

INTERNATIONAL CYANIDE MANAGEMENT INSTITUTE

Cyanide Production Summary Audit Report

***For the
International Cyanide Management Code***

**TaeKwang Industrial Co., Ltd.
Petrochemical Plant #3**

22 January 2014

TaeKwang Industrial Co., Ltd.
Petrochemical Plant #3

Name of Cyanide Production Facility	TaeKwang Industrial Co., Ltd. Petrochemical Plant #3
Name of Facility Owner	TaeKwang Industrial Co., Ltd.
Name of Facility Operator	Mr. Nam-Jae Seok
Name of Responsible Manager	Mr. Jang-Soo Seo / Safety Team Leader
Address	#88 Bukok-dong, Nam-gu,
State/Province	Ulsan-city, 680-110
Country	South Korea
Telephone	82-52-259-9691
Fax	82-52-258-3700
E-Mail	Js8316@lycos.co.kr

Location detail and description of operation:

The TaeKwang Industrial Co., Ltd., Petrochemical Plant #3 (Hereinafter called as TaeKwang Industrial Co., Ltd.) is located at the Ulsan Petrochemical Industry Complex. The whole area covered by the plant is 89,570 m², with its cyanide production facilities accounting for 7,000 m². The cyanide plant includes all facilities related to production, storage and consignment. The cyanide produced by TaeKwang Industrial Co., Ltd. is sodium cyanide used for gold mining. This sodium cyanide is produced using the hydrogen cyanide generated from the acrylonitrile process and sodium hydroxide as raw material. The product is available in briquette form. The plant employs total 110 staff in its production facility. The utilities used in plant, such as electricity, gas and water etc., are being provided by the petrochemical complex support center. TaeKwang Industrial Co., Ltd. established and maintained safety and environmental policy and procedures with the reflection of Korean laws such as Industrial safety & health Act and Environmental Act. Those are strictly controlled by the relevant supervisory authority because the plant is located at the petrochemical industry complex.

The initial certification audit for ICMC was conducted in December 2007 to March 2008 and finally certified and registered on April 14 2008. First recertification audit was conducted in January 2011. Almost 3 years were elapsed since first recertification audit, so second recertification audit was conducted during 7, 9 and 11 January 2014.

During this recertification audit, lead auditor, Mr. Do Sik Yoon confirms the following :

“This operation has not experienced compliance problems during the previous three-year audit cycle.”

TaeKwang Industrial Co., Ltd.
Petrochemical Plant #3

Mr. Do Sik Yoon 

22 January 2014

Name of Production Facility

Lead Auditor Signature

Date

Auditor's Findings

This operation is

X in full compliance

in substantial compliance *(see below) with the International Cyanide Management Code.
not in compliance

with the International Cyanide Management Code.

This operation has maintained full compliance with the International Cyanide Management Code throughout the previous three audit cycle.

Audit Company : DS' GMP

Audit Team Leader : Mr. Do-Sik Yoon

E-mail : dosiky@naver.com

Dates of Recertification Audit : 7, 9 and 11 January, 2014

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.

TaeKwang Industrial Co., Ltd.
Petrochemical Plant #3

Name of Production Facility

Mr. Do Sik Yoon

Lead Auditor Signature

22 January 2014

Date

TaeKwang Industrial Co., Ltd.
Petrochemical Plant #3

Name of Production Facility

Mr. Do Sik Yoon

Lead Auditor Signature

22 January 2014

Date

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.

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

Summarize the basis for this Finding/Deficiencies Identified:

