

# SUMMARY AUDIT REPORT

for the November 2016  
International Cyanide Management Code Certification Audit



**Prepared for:**

Limited Liability Company 'Saratovorgsyntez'

**Submitted to:**

International Cyanide Management Institute  
1400 I Street, NW, Suite 550  
Washington, DC 20005, USA

**FINAL**

29 March 2017



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## SUMMARY AUDIT REPORT

**Name of Plant:** Saratovorgsyntez, Limited Liability Company (LLC)

**Name of Plant Owner:** JSC Lukoil

**Name of Plant Operator:** Saratovorgsyntez LLC

**Name of Responsible Manager:** Volodin Vyacheslav, General Director

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### **Location details and description of operation:**

Saratovorgsyntez sodium cyanide production plant (plant) is part of a large chemical manufacturing complex located in a designated industrial area of Saratov, approximately 15 km southwest of Saratov city centre. The plant manufactures sodium cyanide briquettes for the mining industry using hydrogen cyanide generated as a by-product from an acrylonitrile plant located within the complex. The plant includes two production lines of similar design. The first line began operation in 2008. A second line was constructed in the same building and began operation in 2015. The plant produces between approximately 15,000 and 18,000 tonnes/year of sodium cyanide briquettes.

The key process involves the reaction of liquid hydrocyanic acid with sodium hydroxide to form a sodium cyanide mother solution. The mother liquid is concentrated through evaporation and fed to a crystallizer under controlled conditions. The cyanide crystals formed are separated from the mother liquid and the filtrate is recycled back through the crystallizer. The wet cyanide crystals collected are dried and moulded into briquettes. The briquettes are packed into steel drums, or 400 kg or 1,000 kg plywood boxes, and stored in a dedicated warehouse prior to shipment. All off-gases from the process and ventilation systems pass through a wet scrubber system to remove cyanide and HCN gas prior to discharge through an incinerator to the atmosphere. Wastewater from the process and wash down water is collected in tanks and treated with hypochlorite prior to being piped to the industrial complexes biological wastewater treatment plant prior to discharge into the Volga River.

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### *Auditors' Finding*

**The operation is:**

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

**Audit Company:** **Ramboll Environ**  
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**Audit Team Leader:** John Lambert  
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#### **Names and Signatures of Other Auditors**

**Technical Auditor:** Ivan Senchenya



**Date(s) of Audit:** 23 November 2016 and 25 November 2016

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 Detailed Audit Findings Report (DAFR) 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 latest version of the *International Cyanide Management Code Verification Protocol for Cyanide Production* and using standard and accepted practices for health, safety and environmental audits.



## SUMMARY AUDIT REPORT

### **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:                   ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 1.1.

#### ***Discuss the basis for this Finding/Deficiencies Identified:***

Sodium Cyanide is produced in two facilities commissioned in 2008 and 2015, respectively. Design of the first facility began in 2004 by Giprosintez and plant construction began in 2007 after the design was approved by State expertise. Construction supervision was undertaken by Giprosintez. Construction was signed-off by Rostekhnadzor (RTN) and a Commissioning Act of acceptance was issued prior to start of production. The second plant was designed by GLATT Ingenieurtechnik GmbH, a German engineering company, under licence from E.I. du Pont de Nemours and Co., Inc. (USA). The design was approved by Glavgosexpertiza. Construction supervision and acceptance up to the point of commissioning was undertaken by LUKOIL Nizhegorodniinefteproekt, LLC. A Certificate of Conformity to Technical Regulations for Capital Construction was issued on 5 June 2015. Engineering documentation and approvals for construction are located in Saratovorgsyntez's office or are in their archive.

The Positive Opinion of Glavgosexpertiza concerning the project confirms the materials used for construction of cyanide production facilities are compatible with applicable reagents used in the production process. The majority of piping and vessels used to convey and process cyanide solutions are constructed of various grades/standards of stainless steel depending on use and country of origin of the component with some impellers and other components constructed of carbon steel.

Automatic valves are located at critical points in the circuit to prevent release of HCN and other upsets in the process that could result in releases. The valves are activated by pressure, temperature and/or feed rate deviations. The HCN supply is equipped with interlock valves that activate to shut off supply and flush the associated piping with nitrogen if there is a problem. The HCN supply also enters the plant on the fourth floor providing a head of 11 m, which in the unlikely event of a failure of the nitrogen flush system, provides an additional safety mechanism to drain the HCN line. In addition to the interlock valves the HCN sensors

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are in place at the valve boxes for the HCN lines to detect possible leakage. The HCN sensors also activate the interlocks in the event that HCN gas is detected.

