ICMI CYANIDE CODE
SUMMARY AUDIT REPORT
CERTIFICATION AUDIT
CYANIDE PRODUCTION

CLOSED JOINT STOCK COMPANY
"KORUND ZYAN"
1ST OF MAY STREET, NO. 1
606000 DZERZHINSK
NIZHNI NOVGOROD REGION
RUSSIA

Submitted to:
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CJSC Korund Zyan, Site Dzerzhinsk, Russia
(Signature Lead Auditor Dr. Steinweg)
Audit Date: Feb 17, 2014
Location detail and Description of operation:

The Korund Zyan facility is located on the premises of Korund Industrial Park in Dzerzhinsk, Region Nizhni Novgorod, Russia, which itself is located within a major industrial area predominantly occupied by chemical companies, approximately 3 km east of the Dzerzhinsk city centre. Approx. 2 km south of Korund Industrial Park the Oka river flows, the second largest tributary (approx. 1,480 km) of Wolga river. The plant is designed with a max. production volume of 40,000 tons NaCN / year. The first portion of this total volume -20.000 tons NaCN / year- is currently installed and in operation.

The facility is specialized in the manufacturing of sodium cyanide (NaCN) used in the local Russian gold mining industry. The production of alkali cyanides is completed in several steps. The subject facility depends on several tasks and services provided by Korund Industrial Park organization, in particular related to energy and pressurized air supply, steam, water and cooling water supply, general environmental management services, final wastewater treatment, waste management, security, medical services, additionally emergency preparedness including fire brigade and fire water retention. The services retained are governed by an appropriate service contract. Korund Zyan has established an Emergency Response Plan and performs corresponding mock drills on a regular basis.

The present report describes the results of the initial certification audit assessment according to current ICMI's Production Verification Protocol.
Auditor’s Finding

This operation is

☒ in full compliance
☐ in substantial compliance *(see below)
☐ not in compliance

with the International Cyanide Management Code.

* For cyanide production operations seeking Code certification, the Corrective Action Plan to bring an operation in substantial compliance into full compliance must be enclosed with this Summary Audit Report. The plan must be fully implemented within one year of the date of this audit.

Audit Company ...................................... LULU Intelligent Organization
Audit Team Leader ............................... Dr. Benno Steinweg
Email .................................................. Benno.Steinweg@gmail.com
Names / Signatures of other auditors ... n/a
Date of audit ................................. April 08-12, 2013; Feb 17-18, 2014; May 12, 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.
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.

☒ in full compliance with
☐ in substantial compliance with    ☐ not in compliance with

This operation is                      Production Practice 1.1

Summarize the basis for this Finding:

The Korund Zyan facility at the Dzerzhinsk site (Korund Industrial Park) was built using sound, accepted engineering practices and quality control processes. Green field planning, construction, erection, operational qualification and start-up took place in 2011 / 2012. The complete process up to start-up was done in good cooperation among the main partners Korund Zyan as operating company, CyPlus as process licence donator and an German engineering contractor with good experience in planning and realization of highly automated industrial chemistry projects.

Extensive QC & QA records regarding the construction of the total plant, incl. all production steps, packaging and warehouse facilities were reviewed and were found to be acceptable. Appropriate quality assurance and quality control, management of change documentation, drawing control, equipment sign-offs and usage of a data control computerized system (DCS) were available to demonstrate compliance to Code requirements. Acceptable materials of construction are formally defined in the licence donators as well in the engineering contractors Engineering Standards and a review of records confirmed that materials used conform to those requirements. All operations and process equipment are in closed buildings or under a roof of an open-air building within lined concrete secondary containment areas with concrete pump sumps. The production / packaging area has appropriate containment systems that ensure full containment with sufficient capacity in case of a storm event bringing rain water. Alarms and interlock systems keep the production process under control in the event that there is an upset condition or a container has been overloaded. Korund Zyan uses standard operating procedures and standard forms to inspect their interlocks, dust collection systems, process equipment, continuous and sequenced DCS based recipes and containment systems regularly to ensure functionality and integrity.