This situation was same as first recertification in 2011. The plant was constructed in 1996 and operated in April 1997. Before the construction, facility & piping material were tested by competent suppliers. The construction company implemented test and inspection according to quality plan and submit the results to technical team & supervising agency. Technical team & supervising agency reviewed the result reports and concluded that facilities were established according to drawing & specification. The cyanide process has received the PSM (Process Safety Management) inspection by KOSHA (Korea Occupational Safety & Health Agency) and Ministry of Labor every 3 years by Korea legal requirement. According to the inspection reports from KOSHA, TaeKwang Industrial Co., Ltd. continued operation within established parameters and protection against cyanide exposure and release. Records related to quality control and assurance inspection were maintained. And also the materials used for construction are compatible with hydrogen cyanide, liquid sodium cyanide and other reagents. ESD(Emergency Shut Down) system and automatic interlock system were applied to shut down production system and prevent release due to power outage or equipment failures. To prevent cyanide seepage to subsurface, all cyanide process facilities including condensation, reaction, centrifuge, drier, packaging, storage and pipeline were established and controlled on concrete. Level gauge and alarm system were installed to cyanide process and storage vessels to prevent overfilling & overflow. Secondary containment and dikes were installed enough to contain spilled cyanide solution. And also pipelines were covered by outer piping to prevent spillage of cyanide solution. Since the first recertification audit in 2011, there were total 8 cases of facility changes such as recovery solution route change of sodium cyanide scrubber and storage tank exchange etc. Those facility changes were completed under the change control procedure TACE-09004. For each case, change control committee was opened. The change control committee checked quality, environmental and safety issues and finally approved the changes. After the facility changes, technical team inspected the changed facility, revised operation manual, trained operators and maintained inspection reports and training records. The quality control and quality assurance records including test & inspection reports from engineering & construction company and review results by technical team were maintained. And also records generated from change control committee, test and inspection reports from external agency were maintained according to record control procedure.

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

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

Summarize the basis for this Finding/Deficiencies Identified:

Production Team and Safety Team have established and maintained process operation manual in which standard practices such as operational criteria for pressure, temperature and flow were defined. They maintained start-up and shut down manual, preventive maintenance procedure and emergency preparedness to assure safe and sound process operation. They also have established and maintained emergency response plan to control the possible emergency situations such as spillage, hydrogen cyanide leakage, fire, explosion and humane cyanide exposure. They have tested the emergency response plan periodically. They established and maintained change control procedure in which identification and control of change were defined. Technical team established and implemented preventive maintenance program. Main process parameters as flow rate, temperature and level were monitored by DCS and monitoring equipment was calibrated according to calibration procedure. Cyanide solution and cyanide contaminated water has been treated in waste water treatment facility and prevented unauthorized and unregulated discharge according to waste control procedure. The solid waste were collected and dispatched to qualified sub-contractor according to waste control procedure. The cyanide products were filled and packed in drum and wooden box and stored in warehouse in which ventilation fans were installed and operated to prevent exposure of moisture according to packaging procedure in which the IMDG(International Maritime Dangerous Goods) code reflected. The public is strictly prohibited to enter the warehouse without special acceptance. The warehouse is monitored by CCTV.

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

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

Summarize the basis for this Finding/Deficiencies Identified:

The situation was same as first recertification in 2011. The main facilities including reactor, tank, valve & pipeline were inspected periodically according to Self-inspection procedure. And also detail inspections were implemented by special inspection contractors every 5 years. The secondary containments and deterioration and leakage were checked and results were recorded daily by production team and safety team. Inspection frequency for reactor, tank etc. was defined from the decision of critical item control rule according to Self-inspection procedure and maintenance procedure. Inspection results including inspection date, inspector and deficiency were recorded. And also corrective actions for identified deficiency were implemented according to corrective action procedure.

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.

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


Summarize the basis for this Finding/Deficiencies Identified:

Since initial certification in 2007, TaeKwang Industrial Co., Ltd. have established and implemented safety control procedure TACD-02014 and PPE control procedure TACD-02012 both were revised 30 July 2009. Employee, visitor and contractor were protected from exposure of cyanide during normal, abnormal and emergency operation, maintenance and overhaul activities according to safety control procedure and PPE control procedure. And also each team have developed and maintained work instructions for plant operation including raw material control, production, packing and dispatching in those work instructions detail control and handling method of cyanide were defined. They have developed and maintained work permit procedure for out-sourced repair and maintenance works. Training for precaution and handling of cyanide have been implemented before repair and maintenance works and pre-action and PPE wearing are mandatory for workers according to work permit procedure. They have reviewed operational changes and modifications for their impacts on employee health and safety. Employee have participated safety committee to develop health and safety procedures. Working environment was inspected by sub-contractor twice per year for such items as the concentration of hydrogen cyanide, dust, etc. The inspection results of sodium cyanide, dust etc. were usually "non-detected" comply with ICMC and legal requirement. They also used monitoring device to detect the leakage of hydrogen cyanide. The fixed monitoring equipment and portable detectors for hydrogen cyanide were calibrated every year. Employee, contractor and visitor shall wear clothing provided by safety team and exchanged when they are leaving cyanide process according to safety and health procedure. They identified areas and activities where workers can be exposed to cyanide and maintained warning signs of cyanide presence. Employee, visitor and contractor were required to wear PPE and prohibited from smoking, eating, drinking in those potential cyanide contamination areas such as process and packaging areas. They maintained buddy system for dangerous works as patrol, maintenance and repair works. During those works, employee and contractor use radio to request assistant for the case of emergency situation. Employee receives health check every year. And according to health check results, fitness of employee to perform their tasks were determined and follow up action implemented.