The plants are designed to contain any spills. Spillage or wash water from each floor is directed to wastewater tanks located in a concrete containment basin just outside the plant building. All wastewater no longer suitable for return to the process is directed to the local wastewater treatment plant before being sent to the biological treatment plant that serves the industrial complex. Each floor in the plant and the concrete containment for the waste water tanks were observed to be competent and well maintained.

To prevent overfilling, process tanks are fitted with low and high level visual and aural alarms that report to the control room. The alarms are generally set to alarm when solution drops below 20% and to alarm and lock out when solution reaches 80% of the vessel volume.

Secondary containments have been designed to prevent releases to the environment. All operations and process equipment are in closed buildings or under a roof of an open-air building within competent lined concrete secondary containment areas with concrete pump sumps. These containments are sized to hold a volume greater than that of the largest tank, plus any piping draining back to the tank and design storm event. The production / packaging area has appropriate containment systems that ensure full containment with sufficient capacity to retain precipitation from a design storm event.

Spill prevention or containment measures are provided for all cyanide solution pipelines. All solution pipelines with exception of the HCN supply line to the plant are located within secondary containment provided by the plant. The HCN supply line is constructed of double welded stainless steel and is equipped with shut-off valves that will flood flush the pipe with nitrogen if there is a critical change in flow-rate, pressure or temperature outside of normal operating parameters. The integrity of all pipelines and supporting structures are visually inspected annually and hydrotested at intervals as required by federal regulation.

***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:                   ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 1.2.

***Discuss the basis for the Finding/Deficiencies Identified:***

Operating procedures, parameters and instructions covering normal, operational upsets and emergency response and shutdown are documented in operation manuals and work instructions. Procedures are also in place for personal protection equipment and instruction

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for respiratory protection. Other written instructions are in place that cover all aspects of worker safety in the work place including hot work, fire safety, explosion risk, working at heights, working with electricity, excavation works etc.

Procedures are in place for addressing operational upsets and emergency shutdown. An emergency response plan is also in place to address emergencies including fire, chemical releases and injuries. Operating procedures detail actions to be taken in the event of an upset or an emergency. Alarms and interlocks are in place for critical equipment to shut down the process and alert operators in the event of a potentially serious event. All foreseeable situations are documented in the procedures together with the response required to rectify the situation.

Russian law requires that changes in facility or operating practices undergo review and approval by Glavgosexpertsiza prior to implementation. No facility changes have been made since the start of sodium cyanide production operation. Minor changes have been made in process regulations following the regulatory approval process.

A company standard and instructions are in place for preventative maintenance. As per the standard an annual maintenance plan is developed that itemizes equipment by the name of the equipment and its schematic reference name. The frequency of maintenance (based on the requirements recommended by the manufacturer and provided in the equipment's technical passport) and the month and estimated hours to complete the maintenance are also included. This annual schedule is used to develop a monthly maintenance schedule that itemizes equipment, the date scheduled for the maintenance and the estimated hours to complete the task. The monthly schedule is updated as a record of maintenance completed. Record show the total hours of maintenance undertaken on the equipment and the hours that the equipment is in operation each year. Saratovorgsintez schedules a plant shutdown annually, usually during September/October to permit maintenance of critical equipment. Also, because the operation is regulated as a Class I hazardous facility monthly inspections of the plant are made by RTN.

The production process is continually monitored by shift operators in the plant control room. Instrumentation readout is displayed on the control room console. The instrument controls installed for each piece of equipment and the pressure, flow and/or temperature settings of alarms and interlock systems are listed in a Technical Rule Book. This instrumentation is inspected and calibrated as per a Company Standard.

All wastewater from the cyanide plant is directed to the wastewater tanks located in a concrete containment basin just outside of the plant building (Facility 650). Any precipitation accumulated in the tank containment basin is also pumped into one of the wastewater tanks. Procedures are in place and implemented to prevent unauthorized/unregulated discharge to the environment of any spills or cyanide impacted water that is collected in a secondary containment area. All wastewater, including precipitation accumulating in containment basins but with the exception of sanitary waste, is directed to Facility 572, the local wastewater

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treatment facility, for hypochlorite treatment to neutralize cyanide prior to being directed to the biological wastewater treatment plant for further treatment. At the biological treatment plant the wastewater is processed to remove contaminants, including any residual cyanide, to meet regulatory environmental surface water standards prior to discharge into the Volga River. Discharge is regulated under permit. The operation monitors the discharge from Facility 572 to ensure that it doesn't exceed 0.055 mg/L free cyanide. Although stormwater run-off from the surrounded area mixes with the discharge from Facility 572 on the way to the biological treatment plant, this discharge criteria was set to ensure that wastewater does not exceed 0.03 mg/L free cyanide at the inlet to the biological treatment plant as a concentration above this would be toxic to biological treatment process.