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

☒ in full compliance with
☐ in substantial compliance with    ☐ not in compliance with

This operation is                      Production Practice 1.2

Summarize the basis for this Finding:
The facility has a full set of standard operating procedures that describe the standard practices necessary for it's safe and environmentally sound operation, but also for contingencies during upsets in it's activities that may result in cyanide exposures or releases. Further detailed work instructions are maintained, updated and valid. Preventive maintenance programs are in place. The facility runs a management of change procedure with a corresponding form sheet. In case of planned changes or planned engineering work / projects the site management needs to sign it to release the change suggestion. To assure a safe and continuous production in-line measurement instrumentation such as HCN detectors, transducers, level transmitters etc. are installed. They all supply electronic information to a central computerized system (DCS), where continuous monitoring takes place and controlling field signals are generated to keep the process under control and within defined process specifications. Solid cyanide and cyanide solution is / are recycled within the process and thus do not generate waste. Contaminated solids and other materials are shredded, washed and collected in waste drums which are labeled according to Russian legislation and are transported and disposed by authorized waste-companies. The storage locations are constructed at all sides with full protection against rainfall. Fire fighting with water when cyanide is present is prohibited. Inside the building HCN detectors / indicators are in place. The storage of the final goods is located in an separate building, continuously ventilated by an appropriate HVAC system. The production and storage areas are located within an industrial park property, that is —in general— protected by an very restricted access control system. The produced cyanide is packed in packages which are in full compliance with the international regulations for transportation of dangerous goods (e.g. ADR and UN regulations).

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

- in full compliance with

This operation is
- in substantial compliance with Production Practice 1.3
- not in compliance with

**Summarize the basis for this Finding:**

The facility runs routine inspection and maintenance programs to assure the functionality of all equipment. Besides these inspections (very often required by strict Russian legislation or by Korund Zyan regulations) additional routine inspections for tanks, pipelines, containments, valves are performed regularly by shift leaders and operating personnel throughout the facility. Preventive controls incl. mandatory driven checks such as metering the thickness of tank and container surfaces are considered and are part of the defined maintenance program; inspection plans and schedules are maintained. The performed inspections are sufficient and are in compliance with the local Russian law. Frequencies are defined by law and / or by risk assessments. The facility conducts routine inspection program for tanks, valves, pipelines, containments and other cyanide production and storage facilities. The Russian requirements are very strict and often equivalent or higher than expected by the Code. In cases where no local requirements or just requirements on a lower level exist, the respective ICM Code requirements are defined as valid. All verified inspections were without any complaint. A Technical Measure system is in place to handle deficiencies coming out of inspections or technical checks.

CJSC Korund Zyan, Site Dzerzhinsk, Russia

(Signature Lead Auditor Dr. Steinweg) Audit Date: Feb 17.-18.; May 12, 2014
PRINCIPLE 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.

☐ in full compliance with
☐ in substantial compliance with  Production Practice 2.1
☐ not in compliance with

Summarize the basis for this Finding:

In accordance to Russian law the Korund Zyan organization is enforced to perform a danger and risk analysis in which all relevant aspects regarding safety on work are considered. All working places and effects on all employees such as operational manager, shift leaders or shift-workers have been analyzed. As a result of this analysis, different measures and actions concerning personal protective equipment (PPE), monitoring devices, technical equipments, inspection routines, procedures, instructions, emergency plans, warning signs, medical check-ups were developed and implemented in cooperation with medical experts, doctors and a safety engineer. The danger and risk analysis docs are reviewed routinely by an expert team (medical department, safety engineer and plant superintendent), periodically by internal audits or "clean and order" inspections, partially together with the employees. In addition to this analysis job safety analysis is implemented. All workers in the production and partially in the storage area have to wear a personnel portable HCN detector. Within these procedures all items of verification protocol chapter 2.1 are taken into account.

