of cyanide. The plans, procedures and management systems may be stand-alone documents or they may be incorporated into other more generally-applicable plans or procedures. Similarly, the Code prescribes no specific content or format for inspection and maintenance programs, worker training or operating practices. Evidence that these systems and procedures exist, are implemented and meet the objectives of the Code must be documented by the auditor.

The auditor should determine if an operation's plans, procedures and management systems may reasonably be expected to meet the performance goals of the Production Practices based on available evidence. Disputes over specific assumptions, calculations or procedures should be avoided unless the issue has a significant bearing on the operation's ability to comply with the Code.

The goal of this Protocol is to encourage and support a thorough and probing inquiry by the auditor. This Protocol is structured to require that an auditor provide detailed responses, sufficient to provide a clear justification for the findings. Full responses are necessary for each question; a "yes," "no" or "not applicable" answer is not sufficient. The auditor must describe the specific evidence to support the finding that a cyanide producer meets the Code's expectations. Evidence to support findings may include but is not limited to reviews of documents and records, direct observations, interviews with appropriate personnel and results of inspections by applicable regulatory agencies. Information must be provided on documents reviewed, facilities inspected and personnel interviewed. The auditor must also identify the basis for any representative sampling of records, inspection reports or other documentation.

The results of the audit are the property of the cyanide producer. If the facility is not a Code signatory, the auditor must complete the Code's Auditor Credentials Form and Cyanide Production Audit Summary Report (or otherwise provide the same information) and these must be available upon request to gold mining operations seeking Code certification. The required demonstration that a non-Signatory cyanide producer's operation is conducted in a safe and environmentally protective manner is achieved only if the auditor finds the operation in Full or Substantial Compliance with the Code.

The Protocol requires the auditor to make a finding regarding whether the operation is in full compliance, substantial compliance or is not in compliance with each of the Production

Practices. Being in full compliance does not necessarily require an affirmative answer to all individual questions under a Production Practice. An operation may have used alternative means to meet the Production Practice or the Production Practice or one of its individual questions may have not been applicable for site-specific reasons. The auditor must find that an operation is in compliance with the Code if the operation is in full compliance with all Production Practices.

If a cyanide production operation is not fully compliant, the auditor must identify where compliance has not been fully achieved and where improvements are necessary. In order for the auditor to find that the operation is in substantial compliance with a Production Practice, the operation must have made a good-faith effort to comply and any identified deficiencies must be readily correctable and must not present an immediate or substantial risk to health, safety or the environment. Operations that are in substantial compliance with a Production Practice must develop a Corrective Action Plan to correct the deficiency and commit to fully implement the Corrective Action Plan within a time period mutually agreed to with the auditor but in no case longer than one year. An auditor must find that an operation is not in compliance with the Code if it is neither in compliance nor substantial compliance with any one of the Production Practices.

## Verification Protocol

**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.*

1. Have quality control and quality assurance programs been implemented during construction of cyanide production and storage facilities?
  - a) Have quality control and quality assurance records been retained?
  - b) Have appropriately qualified personnel reviewed facility construction and provided documentation that the facility has been built as proposed and approved?
2. Where there is no available quality control and quality assurance documentation or as-built certification for facility construction, has an appropriately qualified person inspected the facility and issued a report concluding that its continued operation within established parameters will protect against cyanide exposures and releases?
3. Are the materials used for construction of cyanide production facilities compatible with reagents used and processes employed?
4. Are there automatic systems or “interlocks” to shut down production systems and prevent releases due to power outages or equipment failures?
5. Is cyanide managed on a concrete or other surface that can minimize seepage to the subsurface?
6. Does the facility employ methods to prevent the overflowing of cyanide process and storage vessels, such as a level indicator and high-level alarm?
7. Are secondary containments for process and storage tanks and containers constructed of materials that provide a competent barrier to leakage and sized to hold a volume greater than that of the largest tank or container within the containment and any piping draining back to the tank, and with additional capacity for the design storm event (if applicable)?
8. Are spill prevention or containment measures provided for all cyanide solution pipelines?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 1.1? Explain the basis for the finding.

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

1. Does the facility have plans or procedures that describe the standard practices necessary for its safe and environmentally sound operation?
2. Does the facility have procedures for contingencies during upsets in its activities that may result in cyanide exposures or releases?
3. Does the facility have a procedure to identify when site operating practices have or will be changed from those on which the initial design and operating practices were predicated?
4. Are preventive maintenance programs implemented and activities documented for equipment and devices necessary for cyanide production and handling?
5. Are process parameters monitored with necessary instrumentation and is the instrumentation calibrated according to manufacturer's recommendations?
6. Are procedures in place and being implemented to prevent unauthorized/unregulated discharge to the environment of any cyanide solution or cyanide-contaminated water that is collected in a secondary containment area?
7. Does the facility have environmentally sound procedures for disposal of cyanide or cyanide-contaminated solids?
8. Is cyanide stored:
  - a) With adequate ventilation to prevent the build-up of hydrogen cyanide gas?
  - b) With measures to avoid or minimize the potential for exposure of cyanide to moisture?
  - c) In a secure area where public access is prohibited?
9. Are there procedures to ensure that the cyanide is packaged as required by the political jurisdictions through which the load will pass?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 1.2? Explain the basis for the finding.