Sodium cyanide briquettes produced by the plant are packed into steel drums and in supersacks packed in plastic lined 350 kg or 1,000 kg IBC plywood boxes. The drums and IBC boxes are transferred between the plant and warehouse via a covered conveyor system, which prevents the containers being exposed to moisture.

A balanced general natural ventilation system in the warehouse exhausts through channelled baffles and air is supplied through windows and structural openings. The ventilation is designed to turn on in response to hydrogen cyanide gas detectors, in order to ensure the air exchange necessary to reduce the content of pollutant to less than the maximum permissible concentration level (i.e., 0.3 mg/m<sup>3</sup>).

The production and storage areas are located within an industrial area that is protected by a very restricted access control system. Access into the plant process compound is controlled by company security guards. Access is restricted to authorized personnel only and entry requires signed authorization.

The produced cyanide is packed in packages, which are in full compliance with the international regulations for transportation of dangerous goods. Packaging and containers have Certificates of Conformity to the Standards of UN Recommendations on the Transport of Dangerous Goods, International Maritime Dangerous Goods Code (IMDG), The European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), and Regulations concerning the International Carriage of Dangerous Goods by Rail (RID).

### ***Production Practice***

#### **1.3 Inspect cyanide production facilities to ensure their integrity and prevent accidental releases.**

The operation is:   ■ in full compliance  
                          in substantial compliance  
                          not in compliance...with Production Practice 1.3.

#### ***Discuss the basis for the Finding/Deficiencies Identified:***

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Daily inspections of the plant are undertaken by operators at the change of shift as per area operator job instructions and any concerns are documented in the shift log. Procedures are in place and implemented to conduct routine inspection and maintenance of tanks, valves, and pipelines in compliance with these procedures. There are also regulatory requirements for inspection and maintenance of piping and valves with operating pressures up to 100 MPa. Regular expert assessment also carried out on industrial safety of components of the hazardous industrial facilities in accordance with the engineering maintenance and repair provisions and detailed work instructions.

Based on observations made during the site visit the inspection frequencies appear sufficient to assure that equipment is functioning with design parameters. Inspection frequencies are set out in the detailed work instructions for inspection and maintenance of equipment and buildings. The inspection and maintenance frequencies are selected based on the specific equipment passport requirements which follow RTN requirements. Also, because the facility is a Class I hazardous operation monthly inspections are also undertaken by RTN.

All inspection services of the Company file a designated form on the results of the inspection, which includes the data on the nature of observed deficiencies, the date of the inspection, as well as the date of deficiency being eliminated, the name of the inspector, the measures undertaken to address and fix deficiencies identified.

## **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:   ■ in full compliance  
                          in substantial compliance  
                          not in compliance...with Production Practice 2.1.

#### ***Discuss the basis for this Finding/Deficiencies Identified:***

The safe work procedures manual and amendment provides descriptions on the main hazards to be encountered, basic rules of work, fire safety, personal protective equipment (PPE), personal hygiene and cyanide exposure first aid measures. In addition there are specific instructions on the safe performance of hazardous tasks, including, respiratory protection, confined space entry, hot work, working around chemicals, working at heights, working around mobile equipment, and for performing specific maintenance tasks. Operational procedures are also in place that provide instruction on work tasks associated with operating the plant. These include a cyanide plant operating manual that has instructions to evaluate

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and rectify non-routine or abnormal situations; address emergency situations during incidents and accidents, and undertake emergency shutdown. In addition job safety analysis is also implemented. In accordance with Russian regulation Saratovorgsyntez must carry out a hazard and risk analysis in which all relevant aspects regarding safety of work are considered. The hazard and risk analysis documents are reviewed routinely by an expert team, and periodically by internal audits with partial input of employees.

