



INTERNATIONAL CYANIDE MANAGEMENT INSTITUTE

CYANIDE PRODUCTION VERIFICATION PROTOCOL

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PRODUCTION VERIFICATION PROTOCOL

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The International Cyanide Management Code (hereinafter “the Code”, “Code” or “the Cyanide Code”), this document, and other documents or information sources referenced at www.cyanidecode.org are believed to be reliable and were prepared in good faith from information reasonably available to the drafters. However, no guarantee is made as to the accuracy or completeness of any of these other documents or information sources. No guarantee is made in connection with the application of the Code, the additional documents available or the referenced materials to prevent hazards, accidents, incidents, or injury to employees and/or members of the public at any specific site where gold or silver is extracted from ore by the cyanidation process. Compliance with this Code is not intended to and does not replace, contravene or otherwise alter the requirements of any specific national, state or local governmental statutes, laws, regulations, ordinances, or other requirements regarding the matters included herein. Compliance with this Code is entirely voluntary and is neither intended nor does it create, establish, or recognize any legally enforceable obligations or rights on the part of its signatories, supporters or any other parties.



PRODUCTION VERIFICATION PROTOCOL

Introduction

The Cyanide Production Verification Protocol applies to cyanide production operations. Cyanide repackaging and transloading operations and cyanide warehouse operations, as well as operations which produce cyanide from chemical feedstock, are considered to be production operations. Storage of cyanide at a mine is subject to the Mining Operations Verification 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.

Primary production operations are those at which cyanide is manufactured from chemical feedstock. Repackaging and transloading operations are those where cyanide is transferred from its existing packaging to other packaging or containers. Examples include facilities where solid cyanide briquettes are removed from lined Intermediate Bulk Containers (IBCs) or are transloaded from rail cars to isotainers for further transportation, or where liquid cyanide is transloaded from rail cars to tanker trucks. Warehouses are those facilities where cyanide is stored for subsequent distribution while remaining in its existing packaging, such as IBCs or as solids in isotainers. Examples include facilities where IBCs or drums of cyanide are transferred from sea containers into a warehouse, or where sea containers or isotainers of solid cyanide are stored without removal of the cyanide.



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Cyanide Production Guidance

Principle 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 and modification of cyanide production and storage facilities?
 - a) Has design and construction documentation been retained?
 - b) Has an appropriately qualified person 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?
equipment itself should be located on a concrete or other similarly impermeable surface that
6. Does the facility employ, inspect, test, and maintain systems, such as level indicators and high-level alarms, to prevent the overfilling of cyanide process and storage vessels?
equipment is in place and functional through inspection of the operation and review of design drawings and inspection, testing and maintenance records.
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 of cyanide solution 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?



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9. Is cyanide stored:
 - a) With measures to avoid or minimize the potential for exposure of cyanide to moisture?
 - b) With adequate ventilation to prevent the build-up of hydrogen cyanide gas and cyanide dust?
 - c) In a secure area where public access is prohibited?
 - d) Separately from incompatible materials?

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 contingency plans for non-standard operating situations that may present a potential for cyanide exposures or releases?
3. Does the facility have a procedure to identify when cyanide facilities or operating practices have or will be changed from those on which the initial design and operating practices were predicated? Does the procedure require review and sign-off by environment, health, and safety management?
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 management and/or disposal of cyanide waste or cyanide-contaminated materials?
8. Are there procedures to ensure that the cyanide is packaged and labeled as required by the political jurisdictions through which the packaged cyanide will pass?

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:



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- 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?
 - d) Containers used for transportation, where the producer is responsible for their integrity?
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?

Principle 2 | WORKER SAFETY

Protect workers' health and safety from exposure to cyanide.

Production Practice 2.1

Develop and implement procedures to protect facility personnel from exposure to cyanide.

1. Has the facility developed procedures to minimize worker exposure during:
 - a) Normal 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 solicit and consider worker input in developing and evaluating health and safety procedures?
3. Has the facility identified areas and activities where workers may be exposed to hydrogen cyanide gas and/or cyanide dust exceeding 10 parts per million (ppm) on an instantaneous basis or 4.7 ppm continuously over an 8-hour period, as cyanide, and does it require use of personal protective equipment and/or use administrative controls as necessary in these areas or when performing these activities?
4. Does the facility use monitoring devices and associated alarms to confirm that controls are adequate to limit worker exposure hydrogen cyanide gas and/or cyanide dust exceeding 10 parts per million (ppm) on an instantaneous basis or 4.7 parts per million continuously over an 8 hour period, as cyanide?