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

1. Does the facility conduct routine inspections of tanks, valves, pipelines, containments and other cyanide production and storage facilities, including:
  - a) Tanks holding cyanide solutions for structural integrity and signs of corrosion and leakage?
  - b) Secondary containments for their integrity, the presence of fluids and their available capacity, and to ensure that any drains are closed and, if necessary, locked, to prevent accidental releases to the environment?
  - c) Pipelines, pumps and valves for deterioration and leakage?

2. Are inspection frequencies sufficient to assure that equipment is functioning within design parameters?
3. Are inspections documented?
  - a) Does the documentation identify specific items to be observed and include the date of the inspection, the name of the inspector, and any observed deficiencies?
  - b) Are the nature and date of corrective actions documented, and are records retained?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 1.3? Explain the basis for the finding.

**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.*

1. Has the facility developed procedures to minimize worker exposure during:
  - a) Normal plant operations from receipt of raw materials through finished product packaging and shipping?
  - b) Non-routine and emergency operations?
  - c) Maintenance related activities?
2. Does the facility implement procedures to review proposed process and operational changes and modifications for their potential impacts on worker health and safety, and incorporate the necessary worker protection measures?
3. Does the facility solicit and consider worker input in developing and evaluating health and safety procedures?
4. Does the facility use monitoring devices to confirm that controls are adequate to limit worker exposure to hydrogen cyanide gas and sodium, calcium or potassium cyanide dust to 4.7 parts per million ( $5 \text{ mg/m}^3$ ) or less, as cyanide?
5. Is hydrogen cyanide monitoring equipment maintained, tested and calibrated as directed by the manufacturer, and are records retained for at least one year?
6. Has the facility identified areas and activities where workers may be exposed to hydrogen cyanide gas and sodium, calcium or potassium cyanide dust at more than 4.7 parts per million ( $5 \text{ mg/m}^3$ ) or less, as cyanide, and require use of personal protective equipment as necessary in these areas or when performing these activities?
7. Does the facility have provisions to ensure that a buddy system is used or workers can otherwise notify or communicate with other personnel for assistance, help or aid where it has determined it necessary?

8. Does the facility assess the health of employees to determine their fitness to perform their specified tasks?
9. Does the facility have a clothing change policy or procedure for employees, contractors and visitors to areas with the potential for cyanide contamination of clothing?
10. Are there warning signs advising workers that cyanide is present and that, if necessary, suitable personal protective equipment must be worn?
11. Are all personnel prohibited from smoking, eating and drinking, and having open flames in areas where there is the potential for cyanide contamination?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 2.1? Explain the basis for the finding.

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

1. Has the facility developed specific written emergency response plans or procedures to respond to cyanide exposures?
2. Are showers, low-pressure eye wash stations and non-acidic fire extinguishers located at strategic locations throughout the facility? Are they maintained and inspected or tested on a regular basis?
3. Does the facility have water, oxygen, resuscitator, antidote and a means of communication or emergency notification readily available for use in the plant?
4. Does the facility inspect its first aid equipment regularly to assure that it is available when needed? Are first-aid and emergency response equipment stored and/or tested as directed by their manufacturer and replaced on a schedule that assures they will be effective when used?
5. Are Material Safety Data Sheets, first aid procedures or other informational materials on cyanide safety in the language of the workforce and available to workers in areas where cyanide is handled?
6. Are storage tanks, process tanks, containers and piping containing cyanide identified to alert workers of their contents? Is the direction of cyanide flow in pipes designated?
7. Does the facility have a decontamination policy or procedure for employees, contractors and visitors leaving areas with the potential for skin exposure to cyanide?
8. Does the facility have its own on-site capability to provide first aid or medical assistance to workers exposed to cyanide?

9. Has the facility developed procedures to transport exposed workers to locally available qualified off site medical facilities?
10. Has the facility alerted local hospitals, clinics, etc of the potential need to treat patients for cyanide exposure, and is the operation confident that the medical facility has adequate, qualified staff, equipment and expertise to respond to cyanide exposures?
11. Are mock emergency drills conducted periodically to test response procedures for various exposure scenarios, and are lessons learned from the drills incorporated into response planning?
12. Are procedures in place and being implemented to investigate and evaluate cyanide exposure 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?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 2.2? Explain the basis for the finding.

**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.*

1. Does the facility have a direct discharge to surface water?
  - a) Is it no greater than 0.5 mg/l WAD cyanide?
  - b) Is the concentration of free cyanide 0.022 mg/l or lower downstream of any established mixing zone? How has this been determined?
2. Does the facility have an indirect discharge to surface water? If so, does it result in a concentration of free cyanide in excess of 0.022 mg/l?
3. Are WAD cyanide concentrations (or other species of cyanide for which there is a numerical standard established by the applicable jurisdiction) in groundwater at compliance points below or down gradient of the facility at or below levels that are protective of identified beneficial uses of the groundwater?
4. If seepage from the facility has caused the cyanide concentration of the ground water to exceed that necessary to protect its beneficial use, is the facility engaged in remedial activity to prevent further degradation and restore beneficial uses?
5. Does the facility limit atmospheric process emissions of hydrogen cyanide gas such that the health of workers and the community are protected? How have these limits been established?
6. Does the facility monitor for cyanide in discharges to surface water and in surface and ground water upgradient and down gradient of the site?

