INTERNATIONAL CYANIDE MANAGEMENT INSTITUTE

Cyanide Production

Pre-Operational Verification Protocol

For The
International Cyanide Management Code

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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.

The specific facilities to be reviewed under this protocol are those that will produce the cyanide product(s) used in the gold mining industry; solid and liquid sodium cyanide, calcium cyanide or potassium cyanide. Facilities that will produce precursor chemicals such as hydrogen cyanide are 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 will be stored prior to its use in the production of alkaline metal cyanides, and where alkaline metal cyanides will be packaged, repackaged, 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 will produce and sell hydrogen cyanide to other chemical manufacturers, or which will 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 is a signatory to the Code and that has had its production operation certified in compliance with the Code.

The Code allows for conditional certification of a cyanide production operation that is not yet active but that is sufficiently advanced in its planning and design phases so that its site plans, design drawings and proposed operating procedures can be audited for conformance with the Code's Principles and Production Practices. This Verification Protocol is used by a third-party auditor in assessing whether a pre-operational cyanide production operation of a Signatory to the International Cyanide Management Code can be conditionally certified based on the expectation that it will meet the Principles and Production Practices of the Code. For this audit to be acceptable for this purpose it must be conducted by auditors meeting the third-party auditor criteria of the International Cyanide Management Institute.

Since a pre-operational audit cannot evaluate on-the-ground compliance with the Code, cyanide production facilities seeking pre-operational conditional certification are expected to have written documentation of proposed design and operating plans and procedures available for the auditor's review whenever practical. Design drawings, draft operating procedures, draft emergency response plans and draft training plans will provide an auditor with the best evidence that the operation can be expected to be in full compliance with the Code's Principles and Production Practices. However, it is recognized that a production operation seeking pre-operational certification may not have progressed to a point where this degree of planning has been completed. In such a case, in lieu of proposed design drawings, operating procedures or other draft management plans, an operation may provide its commitment to implement measures consistent with the Principles and Production Practices of the Code. Such commitments can be in form of process descriptions, cyanide management plans, and other written statements of intent that conclusively demonstrate that, once the production facility begins handling cyanide

and the actions to which it has committed are implemented, the operation will comply with the Code's Principles and Production Practices. The commitment must include sufficient detail for the auditor to be confident in such a finding.

Operations are encouraged to use this Verification Protocol as a template in preparing a Cyanide Management Plan that would describe how the operation planned to address each element and reference the existing documentation available for review. Although such a plan is not required in order to comply with the Code, it would guide the operation in addressing all elements required for Code compliance during the planning and design stages of the project, and aid an auditor in evaluating an operation that has not begun handling cyanide and therefore cannot be visually inspected to verify the implementation of its draft procedures.

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; "yes", "no" or "not applicable" answers are not sufficient. The auditor must describe the specific evidence to support the findings that a gold mine operation using cyanide is expected to meet the Code provisions. Information must be provided on the documents reviewed.

This Protocol is not meant to limit inquires made by an auditor in the conduct of an audit or the actions taken by any cyanide producer to handle cyanide in a responsible manner or to implement the provisions of the Code.

It also is not intended to suggest, with respect to any of the Principles or Production Practices that there is only one way for a cyanide 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 use alternative means to meet a particular Code provision. Familiarity with the Code's Implementation Guidance (although developed specifically for gold mining operations), and Auditor Guidance for the Use of the Cyanide Production Verification Protocol are essential to place each Protocol question in the appropriate context, understand the intent and expectation of performance for each Production Practice and evaluate the measures to be taken by an operation to meet the Practice. Site specific conditions and local regulatory requirements may play a significant role in determining the approaches used by an operation. The auditor's detailed descriptions of the evidence that supports a finding is particularly important to demonstrate how alternative methods have satisfied the Code provisions.