Worker input is encouraged. This is achieved through designated worker H&S representatives on the Saratovorgsyntez professional union H&S committee. Committee meetings are held quarterly during which worker representatives present input. Saratovorgsyntez also holds an annual H&S review competition in which workers are invited to present ideas for OH&S improvement. The winners of the competition receive a financial bonus. There is also a 5S (efficiency and effectiveness management) competition held between Saratovorgsyntez departments. The competition encourages improvement in production efficiencies and overall organization including H&S management and general housekeeping. The winning department receives a financial reward.

There are 90 fixed HCN monitors located in strategic areas of the plant where HCN is a potential risk. The units monitor ambient conditions in the work place as well as interstitial space between HCN lines and conduits to monitor for leakage. The monitors are equipped with audial and visual alarms and are set to alarm at 0.3 mg/m<sup>3</sup>, the maximum permissible concentration. Maintenance keeps an additional 45 instruments in stock for replacement as monitors are taken out of service for calibration. In addition there are 15 portable HCN monitors. The HCN monitors are sent to the St. Petersburg Institute for sensor replacement and calibration annually. Relevant records and documents are retained.

All hazards associated with the workplace are identified and workers are trained in use of mandatory PPE to be used in the workplace as well as additional PPE required for undertaking specific tasks. The required PPE is displayed on signed posted throughout the plant. Operators have radios for communication with the control room. There is also a loud speaker system. Health and safety work instructions specify those tasks where a second person is required to be in attendance.

All employees are subjected to obligatory preliminary and further regular medical examinations to determine their fitness to perform their specified tasks. Medical examination is a requirement of the Russian Federation. A medical clinic is located at the site and undertakes the employee medical examinations.

All employees, contractor representatives and visitors must use PPE, including facility provided coveralls. Coveralls must be removed, vacuum cleaned in a dedicated "undusting" room, and stored in separate lockers at the end of shift. Onsite laundry facilities are to be used for work cloths. Workers are provided with two sets of coveralls and are required to shower at the end of each shift and launder their coveralls at least every four days.

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Hazard warning signs are prominently located throughout the plant to inform workers of the various chemicals and other hazards present. Signs and also displaced showing the PPE that must be worn is various areas of the plant. Tanks and vessels are labelled to identify their contents and piping is colour coded and labelled to identify the contents and flow direction.

As part of personal hygiene requirements no food, cooking or eating is permitted to be conducted on the industrial premises except at specific locations or in the dining room. It is a requirement to wash hands before eating. Smoking is only permitted in designated smoking rooms. The use of open flames is prohibited without a hot work permit.

### ***Production Practice***

#### **2.2 Operate unloading, storage and mixing facilities using inspections, preventive maintenance and contingency plans to prevent or contain releases and control and respond to worker exposures.**

The operation is:                   ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 2.2.

#### ***Discuss the basis for this Finding/Deficiencies Identified:***

An Emergency Response Plan is in place for the site. The plan provides the response actions to be taken for various emergency scenarios. The Plan is approved and signed off by senior management of the Saratovorgsyntez and representatives of government response agencies.

There are no acidic portable fire extinguishers in the cyanide production plant. In the event of a fire this building is equipped with an automatic system charged with Freon gas.

Shower stations and eyewash are located on each floor of the cyanide production plant. For the dry zone there is a nearby shower station and eyewash in the adjoining room. Each floor is also equipped with an oxygen supply escape hood. Amyl nitrite antidote kits are stored in refrigerators located in the Control Room of Building, Medical Clinic, Warehouse, and in the Rescue Team Centre. The kits are stored in refrigerators with temperature gauges to ensure that the kits are stored within the temperature range recommended by the manufacturer. First aid equipment including amyl nitrite is checked once every 30 days. Amyl nitrite is carried by maintenance personnel when undertaking maintenance work in the plant and returned to the head of shift and refrigerator at the end of shift. There are 12 medical oxygen and resuscitator kits kept at the Rescue Team Centre and on the rescue team vehicle. The Rescue Team Centre also has equipment for recharging the oxygen bottles. Operators have radios for communication with the Control Room. An emergency dispatch control centre is located at the Rescue Team Centre that is manned 24 hrs.

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Hazard information, appropriate PPE, exposure symptoms, and first aid measures are documented in the Health and Safety Manual. Product MSDS sheets are available for distribution to customers.