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

☒ in full compliance with
☐ in substantial compliance with  Production Practice 2.2
☐ not in compliance with

Summarize the basis for this Finding:

The cyanide plant has developed and implemented an operational alarm and emergency response plan in accordance to Russian legal requirements. This includes the specific conditions and measures in the production plant, e.g. summary of the most important responsibilities for emergency cases, behaviour in case of emergency, cooperation with cyanide squad of the local and regional chemical protection organization. Antidote management system and handling standard operation procedures are in place. Material Safety Data Sheets (MSDS) are available in Russian language, e.g. for sodium cyanide bricks and cyanide solution. According to Russian law additional advices in writing are available on that place where cyanide handling is performed. These advices are basis of routine trainings. First-aid equipment is in place at the plant. The emergency facilities are inspected periodically, records on that checks are available and in place. Medical support with all required instruments and equipment is implemented on site. First aid, emergency response equipment and medical material is stored, shelf live monitored and in maintenance as recommended by the experts.
doctor, manufacturer). The Korund Zyan as well as the Korund Industrial Park medical personnel cooperates with local hospitals and neighbored industry. Beside these activities, in cooperation with Korund Industrial Park Organization and local fire-brigades mock-drills are conducted routinely on the cyanide production site and facilities. Lessons learned are derived from those drills and the corresponding operating procedures are updated, as required.

Dangerous goods labelling (not just cyanide, but also other dangerous goods related) of storage and process tanks, pipelines, containers, transportation facilities and so on are in place; in case of piping also with arrows indicating the direction of cyanide flow. This is also in accordance to local Russian regulations (“Dangerous Goods Directive”).

The decontamination policy is established and transferred to different work instructions of the plant documentation. All the cyanide plant’s programs and procedures maintained are defined in controlled documents. In general there are two ways / rationales to review and update those plant’s emergency response programs and procedure: driven by time and driven by event.

The operational alarm and emergency response plan as the very central ERP document requires the updating each 5 years according to Russian law. Additionally after each and every incident an evaluation of the situation must be done and an update of the ERP must be done. This combination of event and time driven procedure is mandatory required by Russian legal requirement “PA 09-536-03 / 2003” (method of preparation and review / updating of a plant specific ERP). In this method not only the 5 year’s activity is required, but also the incident driven review process.

**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.

☑ in full compliance with

☐ in substantial compliance with Production Practice 3.1

☐ not in compliance with

**Summarize the basis for this Finding:**

The Korund Zyan production plant at Dzerzhinsk site has no direct discharge to surface water. Production plants operating on the Korund Industrial Park in Dzerzhinsk discharge their wastewater in the Korund Industrial Park infrastructure sewer system. Process wastewater is treated at the Korund Zyan owned and operated on-site wastewater treatment plant. Monitoring and control systems are in place to prevent unplanned spill into the Korund Industrial Park infrastructure sewer system. The CN concentrations of the wastewater prior to discharge into the sewer are determined per titration each 5 to 10 minutes and displayed in the Korund Zyan control room and also transmitted to the water protection department of Korund Industrial Park infrastructure service. The measurements show that the free cyanide content before biological treatment is not higher than 20 mg/l (average approx.: 0,5 mg/l). The Korund Industrial Park defined and operated continuous measurements after final mixing and before discharging show in each case values below 1 ppb CN-free and 0,5 mg / ltr. WAD CN. The groundwater regime is continuously investigated and clearly evidenced due to the specific local requirements.
Groundwater measurements are installed as a routine and were done currently at two points-of-monitoring located downstream of Korund Zyan site. Even when there are no specific legal thresholds defined for groundwater CN-contamination the results show values being fully within specifications for surface waters.

Generally all filling processes are controlled by suction units in the immediate surrounding of the scales. The emissions are finally treated in a gas scrubber. Site management has initiated workplace measurement for CN and NH₃ in order to evaluate the consequences of a proposed decrease of the cyanide limit. Based on a report, it was concluded that current allowable workplace concentrations are met. The site operates in compliance with the permit requirements stipulated for air emissions.

The monitoring frequency (annually) of the groundwater situation seems to be sufficient because all potential handling areas are constructed to keep potential spills away from soil / natural ground. This is also valid for whether situations incl. strong wind.

The monitoring frequency (continuously = min. daily) of the process water situation (including the collected surface water) seems to be sufficient because all potential changes (e.g. caused by technical defects) can be detected in a timely manner (max. 10 minutes grid of measurement; with respective communication in case of non-compliance).

The monitoring frequency of the gas phase processes are both: mandatory defined (3 years at two defined gaseous wells) and voluntary defined (different frequencies; partly continuous measurements displayed at DCS interfaces to shift personnel; incl. the two wells to be monitored mandatory). Based on fail-safe-controls (e.g. gas scrubber) on the one hand and the available long-term results of the mandatory defined measurements on the other hand the defined monitoring seems to be sufficient.
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 plant in a manner that minimizes the potential for cyanide exposures and releases.