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5. Is hydrogen cyanide monitoring equipment maintained, tested and calibrated as recommended by the manufacturer, and are records retained?
6. 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?
7. Does the facility assess the health of employees to determine their fitness to perform their specified tasks?
8. Does the facility have a clothing change policy or procedure for employees, contractors and visitors that enter areas with the potential for cyanide contamination of clothing?
9. Are there warning signs advising workers that cyanide is present and that, if necessary, suitable personal protective equipment must be worn?
10. Are smoking, eating, drinking, and open flames prohibited in areas where there is the potential for cyanide contamination?

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 oxygen, resuscitator, antidote and a means of communication or emergency notification readily available for use?
4. Does the facility inspect its first aid equipment regularly to ensure that it is available when needed? Is first-aid and emergency response equipment stored and/or tested as directed by its manufacturer(s) and replaced on a schedule that ensures it will be effective when used?
5. Are 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?



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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 made formalized arrangements with local medical facilities 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 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?

Principle 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 monitor for cyanide in discharges to surface water and in surface and ground water upgradient and downgradient of the site?
2. If the facility has a direct discharge to surface water:
 - a) Is it no greater than 0.5 mg/l WAD cyanide at the point of discharge?
 - b) Can the operation demonstrate that it does not cause the concentration of free cyanide in the receiving water to exceed 0.022 mg/l downstream of any established mixing zone?
3. Can the operation demonstrate that indirect discharges to surface water do not cause the in-stream concentration of free cyanide to exceed 0.022 mg/l taking into consideration any established mixing zone?
4. Has the jurisdiction identified beneficial uses of groundwater at the operation, and have numerical standards for cyanide species (free, WAD, or total) in groundwater been established? Are cyanide concentrations in groundwater below or downgradient of the facility at or below levels that are protective of actual or identified beneficial uses of the groundwater?



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5. 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?
6. Can the operation demonstrate that the levels of atmospheric process emissions of hydrogen cyanide gas or cyanide dust are limited in order to protect the health of workers and the community?
7. Is monitoring conducted at frequencies adequate to characterize the medium being monitored and to identify changes in a timely manner?

Principle 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 facility 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 employees trained prior to allowing them to work with cyanide?
5. Is refresher training on normal production tasks provided to ensure that employees continue to perform their work in a safe and environmentally protective manner?
6. Are the training elements necessary for each job identified in training materials?
7. Is training provided by appropriately qualified personnel?
8. Does the facility evaluate the effectiveness of cyanide training by testing, observation or other means?



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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 exposure or release occurs?
2. Does the facility train workers to respond to worker exposure to cyanide and to cyanide releases?
3. 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?

Principle 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 of solid or liquid cyanide during packaging, storage, loading and unloading 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?



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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 operation identified external entities having emergency response roles, and involved those entities in the cyanide emergency response planning process?
4. Does the operation engage in regular consultation or communication with stakeholders to assure that the Emergency Response Plan addresses current conditions and risks?

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 any external responders, medical facilities, communities, or other entities having designated roles in emergency response procedures?
2. Has the facility confirmed that external entities included in the Plan are aware of their involvement and are included as necessary in mock drills or implementation exercises?



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Production Practice 5.4

Develop procedures for internal and external emergency notification and reporting.

1. Does the Emergency Response Plan include procedures and contact information for notifying management, regulatory agencies, external 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?
3. Does the operation have a written procedure for notifying ICMI of any significant cyanide incidents, as defined in ICMI's *Definitions and Acronyms* document? Have all such significant cyanide incidents that have occurred been reported to ICMI?

Production Practice 5.5

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

1. Does the Emergency Response Plan describe specific, appropriate remediation measures, such as:
 - a) Recovery or neutralization of solutions or solids?
 - b) Decontamination of soils or other contaminated media?
 - c) Management and/or disposal of spill clean-up debris?
 - d) 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 or that could reasonably be expected to enter 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 and parameters?

Production Practice 5.6

Periodically evaluate response procedures and capabilities and revise them as needed.

1. Does the Emergency Response Plan include provisions for reviewing and evaluating its adequacy on an established frequency?
2. Are mock emergency drills conducted periodically to evaluate the operation's plans, training, resources, and preparedness for response to cyanide releases and to cyanide exposures of workers?



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3. Are there provisions to evaluate the Plan and revise as necessary after any emergency that required its implementation, and have such reviews been conducted?