Cyanide awareness training, including symptoms of cyanide poisoning and first aid are a part of all cyanide plant personnel training. Several facility personnel are also trained as first responders to apply amyl nitrite. The Saratovenergoneft industrial complex retains Medis, an emergency rescue team and medical centre, under contract. Medis has 3 doctors on night shift and 10 doctors on day shift. The rescue team comprised a total of 32 emergency response personnel. All doctors and the rescue team are trained in the application of amyl nitrite and use of medical oxygen. Doctors are also approved to apply intravenous antidote such as sodium thiosulphate. The medical centre maintains an ambulance for conveying workers to the local hospital. Russian Federal Law requires all medical facilities across the country to provide emergency first aid without the need for a special agreement.

The mock-up drills are conducted routinely according to the schedule approved by a Company Order and Emergency Response Procedures to make sure the facility takes planned actions during emergencies. The drill results are evaluated and analysed, and are used to further enhance the procedures. All results are archived and controlled. Records on most recent drills conducted in the cyanide production shop on July 18, 2016; August 24, 2016 and September 9, 2016 were available for review.

Procedures are in place to investigate and evaluate incidents, including 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. No cyanide related incidents have occurred but records are available for other incidents demonstrating the procedure is being used. According to the Russian requirements an evaluation must be completed after each and every incident and an update of ERP completed as required.

**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:                   ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 3.1.

***Discuss the basis for the Finding/Deficiencies Identified:***

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There is no direct or indirect discharge of wastewater into surface waters. All wastewater from the production area undergoes local treatment with sodium hypochlorite at Facility 572 to neutralize cyanide. Discharge from the local wastewater treatment plant is directed for further treatment at the Saratovenergoneft biological treatment facility before final discharge to the Volga River.

The standard for the level of cyanide ion concentration at the control monitoring point prior discharge to biological treatment facility is 0.055 mg/l. The cyanide concentration is further reduced as the discharge is diluted with other sources of wastewater entering the sewer as it flows to the biological treatment facility which is located approximately 1.3 km away, near the acrylonitrile plant. Because of toxic effects to the biological process, the maximum allowable concentration of free cyanide permitted in feed to the biological treatment plant is 0.03 mg/L. At the biological treatment facility residual cyanide concentrations are further reduced before discharge to the Volga River. The regulated maximum permissible concentration at the discharge point to the Volga River is 0.05 mg/l for protection of fishery water bodies.

According to data for the last 3 years the concentration of free cyanide ions ranged from 0.0049 to 0.0050 mg/l; significantly below the levels of both maximum permissible concentration and concentration limits set out in the Code (0.022 mg/l) for protection of aquatic life.

There is a network of groundwater monitoring wells located over the Saratovenergoneft industrial complex of which 9 wells are monitored by Saratovorgsyntez. There are also additional wells located outside the plant boundary. Review of monitoring data from these wells for 2016 show that the groundwater has not been impacted by cyanide production activities. The concentration of free cyanide ions in these wells was below the detection limit of 0.005 mg/l or less than 0.022 mg/l.

To protect workers, there are HCN detectors located throughout the plant that alarm at 0.3 ppm, the maximum exposure limit for HCN.

Atmospheric emissions are controlled by the use of scrubbers and an incinerator to ensure that the maximum permissible concentration limits established by sanitary regulations and standards for atmospheric air quality of residential areas are not exceeded at the boundary of the sanitary zone of the enterprise. Interlocks activate on the incinerator if temperature or flow upsets compromise the quality of emissions. Ambient air quality is monitored using a mobile vehicle laboratory furnished with air sampling and analysis equipment. Measurements are collected at several points downwind of the industrial complex each day, twice a day. No exceedances have been identified.

There is an approved schedule to monitor both surface water discharge and groundwater quality. The water quality of the Volga River is monitoring both upstream and downstream of the discharge point from the biological treatment plant. Monitoring of wastewater quality after biological treatment facilities is carried out according to the "Schedule of Analytical Control of

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SC "Saratovenergoneft" Wastewater and Water Protection Sites", approved by designated legal authorities. Groundwater wells on the site are monitored quarterly while the offsite wells are monitored semiannually. Air quality monitoring is conducted according to the "Schedule of Analytical Control of Industrial Emissions of Pollutants at LLC" Saratovorgsintez", which is an integral part of the Project for the Standards for Maximum Permissible Emissions, approved by Rosprirodnadzor (Federal Environmental, Industrial and Nuclear Supervision Service of Russia). It is the opinion of the auditors that the frequency of monitoring is adequate to characterize the medium being monitored and to identify changes in a timely manner.

**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.**

The operation is:           ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 4.1.