7. Is monitoring conducted at frequencies adequate to characterize the medium being monitored and to identify changes in a timely manner?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 3.1? Explain the basis for the finding.

**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.*

1. Does the facility train workers to understand the hazards of cyanide and is refresher training periodically conducted?
2. Does the facility train workers in the use of personal protective equipment and when and where this equipment is required?
3. Does the facility train workers to perform their normal production tasks with minimum risk to worker health and safety and in a manner that prevents unplanned cyanide releases?
4. Are the training elements necessary for each job identified in training materials?
5. Is training provided by appropriately qualified personnel?
6. Are employees trained prior to allowing them to work with cyanide?
7. Does the facility evaluate the effectiveness of cyanide training by testing, observation or other means?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 4.1? Explain the basis for the finding.

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

1. Does the facility train workers in the procedures to be followed if a cyanide release is discovered?
2. Does the facility train workers to respond to worker exposure to cyanide and are routine drills used to test and improve their response skills?
3. Are emergency drills evaluated from a training aspect to determine if personnel have the knowledge and skills required for effective response, and are training procedures revised if deficiencies are identified?

4. Are training records retained throughout an individual's employment 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?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 4.2? Explain the basis for the finding.

**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.*

1. Has the facility developed an Emergency Response Plan to address potential releases of cyanide that may occur on site or may otherwise require response?
2. Does the Plan consider the potential failure scenarios appropriate for its site-specific environmental and operating circumstances, including the following, as applicable?
  - a) Catastrophic release of hydrogen cyanide
  - b) Releases during loading and dissolution operations
  - c) Releases during fires and explosions
  - d) Pipe, valve and tank ruptures
  - e) Power outages and equipment failures
  - f) Overtopping of ponds, tanks and waste treatment facilities
3. Does the Plan describe:
  - a) Specific response actions, as appropriate for the anticipated emergency situations, such as evacuating site personnel and potentially affected communities from the area of exposure?
  - b) Use of cyanide antidotes and first aid measures for cyanide exposure?
  - c) Control of releases at their source?
  - d) Containment, assessment, mitigation and future prevention of releases?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.1? Explain the basis for the finding.

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

1. Has the facility involved its workforce and stakeholders, including potentially affected communities, in the emergency response planning process?
2. Has the facility made potentially affected communities aware of the nature of their risks associated with accidental cyanide releases, and consulted with them directly or through

community representatives regarding what communications and response actions are appropriate?

3. Has the facility involved local response agencies such as outside responders and medical facilities in the emergency planning and response process?
4. Does the operation engage in regular consultation or communication with stakeholders to assure that the Plan addresses current conditions and risks?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.2? Explain the basis for the finding.

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

1. Does the Emergency Response Plan:
  - a) Designate primary and alternate emergency response coordinators with explicit authority to commit the resources necessary to implement the Plan?
  - b) Identify Emergency Response Teams?
  - c) Require appropriate training for emergency responders?
  - d) Include call-out procedures and 24-hour contact information for the coordinators and response team members?
  - e) Specify the duties and responsibilities of the coordinators and team members?
  - f) List all emergency response equipment that should be available?
  - g) Include procedures to inspect emergency response equipment and assure its availability when required?
  - h) Describe the role of outside responders, medical facilities or communities in emergency response procedures?
2. Has the facility confirmed that outside entities included in the Plan are aware of their involvement and are included as necessary in mock drills or implementation exercises?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.3? Explain the basis for the finding.

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

1. Does the Plan include procedures and contact information for notifying management, regulatory agencies, outside response providers and medical facilities of the emergency, as appropriate?
2. Does the Plan include procedures and contact information for notifying potentially affected communities of the incident and/or response measures and for communication with the media?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.4? Explain the basis for the finding.

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

1. Does the Plan describe specific, appropriate remediation measures, such as recovery or neutralization of solutions or solids, decontamination of soils or other contaminated media and management and/or disposal of spill clean-up debris, and provision of an alternate drinking water supply, as appropriate?
2. Does the Plan prohibit the use of chemicals such as sodium hypochlorite, ferrous sulfate and hydrogen peroxide to treat cyanide that has been released into surface water?
3. Does the Plan address the potential need for environmental monitoring to identify the extent and effects of a release, and include sampling methodologies, parameters and, where practical, possible locations?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.5? Explain the basis for the finding.

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

1. Does the Plan include provisions for reviewing and evaluating its adequacy on an established frequency?
2. Are mock emergency drills conducted periodically as part of the Plan evaluation process?
3. Are there provisions to evaluate the Plan after any emergency that required its implementation, and for revising it as necessary, and have such reviews been conducted?

Finding: Is the operation in full compliance, substantial compliance, or non-compliance with Production Practice 5.6? Explain the basis for the finding.