☑ in full compliance with
☐ in substantial compliance with  Production Practice 4.1
☐ not in compliance with

Summarize the basis for this Finding:

Based on their professional education, the operating employees are qualified as skilled chemical workers. They went through professional training, especially training-on-the-job mostly for a 3-months period and finished their education with an examination that leads to a certified degree. This education is the basis for the further training concept which is specified to the requirements of the certain function of each and every employee. One of the many further trainings are basic safety trainings which are enforced by Russian legislation or which are in accordance to the risk analysis, such as: handling of hazardous materials, usage of PPE, alarm and emergency responding, emergency drills, cyanide exposures and how to act / react, or operating procedures/instructions. These trainings are partially mandatory required and have to be repeated annually, held by specially qualified trainers. The trainings are focussing on the specifics of the dangerous materials, e.g. cyanides and HCN. A training schedule is maintained, based on requirements of the jobs (taking HAZOP study into account) and also based on the skills of each individual.

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

☑ in full compliance with
☐ in substantial compliance with  Production Practice 4.2
☐ not in compliance with

Summarize the basis for this Finding:

All employees at the Korund Zyan plant undergo periodical training lessons regarding safety issues when cyanide handling occurs. This includes potential exposures and releases. The training contents are mostly an outcome of the Emergency Response Plan. The risk scenarios are practised by routine drills. Corrective actions are derived, defined and realized. The acting people of the Korund Zyan plant are involved throughout the complete mock drill activities to improve their skills and to optimise their awareness. Following the specific Russian requirements the trainings are documented as required: to be traced back personally to each individual, covering the subjects trainer, topic, date, duration and kind of verification of understanding and effectiveness.
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.

☑ in full compliance with
☐ in substantial compliance with Production Practice 5.1
☐ not in compliance with

Summarize the basis for this Finding:

All relevant and potential failure scenarios were initially defined during the new plant’s project phase by performing an intensive HAZOP analysis in cooperation with the licence donator and the engineering contractor. Derived from that the cyanide plant has developed and implemented an operational alarm and emergency response plan: the plan “ПЛАН” from Korund Zyan an. Those plan is in conjunction with outside responding partner’s systems, especially Korund Industrial Park’s emergency system. Crisis and emergency response management is regulated in detail. The local emergency responders such as Korund Industrial Park’s fire brigade, medical doctors and diverse state agencies are involved in the process of developing these Emergency Response Plans. Objectives and contents of the “ПЛАН” (ERP) are defined and described. In all emergency situations the central fire-brigade and the medical station are alarmed; they are present on site within a few minutes in order to control releases, to extinguish fires, to give first aid measures and cyanide antidotes

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

☑ in full compliance with
☐ in substantial compliance with Production Practice 5.2
☐ not in compliance with

Summarize the basis for this Finding:

According to Russian legislation, the operational alarm and emergency response plan “ПЛАН” is a mandatory document, where different parties must be involved and informed. As a first step the ПЛАН was initially drafted during the project phase involving the licence donator and the engineering contractor. During this process of preparation the inputs were asked from –among others- state inspectors for occupational health and worker’s safety, neighbored plants within Korund Industrial Park Site, Korund Industrial Park Site Management, Korund Industrial Park Site fire brigade, municipal fire brigade, hospitals, City administration of Dzerzhinsk, State Security Department, Ministry of the Interior, state representative for plant safety in Moscow.

Once released, the ПЛАН is continuously maintained in a current status. The continuous updating of the ПЛАН is done mainly with the internal resources, especially when technical changes are planned
and realized. In this case the lead planning engineer has to ensure, that the respective portions of the ПЛАН also have to be considered / updated, as necessary. If so, the ПЛАН has to be changed and the change has to be communicated to each and every holder of a controlled copy, also the external entities and parties. Contributions to the ПЛАН to be updated, coming from the external entities and parties are discussed and can be involved, as required.

The “ПЛАН” (ERP) contains a list of the industrial neighbors which may be affected in case of cyanide release. Their activities, addresses, contact dates and contact names are listed. Some communication activities with interested parties and stakeholders are initiated to assure that the relevant information and updates concerning the actuality of emergency response plans are addressed.