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

The operation is **X in full compliance with** in substantial compliance with Production Practice 2.2
not in compliance with

TaeKwang Industrial Co., Ltd.
Petrochemical Plant #3

Mr. Do Sik Yoon 

22 January 2014

Name of Production Facility

Lead Auditor Signature

Date

Summarize the basis for this Finding/Deficiencies Identified:

The situation was same as first recertification in 2011. TaeKwang Industrial Co., Ltd. has developed and maintained self-prevention plan in which detail emergency preparedness including cyanide exposure case were defined. First aid equipment such as low pressure eye-wash station, air shower and fire extinguisher were maintained in process and packaging areas. First aid kits such as water, oxygen, resuscitator and antidote were maintained in cabinets installed in process area and office. Safety team have inspected the first aid equipment and kits by monthly basis and replaced the equipment and kits not effective any more according to safety procedure. They maintained the MSDS, first aid procedure, emergency plan and cyanide handling method written in Korean in process and control room area. The storage tanks, containers and pipe line containing cyanide were identified by material name, MSDS and warning signal. And cyanide flow directions were identified by arrow mark in pipe line. They have implemented control procedure for entrance and leaving from process area. According to that procedure, employee, contractor and visitor shall exchange clothing and pass the air shower before leaving the process. They have employed nurse and maintained first aid kits and ambulance in plant. They nominated Good Morning Hospital in Ulsan city and informed about potential need to treat employee exposed to cyanide. The Good Morning Hospital understands TaeKwang Industrial Co., Ltd.' situation and nominated staff ready for emergency situation. Emergency plans of cyanide exposure cases were tested every year and the result and lesson were reflected revised plans. They established and maintained incident evaluation procedure in which detail investigation and evaluation for cyanide exposure incidents were defined. Since the recertification audit in 2011, cyanide exposure incident has not been occurred in their plant.

TaeKwang Industrial Co., Ltd.
Petrochemical Plant #3

Mr. Do Sik Yoon

22 January 2014

Name of Production Facility

Lead Auditor Signature

Date

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.

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

Summarize the basis for this Finding/Deficiencies Identified:

The control and treatment methods and routes for waste water, land contamination and air emission were almost same as first recertification audit in 2011. Waste water from process was treated in in-house waste water treatment facility and then discharged to Yongyeon final waste water treatment facility operated by Ulsan Metropolitan City. Monitoring results of discharged from in-house waste water treatment facility showed the cyanide concentration range was 0.10ppm to 0.20ppm through the year 2011 to 2013, and comply with Code's requirement and Korea legal requirements. The discharged water is mixed and diluted in Yongyeon final waste water treatment facility, so the cyanide concentration is far below the 0.022mg/l. TaeKwang Industrial Co., Ltd. do not need to monitor the free cyanide concentration in mixing zone, because the final waste water treatment facility has been operated by Ulsan Metropolitan city. TaeKwang Industrial Co., Ltd. do not discharge to surface water. Because all cyanide process were covered by dike and spilled cyanide, chemical and rain water were collected and dispatched to waste water treatment facility. The capacity of secondary tank is enough to collect initial water poured into cyanide process area. In Ulsan city, there is no designated beneficial use of ground water, no regulatory requirement of compliance and no actual beneficial use of the ground water. So they do not monitor the quality of ground water. Only they have conducted the monitoring of land contamination to preserve land and soil. The result of recent test was that the cyanide was not detected. They limited the hydrogen cyanide gas emissions maximum 4.7ppm according to Korean legal requirement to protect the health of employee and local community. Monitoring result of hydrogen cyanide concentration was 0.23ppm in December, 2013. Monitoring frequency for air emission of hydrogen cyanide and water discharge was defined according to Korea legal requirements. With the analysis of monitoring results, they can identify the process change, incident and implement required corrective action.

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.