***Discuss the basis for the Finding/Deficiencies Identified:***

The employer has evaluated the risks, hazards, skills and training required and developed written policies, practices and procedures to protect employees during the course of their work. Task instructions are developed for the every workplace and include requirements on safe conduct of the production process, emergency response, maintenance and other types of works.

Workers are required to complete a training program on hazard awareness and emergency response. This training includes hazards associated with cyanide and response to cyanide related emergencies. Semi-annual knowledge refresher training is also a regulatory requirement.

Refresher training is carried out in accordance with the list of obligatory instructions with the record being made in every worker's personal training card. The hazards related to the substances used in production are described and addressed in task instructions on working in the sodium cyanide production area and degasification area, and on use of PPE including gas masks and respirators. These instructions serve as training material for the trainings conducted twice a year.

The training is provided by engineering personnel of the cyanide production and degasification areas and is certified in compliance with the procedure established at the Company. Trainers

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are all engineers with higher education and specific safety training. They have worked at the plant for a minimum of 3 years and are required as part of Russian Regulation to take refresher training every 5 years through examination by special committee.

All new employees for the whole period of job training and training in safety are required to be accompanied by designated persons (supervisor or qualified specialists) according to a Company Order to acquire hands-on experience in the work place. In case a newly hired worker does not possess necessary qualification, a training course is offered in an educational agency in accordance to his/her major field of occupation.

Upon completion of the course and the traineeship, workers are examined in the field of standard operating procedures and/or specific occupations by a workshop's qualification committee prior to being permitted to work unattended.

To obtain hands-on experience in the field of safety, accidents prevention and their elimination in production facilities with Class I and II explosion hazard, all workers and engineering staff, directly involved in management of technological process and equipment operations at such facilities, are required take the qualification course assisted by contemporary training and skills development devices (e.g. computer simulators) in line with the Federal norms in the field of industrial safety "General Codes on Explosion Protection for Explosive and Fire Hazardous Chemical, Petrochemical Plants and Oil Refineries".

Examinations are undertaken on completion of training and annually as part of knowledge assessment refresher training. Examination is by special committee approved by Company Order. Job competence is also assessed informally through task observation. All workers must pass the testing before being allowed to work unsupervised, the testing is provided by the certification committee, consisting of engineering personnel of the production and degasification areas, representatives of the Occupational Health and Safety Department, Training and Information Centre, and the Department of Production and Operation. Following Russian requirements, the trainings are documented as required: to be traced back personally to each individual, covering the training subjects, trainers, topic, date, duration and kind of verification of understanding and effectiveness.

***Production Practice***

**4.2 Train employees to respond to cyanide exposures and releases.**

The operation is:                   ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 4.2.

***Discuss the basis for the Finding/Deficiencies Identified:***

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The Facility trains workers to understand the hazards of cyanide through induction training, which includes how to behave in the presence of special hazardous chemicals and follow safety procedures that are in place. Workers also complete induction training to perform their normal production tasks with minimum risk to worker health and safety and in a manner that prevents unplanned cyanide releases. Training is conducted by the heads of departments and shifts. Trainings on emergency response is conducted annually by instructors that underwent training in the Region Training Centre of the Civil Defense and Emergencies. Training is conducted in accordance with "Organizational and Methodological Guidelines of EMERCOM (The Ministry of the Russian Federation for Affairs for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters) for Civil Defense and Emergency Response Training for 2016-2020" and Company Directive, dated 25 February 2016. All training is documented to comply with Russian requirements: to be traced back personally to each individual, covering the training subjects, trainers, topic, date, duration and kind of verification of understanding and effectiveness.

Workers are trained how to respond to exposure to cyanide through the induction training process and on-going training. Workers are trained to respond to worker exposure to cyanide and routine drills are used to test and improve their response skills. Drills are conducted regularly and lessons learned are analysed and taken into account during updates of the training programs.

The risks scenarios are practiced by routine mock drills. These drills are conducted according to a schedule, that is developed and approved annually by Company Order and the Emergency Response Procedures to make sure the facility takes planned actions during emergencies. The drill results are evaluated and analysed, and are used to further enhance the procedures. All results are archived and controlled. Records on most recent drills conducted in cyanide production shop on 18 July 2016; 24 August 2016 and 9 September 2016 were provided for review.

Corrective actions are derived, defined and implemented. The staff of the plant is involved throughout the complete mock drill activities to improve their skills and to optimize their awareness.