A cyanide producer is expected to develop and implement a number of written management systems or procedures addressing issues such as worker safety, preventive maintenance, operator training and emergency response. These plans can take any form including but not limited to formalized manuals, standard operating procedures, checklists, signs, work orders and training materials. None of these need be limited solely to issues involving cyanide management. The intent of the Code is that management systems and procedures demonstrate that the operation understands the practices necessary to manage cyanide in a manner that prevents and controls releases to the environment and exposures to workers and the community.

The audit should determine if an operation's plans, procedures and management systems, when implemented, may reasonably be expected to meet the performance goals of the Production Practices. 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 Protocol requires the auditor to make a finding regarding whether or not the operation is expected to be in full compliance with each Production Practice once it becomes operational. Being in full compliance does not necessarily require an affirmative answer to all individual Verification Protocol questions under a particular Production Practice. An operation may utilize alternative means that are consistent with the Principles and Production Practices, but are not specifically identified in the Audit Protocol or Auditor Guidance document, or a particular question in the Audit Protocol may not be applicable for site-specific reasons.

A pre-operational production facility cannot be conditionally certified unless the auditor finds that, based upon the proposed plans, designs, procedures, and/or commitments, the operation is expected to be in full compliance with all Principles and Production Practices. If not fully compliant, the auditor must identify the specific aspects of the proposed plans, designs, procedures and commitments that have been judged to be inconsistent with the Principles and Production Practices. However, unlike a verification audit of an operational producer, pre-operational certification cannot result in conditional certification of an operation that is only in substantial compliance. The auditor can pre-operationally certify the operation once it has provided the additional or revised information necessary to demonstrate that it is expected to be in full compliance.

A pre-operational facility found in full compliance is conditionally certified, subject to an on-site audit to confirm that the operation is being operated in compliance with the Code. The confirmatory audit must follow the Code Certification Process as an initial verification with the exception that the 3 year time frame between becoming a signatory and submitting the audit report to ICMI does not apply. The on-site confirmatory audit must be conducted within six months of the date on which the production facility first handles cyanide.

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. Has the production facility committed to develop and implement quality control and quality assurance programs during construction of cyanide production and storage facilities?
   a) Has the production facility committed to retain quality control and quality assurance records?
   b) Has the production facility committed to have appropriately qualified personnel review facility construction and provided documentation that the facility has been built as proposed and approved?

2. Has the production facility committed to use materials for construction of cyanide production facilities that are compatible with reagents used and processes employed?

3. Has the production facility committed to use automatic systems or "interlocks" to shut down production systems and prevent releases due to power outages or equipment failures?

4. Has the production facility committed to manage cyanide on a concrete or other surface that can minimize seepage to the subsurface?

5. Has the production facility committed to employ methods to prevent the overfilling of cyanide process and storage vessels, such as a level indicator and high-level alarm?

6. Has the production facility committed to construct secondary containments for process and storage tanks and containers with materials that provide a competent barrier to leakage and that are 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)?

7. Has the production facility committed to develop and implement spill prevention or containment measures provided for all cyanide solution pipelines?

Finding: If it implements the commitments it has made, is the production facility expected to be in full 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. Has the production facility committed to develop and implement plans or procedures that describe the standard practices necessary for its safe and environmentally sound operation?

2. Has the production facility committed to develop and implement procedures for contingencies during upsets in its activities that may result in cyanide exposures or releases?

3. Has the production facility committed to develop and implement 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. Has the production facility committed to develop and implement preventive maintenance programs and document maintenance activities for equipment and devices necessary for cyanide production and handling?

5. Has the production facility committed to monitor process parameters with necessary instrumentation and to calibrate the instrumentation according to manufacturer's recommendations?

6. Has the production facility committed to develop and implement 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?

7. Has the production facility committed to develop and implement environmentally sound procedures for disposal of cyanide or cyanide-contaminated solids?

8. Has the production facility committed to store cyanide:
   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. Has the production facility committed to develop and implement procedures to ensure that the cyanide is packaged as required by the political jurisdictions through which the load will pass?