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

Summarize the basis for this Finding/Deficiencies Identified:

The situation was same as recertification audit in 2011. TaeKwang Industrial Co., Ltd. has established and implemented safety training procedure TACD-02004. They recruited those candidates who have been trained in the fields of chemistry and chemical engineering. Their training policy, procedure and program were established effectively to meet the legal requirements and international standards including this ICMC code. Based on the plant training program and training needs of each personnel, training has been provided regularly to all workers. Training materials were prepared well and contained all information such as hazards of cyanide, MSDS, use of PPE and emergency preparedness. The trainings have been provided by manager, safety team leader and members qualified according to training procedure. All operators, maintenance staffs affecting the risk of cyanide are qualified as required by training & qualification procedure. Also, training effectiveness has been evaluated every six month by testing and observation. The evaluation results are reflected on training programs. In addition, all new employees prior to perform their job should be trained on safety and health for 16 hours at the time of joining the plant and for 2 hours per month thereafter.

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

..... **X in full compliance with**
The operation is. in substantial compliance with Production Practice 4.2
 not in compliance with
 not subject to

Summarize the basis for this Finding/Deficiencies Identified:

All employees are well aware of the emergency response actions against cyanide exposures and releases through repeated education, training and emergency drills. The emergency response plans specify all the employees' duties such as safety representative, first-aid responder or firemen, etc. Mock emergency drills are regularly conducted to ensure that the employees are familiar with their duties and roles. The results of the mock emergency drills are evaluated and analyzed. Any area need for improvement found was immediately improved. The results of education or training are recorded.

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

..... **X in full compliance with**
The operation is. in substantial compliance with Production Practice 5.3
. not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

Plant employees have been tasked with their respective duties to perform during an emergency situation. TaeKwang Industrial Co., Ltd. have nominated safety team leader as primary emergency response coordinator, technical team leader as alternative emergency response coordinator and plant manager as total supervisor. In emergency response plan, the organization was consisted of communication team, personnel rescue team, excavation leading team and facility control team etc. Detail training such as personnel rescue, lead excavation, control of facility and etc. were required and provided to emergency responders. And also safety team tested the call-out response and feedback the results to responders. The equipment required for emergency response actions is maintained in a ready state through regular check and repair. A list of such equipment is also maintained. Moreover a cooperative system with outside entities has been established effectively. The outside entities are participated in the mock emergency drills. After the mock emergency drills, evaluation and review of effectiveness for emergency response plans were implemented.

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

..... **X in full compliance with**
The operation is. in substantial compliance with Production Practice 5.4
. not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

The emergency communication channel, communication method and contact information were defined in emergency response plan. In internal communication channel, the contact information as telephone number etc. for top management, plant manager, each team leader and safety team members were identified. In external communication channel, regulatory agencies such as Ulsan Municipal Office, Korea Safety & Health Agency, labor office and outside response providers such as fire agency, nearby plants and Good Morning Hospital were identified. And through emergency simulation test, TaeKwang Industrial Co., Ltd. identified potentially affected communities as nearby companies and plants. The communication methods and contact information such as telephone, mobile phone etc. for relevant personnel of outside responders and potentially affected communities were identified and updated in emergency response plan.

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

..... **X in full compliance with**
The operation is. in substantial compliance with Production Practice 5.5
 not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

TaeKwang Industrial Co., Ltd. has established emergency response plan and toxic chemical neutralization plan. Detailed methodologies for remediation, neutralization, decontamination and control of contaminated material were defined in the plan. The emergency response plan defined that sodium hypochlorite, ferrous sulfate and hydrogen peroxide shall not be used to treat and neutralize the cyanide released into surface water. They also have established the environmental monitoring for emergency release to identify the extent and effect of release, sampling methods, parameter and possible location in emergency plan.

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

..... **X in full compliance with**
The operation is. in substantial compliance with Production Practice 5.6
 not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

TaeKwang Industrial Co., Ltd. has periodically conducted emergency response mock drill, and the plan was reviewed and evaluated for its adequacy and revised every year. The results of emergency mock drill were adequately evaluated, analyzed and used as data to improve the plan and procedure. Additionally, they implemented regular mock emergency communication training to check the state of the communication system. According to emergency procedure, emergency plan shall be evaluated for its adequacy after the actual emergency cases and also the plan was revised as needed. Actual emergency situation has not been occurred since last recertification visit in 2011.