Training is entered into a logbook that includes the type of training, trainee name and signature, date of training, and trainer name and signature. A Personal Registration Form is also completed, which is filed in the employee's personal file. Training session schedules and session logbooks are kept and signed by the trainers. Training session schedules and session logbooks are retained by the HSE Department and stored in the training and information centre.

**5. EMERGENCY RESPONSE: Protect communities and the environment through the development of emergency response strategies and capabilities.**

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**Production Practice**

**5.1 Prepare detailed emergency response plans for potential cyanide releases.**

The operation is:           ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 5.1.

***Discuss the basis for the Finding/Deficiencies Identified:***

The Facility has an Emergency Response Plan (ERP) to address potential releases of cyanide that may occur on site, and considers all relevant and potential failure scenarios that may otherwise require response

The ERP was agreed on with the Saratov Municipality Administration Department for Protection of the Population and Territories from Emergency Situations on 15 August 2013 and approved by the Managing Director on 22 August 2013. The Plan was also agreed on with the Chief Directorate of the EMERCOM of Russia for Saratov Oblast on 24 July 2012 and approved by the Saratovorgsyntez’s Managing Director on 18 September 2012.

The ERP is linked to specific emergency situations and the appropriate procedures and responses within the site’s systems. The scope of the ERP and associated procedures include all potential accidental releases of cyanide and potential failure scenarios. The ERP addresses the following emergency scenarios: emergencies with hazardous chemicals releases; releases during fires and explosions; releases during shipment; releases during collapse of structure elements of building and facilities; during power supply failure, in case of terrorist attack; and in case of emergency situations of a natural origin. The ERP identifies credible emergency scenarios for catastrophic release of hydrogen cyanide, releases during loading and dissolution operations; pipe, valve and tank ruptures, as well as, but not limited to, impacts of power outages, fire, etc.

The ERP contains a procedure for personnel evacuation in case of natural and man-made emergencies threat and occurrence. Specific response measures, first aid measures and use of cyanide antidotes, as well as analytical environmental monitoring are described. Specific measures on personnel response actions are presented in modules (according to the potential emergency scenario). The ERP describes specific emergency response actions for different situations, including: control of any release at source; evacuation of workers and potentially affected communities; use of first aid measures and antidotes; and containment, assessment, mitigation and future prevention of releases.

**Production Practice**

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

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The operation is:                   ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 5.2.

***Discuss the basis for the Finding/Deficiencies Identified:***

Because cyanide is classified as a poisonous substance in Russia, cyanide production, storage, transport and handling is strictly regulated by the government, and government involvement in emergency planning is required. Subdivision Managers and staff are involved in the process of development of all emergency response plan documents.

Governing authorities of the Oblast, the City of Saratov, Saratov District, and the entities and organizations within 2.5 km from the site are made aware of the nature of the risks associated with the production plant. In case of emergency threat or its occurrence, an operator of the Production Dispatcher Division of the facility notifies these parties through the local alerting network. The site regularly conducts joint drills with the town emergency services, to check that communication and response actions are appropriate.

The Fire Brigade provides its services to the facility under an agreement. The Paramilitary Gas Rescue Squad, LLC "Medis" medical institution, and security for the facility are also involved in development of all emergency response plans and measures.

Site is engaged in regular consultations/ communications with relevant stakeholders to assure that the ERP addresses current conditions and all risks.

The Company engages with the Saratov Oblast and Saratovskiy District governing authorities, and federal executive authorities on the matter of:

- emergency situations data gathering and exchange;
- assignment of additional forces and resources for the liquidation of emergency situations;
- order of emergency response measures (Rescue and Other Urgent Operations) to be initiated;
- arrangement of security at the facility during emergencies, including terrorist attacks.

***Production Practice***

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

The operation is:                   ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 5.3.

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**Discuss the basis for the Finding/Deficiencies Identified:**

The operative part of the ERP on localization and liquidation of emergencies at the cyanide production and degasification area specifies the responsible parties and emergency response procedures they are to follow.

The ERP trainings are conducted in the course of emergency drills for every module and scenario for every shift, including all specialized response services being called. A list of emergency response equipment is developed and in place.

The ERP calls for the designation of personnel to fill the roles of Emergency Response Coordinator, identifies emergency response team, defines training needs, includes call-out procedures and 24-hour contact information for the emergency response coordinator and response team members and specifies their duties. The ERP also lists all emergency response equipment that should be available, and includes procedures to inspect emergency response equipment and assure its availability when required. The ERP also describes the role of outside responders, medical facilities or communities in emergency response procedures.