Finding: If it implements the commitments it has made, is the production facility expected to be in full 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. Has the production facility committed to 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. Has the production facility committed to inspect its cyanide facilities on frequencies sufficient to assure that equipment is functioning within design parameters?

3. Has the production facility committed to document its inspections?
   a) Will 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) Will the nature and date of corrective actions documented, and are records retained?

Finding: If it implements the commitments it has made, is the production facility expected to be in full 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 production facility committed to develop and implement 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. Has the production facility committed to develop and 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. Has the production facility committed to solicit and consider worker input in developing and evaluating health and safety procedures?

4. Has the production facility committed to 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 mg/m^3) or less, as cyanide?

5. Has the production facility committed to maintain, test and calibrate hydrogen cyanide monitoring equipment as directed by the manufacturer, and to retain records for at least one year?

6. Has the production facility committed to identify 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 mg/m^3) or less, as cyanide, and to require use of personal protective equipment as necessary in these areas or when performing these activities?

7. Has the production facility committed to develop and implement provisions to ensure that a buddy system is used or that workers can otherwise notify or communicate with other personnel for assistance, help or aid where it has determined it necessary?

8. Has the production facility committed to assess the health of employees to determine their fitness to perform their specified tasks?

9. Has the production facility committed to develop and implement a clothing change policy or procedure for employees, contractors and visitors to areas with the potential for cyanide contamination of clothing?

10. Has the production facility committed to place warning signs at appropriate locations advising workers that cyanide is present and that, if necessary, suitable personal protective equipment must be worn?

11. Has the production facility committed to prohibit personnel from smoking, eating and drinking, and from having open flames in areas where there is the potential for cyanide contamination?

Finding: If it implements the commitments it has made, is the production facility expected to be in full 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 production facility committed to develop and implement specific written emergency response plans or procedures to respond to cyanide exposures?

2. Has the production facility committed to have showers, low-pressure eye wash stations and non-acidic fire extinguishers at strategic locations throughout the facility? Has the production facility committed to maintain and inspect or test this equipment on a regular basis?

3. Has the production facility committed to have water, oxygen, resuscitator, antidote and a means of communication or emergency notification readily available for use in the plant?

4. Has the production facility committed to inspect its first aid equipment regularly to assure that it is available when needed? Has the production facility committed to store and/or test its first-aid and emergency response equipment as directed by their manufacturer and replace them on a schedule that assures they will be effective when used?

5. Has the production facility committed to have 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. Has the production facility committed to identify storage tanks, process tanks, containers and piping containing cyanide to alert workers of their contents? Has the production facility committed to identify the direction of cyanide flow in pipes?

7. Has the production facility committed to develop and implement a decontamination policy or procedure for employees, contractors and visitors leaving areas with the potential for skin exposure to cyanide?

8. Has the production facility committed to have its own on-site capability to provide first aid or medical assistance to workers exposed to cyanide?

9. Has the production facility committed to developed and implement procedures to transport exposed workers to locally available qualified off site medical facilities?

10. Has the production facility committed to alert local hospitals, clinics, etc of the potential need to treat patients for cyanide exposure, and will it confirm that the medical facility has adequate, qualified staff, equipment and expertise to respond to cyanide exposures?

11. Has the production facility committed to conduct mock emergency drills periodically to test response procedures for various exposure scenarios, and to incorporate any lessons learned from the drills into its response planning?

12. Has the production facility committed to develop and implement procedures 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: If it implements the commitments it has made, is the production facility expected to be in full 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. Will the facility have a direct discharge to surface water?
   a) Has the production facility committed to limit the discharge to no greater than 0.5 mg/l WAD cyanide?
   b) Has the production facility committed to limit its discharge such that the concentration of free cyanide is 0.022 mg/l or lower downstream of any mixing zone established by the applicable jurisdiction?

2. Will the facility have an indirect discharge to surface water? If so, has it committed to limit it such that the concentration of free cyanide is surface water is 0.022 mg/l or less?