Finally Korund Zyan’s employees are also involved in planning and updating the “ПЛАН” (ERP), e.g. by an maintained proposal system and by definition room for improvement e.g. during participation at the mock drills.

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

- in full compliance with
- in substantial compliance with
- not in compliance with

**Summarize the basis for this Finding:**

Crisis and emergency response management is clearly defined and trained. The ПЛАН is the core document to describe the relevant activities in case of incidents. Parts of these document are the determination of tasks and responsibilities and the description of certain functions such as security personnel, fire-brigade, medical department, 24-hour-standby duty service team or site crisis team. The specific members of these teams are named, listed and kept up to date. The responsible coordinators and functional leaders are defined as well, e.g. the Korund Zyan site manager and his backup, the chief emergency response coordinator, the head of the fire-brigade or the communication manager. Call-out procedures are included and 24-hour contact information for the response team members is ensured. Alert chains and internal / external reporting lines are implemented. According to the ПЛАН and to detailed procedures appropriate trainings for the staff of the fire-brigade are exercised routinely. All emergency respond equipment including its inspection is listed in the corresponding attachment of the ПЛАН. The cooperation with outside responders is also part of the ПЛАН; telephone numbers, addresses and contact persons (includes internal contacts and external contacts such as authorities, police, neighbored companies, public institutions, transport companies, hospitals and medical support, public media ) are listed and kept up to date.
Production Practice 5.4: Develop procedures for internal and external emergency notification and reporting.

☑ in full compliance with
☐ in substantial compliance with  Production Practice 5.4
☐ not in compliance with

Summarize the basis for this Finding:

The ERP (ПЛАН) describes in detail the anticipated emergency situations using a risk assessment method. As an outcome of this risk assessment the following organizational steps are defined:

• General alarming procedures (warning of the employees; internal reporting; communication processes depending on the severity of the incident; involvement of the neighbourhood; cooperation with public media in cooperation with Korund Industrial Park Organization).

• Fast definition of: Who is responsible? What does he has to organize? (general roles and rules of behaviour; description of certain functions such as security personnel, fire-brigade, medical department, production plant staff, technical and environmental department, 24 hours standby service team, site crisis team, district fire-brigade)

• Centrally organized information and communication duties organized by dispatcher ("Диспетчер ПТО").

• Telephone numbers, addresses and contact persons (including internal and external contacts such as authorities, police, city government, adjacent companies, public institutions, transport companies, hospitals and medical support, public media such as local radio stations)

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

☑ in full compliance with
☐ in substantial compliance with  Production Practice 5.5
☐ not in compliance with

Summarize the basis for this Finding:

The emergency response plan ПЛАН includes remediation measures as integrated requirements, clearly defined during risk assessment. On site these activities are accompanied by the analytical lab and, in case of spillage, by the fire brigade. If necessary, specific activities will be realized in relation to the environmental impacts. The use of chemicals is regulated in the procedures, sodium hypochlorite, ferrous sulfate or hydrogen peroxide treatment of cyanide that has been released into surface water is prohibited. Furthermore and according to the ПЛАН: if negative environmental impact may occur from cyanide accidents, monitoring instruments, methods, parameters and locations have to be identified to check the current situation and to figure out an appropriate action plan for remediation activities.

CJSC Korund Zyan, Site Dzerzhinsk, Russia

(Signature Lead Auditor Dr. Steinweg)  Audit Date: Feb 17-18; May 12, 2014
Production Practice 5.6: Periodically evaluate response procedures and capabilities and revise them as needed.

☑ in full compliance with

This operation is ☐ in substantial compliance with Production Practice 5.6
☐ not in compliance with

Summarize the basis for this Finding:

The routine and the non-routine process for plan reviewing procedure is described in the emergency response plan ПЛАН. Beyond the statutory requirement of updating as a minimum each 5 years intensive and routinely performed mock emergency drills have been conducted all over the Korund Zyan organisation with all necessary resp. interested parties as described in the previous chapters of this report. Resulting findings and room for improvement analysis are part of systematic evaluation process of the emergency response plan. This is the basis for the continuous improvement of the safety and security situation at the Korund Zyan site within the industrial park in Dzerzhinsk.