The ERP was developed with input from and agreed on with third party organizations, involved in localization and liquidation of emergencies; and the facility security service, fire brigade and gas rescue squad. A mock drills schedule for facility areas is developed annually, and is introduced by the Order of the Senior Engineer of the Company. The Schedule is distributed among all facility areas and third parties: facility security service, fire brigade, gas rescue squad, medical service.

Outside entities are included in the ERP through the Regional Authority who produces the External Emergency Plan for the City of Saratov. The facility provides confirmation that outside entities included in the Plan are aware of their involvement and are involved in mock drills and implementation exercises. Records of three drills conducted in 2016 were reviewed and the formal follow up training were reviewed and accepted. Training needs of the organization are defined in the emergency response plans and formal training of all personnel involved in cyanide production/handling is carried out. Telephone numbers, addresses and contact persons (includes internal contacts and external contacts such as authorities, police, neighboured 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.**

- The operation is:
- in full compliance
  - in substantial compliance
  - not in compliance...with Production Practice 5.4.

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***Discuss the basis for the Finding/Deficiencies Identified:***

The ERP includes procedures and contact information for notifying management, regulatory agencies, outside response providers and medical facilities of an emergency. If external medical support or follow-up care is required, medical facilities and care are available at Saratov City hospitals. The ERP includes as attachments:

- Scheme of notification;
- Scheme of management organization; and
- Scheme of communication organization.

The ERP also includes procedures and contact information for notifying potentially affected communities of the incident and/or any response measures, and procedures for communication with the media.

In case of emergency threat or its occurrence an operator of the Production Dispatcher Division of the facility notifies enterprises and organizations within 2.5 km from the site using the means of local alerting network. Local Civil Defense and Emergency Situations Authorities are notified using point-to-point communication. The Production Dispatcher Division operator (personnel work in 24-hour shifts) has a list of contacts for immediate notification, which is annually updated.

***Production Practice***

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

The operation is:                   ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 5.5.

***Describe the basis for the Finding/Deficiencies Identified:***

The ERP incorporates appropriate remediation measures and chemical application and monitoring requirements associated with the use of cyanide treatment chemicals. The ERP includes provisions for emergency spill clean-up measures and personnel actions for every particular scenario.

The possibility for cyanides being released into surface water is extremely low due to the provision of secondary containments and a system for collection of cyanide releases into wastewater collection reservoirs and subsequent sodium hypochlorite treatment at the local treatment facility prior of additional treatment at the industrial complex biological treatment facility.

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Analytical monitoring is carried out throughout all stages of treatment. Discharge into biological treatment facility is exercised only under permission given based on the results of laboratory analyses of wastewater at the inlet. Cyanide concentrations control at the biological treatment facility inlet is carried out every two hours. All types of polluting substances are neutralized at the biological treatment facility using microorganism activated sludge, which achieves minimum pollutant concentrations in wastewater treated. In order to prevent high concentrations of cyanide ions being released to biological treatment there is a system of wastewater preventive monitoring developed by the Company.

Wastewater sampling is conducted every two hours. In case of emergency it is designed for wastewater to be gathered into reservoirs with follow-up two-stage treatment. Additional monitoring of pollutants releases is provided according to the ERP. For that purpose the Company established a mobile environmental monitoring station, at which the contamination zone is identified and analysis results are reported to the operator at the facility. Additional wastewater sampling is conducted at an observation well prior to wastewater being discharged to biological treatment facilities. Storm sewage, including emergency cases, is also designed to be collected in wastewater reservoirs with following discharge into industrial sewer system to be processed. All other releases, discharges from industrial sites of cyanide production and degasification area are excluded.

### ***Production Practice***

#### **5.6 Periodically evaluate response procedures and capabilities and revise them as needed.**

The operation is:                   ■ in full compliance  
  in substantial compliance  
  not in compliance...with Production Practice 5.6.

*Describe the basis for the Finding/Deficiencies Identified:*

Provisions for reviewing and evaluating the adequacy of the ERP are set out in the ERP. Intensive and routinely performed mock emergency drills are an important part of the ERP evaluation process and involve all the necessary respective interested parties. To date mock drill results have not identified the need to update the ERP itself but decisions have been made to deliver elements of the emergency response training materials more widely within specific services of the organisation. Russian regulation requires that all emergency incidents are investigated and that the ERP must be reviewed and updated as applicable.