3. Has the production facility committed to operate such that the WAD cyanide concentration (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 is at or below levels that are protective of identified beneficial uses of the groundwater?

4. Has the production facility committed to engaged in remedial activity as necessary to prevent further degradation and restore beneficial uses in the event that seepage from the facility causes the cyanide concentration in ground water to exceed that necessary to protect its beneficial use?

5. Has the production facility committed to limit atmospheric process emissions of hydrogen cyanide gas such that the health of workers and the community are protected?

6. Has the production facility committed to monitor for cyanide in discharges to surface water and in surface and ground water upgradient and down gradient of the site?

7. Has the production facility committed to monitor for cyanide in surface and ground water at frequencies adequate to characterize the medium being monitored and to identify changes in a timely manner?

Finding: If it implements the commitments it has made, is the production facility expected to be in full 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. Has the production facility committed to train workers to understand the hazards of cyanide and is refresher training periodically conducted?

2. Has the production facility committed to train workers in the use of personal protective equipment and when and where this equipment is required?

3. Has the production facility committed to 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. Has the production facility committed to identify the training elements necessary for each job in training materials?

5. Has the production facility committed to provide training by appropriately qualified personnel?

6. Has the production facility committed to train employees prior to allowing them to work with cyanide?

7. Has the production facility committed to evaluate the effectiveness of cyanide training by testing, observation or other means?

Finding: If it implements the commitments it has made, is the production facility expected to be in full 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. Has the production facility committed to train workers in the procedures to be followed if a cyanide release is discovered?

2. Has the production facility committed to train workers to respond to worker exposure to cyanide and to use routine drills to test and improve their response skills?

3. Has the production facility committed to evaluate emergency drills from a training aspect to determine if personnel have the knowledge and skills required for effective response, and to revise training procedures if deficiencies are identified?

4. Has the production facility committed to retain training records 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: If it implements the commitments it has made, is the production facility expected to be in full 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 production facility committed to develop and implement an Emergency Response Plan to address potential releases of cyanide that may occur on site or may otherwise require response?

2. Has the production facility committed to consider in its Plan 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. Has the production facility committed to describe the following in the Plan:
   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: If it implements the commitments it has made, is the production facility expected to be in full 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 production facility committed to involve its workforce and stakeholders, including potentially affected communities, in the emergency response planning process?

2. Has the production facility committed to make potentially affected communities aware of the nature of their risks associated with accidental cyanide releases, and to consult with them directly or through community representatives regarding what communications and response actions are appropriate?

3. Has the production facility committed to involve local response agencies such as outside responders and medical facilities in the emergency planning and response process?

4. Has the production facility committed to engage in regular consultation or communication with stakeholders to assure that the Plan addresses current conditions and risks?

Finding: If it implements the commitments it has made, is the production facility expected to be in full 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. Has the production facility committed that its Emergency Response Plan or other emergency planning documents will:
   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 production facility committed to confirm that outside entities included in the Plan are aware of their involvement and are included as necessary in mock drills or implementation exercises?

Finding: If it implements the commitments it has made, is the production facility expected to be in full 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. Has the production facility committed that its Plan will include procedures and contact information for notifying management, regulatory agencies, outside response providers and medical facilities of the emergency, as appropriate?

2. Has the production facility committed that its Plan will include procedures and contact information for notifying potentially affected communities of the incident and/or response measures and for communication with the media?

Finding: If it implements the commitments it has made, is the production facility expected to be in full 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. Has the production facility committed that its Plan will 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. Has the production facility committed that its Plan will 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. Has the production facility committed that its Plan will 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: If it implements the commitments it has made, is the production facility expected to be in full 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. Has the production facility committed that its Plan will include provisions for reviewing and evaluating its adequacy on an established frequency?

2. Has the production facility committed to conduct mock emergency drills periodically as part of the Plan evaluation process?

3. Has the production facility committed that it will have 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: If it implements the commitments it has made, is the production facility expected to be in full compliance with Production Practice 5.6? Explain the basis for the finding.