

***INTERNATIONAL CYANIDE
MANAGEMENT INSTITUTE***

***Summary Cyanide Production
Recertification Audit Report
Cyanide Plants 1 & 2***

***Sasol South Africa (Pty) Ltd
Sasolburg, South Africa***

5th – 8th November 2018

***For The
International Cyanide Management Code***



Name of Cyanide Production Facility : Midlands site, Sasolburg Operations

Name of Facility Owner: Sasolburg Operations,
Sasol South Africa Ltd

Name of Facility Operator : Sasolburg Operations,
Sasol South Africa Ltd

Name of Responsible Manager : Mandla Lehloo

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Location detail and description of operation:

Sasolburg Operations is a division of Sasol South Africa (Pty) Ltd, formerly known as Sasol Chemical Industries (Pty) Ltd. Sasolburg Operations consists of a number of support functions and chemical production facilities, of which the Cyanide plants are one.

The Cyanide plant is a production facility consisting of two operating plants, namely Cyanide 1 & Cyanide 2, located in the North West corner of the Midlands Site. The facility specializes in the manufacture of liquid sodium cyanide solution for use in the South African gold mining industry. The production of the final product is accomplished by converting ammonia and natural gas to hydrogen cyanide gas in Shawinigan Reactors then absorbing it in caustic soda to form sodium cyanide. The main raw materials, ammonia, natural gas and caustic soda, are sourced from within Sasol business units.

Sasolburg Operations is responsible for the provision of plant utilities (instrument air, process water, etc.) and specialised services to the various Sasol entities operating or performing functions on the Sasol Sasolburg sites, including the Cyanide plant on the Sasol Midlands Site. The aforementioned services include the following:

- Emergency Services (security, fire station, HAZCHEM, medical centre etc.)
- Environmental Services
- Water and Waste
- Site Logistics (Sasol Transportation)
- AIA (Approved Inspection Authority) Inspection Services
- Occupational Health and Safety



Auditor's Finding

This operation is

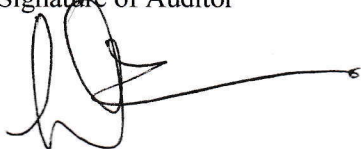
- in full compliance
- in substantial compliance *(see below)
- not in compliance

with the International Cyanide Management Code.

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

Audit Company: Eagle Environmental


Audit Team Leader: Arend Hoogervorst E-mail: arend@eagleenv.co.za


Name of Production Auditor	Signature of Auditor	Date
Dawie Viljoen		15-01-2019

Date(s) of Audit: 5th – 8th November 2018

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.

Name of Facility	Signature of Lead Auditor	Date
Sasol Cyanide Plants 1 & 2		18/01/2019

Cyanide Plants 1 & 2	 Signature Lead Auditor	14 th January 2019
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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:

The original Quality Assurance/Quality Control plant documentation, in conjunction with the Engineer's Fit for Purpose report, was reviewed in the original Certification Report. Repairs recommended by the Professional Engineer have been implemented and signed off. Two additional cyanide storage tanks were constructed in 2013 including the pumps, pipes, valves, secondary containment and structures. The project was executed by a construction company, who were contractually required by Sasol to implement a quality assurance program and quality records were sighted and sampled. Subsequent annual fit-for-purpose engineering reports for all the production facilities were sampled and reviewed. The qualifications and competencies of the appropriately qualified persons were sighted. Documentation sighted showed that materials used for construction of cyanide production facilities were compatible with the reagents used and processes employed.

Pipelines are included in the SAP Planned Maintenance System (PMS) and form part of the operational inspections. PMS inspections and process inspections are used as preventative measures for spill prevention of the cyanide solution pipelines.

There are systems in place to: - stop gas flows, stop pumps, release emergency nitrogen into the process, shut down reactors, and use back-up power to enable an orderly plant shutdown in case of power outages. The new tanks are mechanically linked, level measuring instrumentation and alarms are fitted, and interlocks in place will stop the filling of tanks if they reach 95%. Cyanide is managed on concrete surfaces to prevent seepage to subsurface. Secondary containments for process and storage tanks and containers are constructed of materials that provide a competent barrier to leakage, and are sized to hold a volume greater than that of the largest tank or container within the containment, and any piping draining back to the tank, and with additional capacity for the design storm event. The dam levels are shown on the SCADA (Supervisory Control and Data Acquisition) system and are equipped with high level alarms to ensure that the operating capacity remains available. Any overflow from the effluent dams is designed to flow down concreted trenches to the unlined environmental control dams. Any cyanide incidents requiring clean-up or remediation would be dealt with in terms of the plant clean-up, remediation and waste disposal procedure, Sasol undertakes widespread borehole, dam and outfall sampling continuously over the larger extended Midland site, as well as offsite, to check for contamination.

No changes were made or additional facilities added since the previous recertification audit.

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:

There are 310 procedural documents and 59 engineering procedures in place. Documents are now broken down into subsections: - MR-PRC-AS – assessments; MR-PROC-CL – checklists, MR-PROC-LOG – Log sheets, MR-PROC-OTM – Operating Training Manuals; MR-PROC-PJO – Planned Job Observations; MR-PROC-PTW – Permit to Work; MR-PROC-WI – Works Instructions. The procedures have been revised since the previous audit, reduced in number, and confirmed. All documents are quality controlled by a dedicated Quality Practitioner who has a specific document control function.

There is a procedure in place which covers contingencies relating to Level 1 emergencies (within the cyanide plants). A Sasolburg Operations procedure explains the Level 1, 2, and 3 emergencies. (Level 1 – site based, Level 2 – area based (Midland complex), Level 3 – External to complex.) Cyanide 1 and 2 plants are located within a much larger Sasol chemical complex (Midland Complex) which includes Sasol Operations and other companies.

Sasol has a Management of Change (MOC) Procedure which is used for any changes to equipment, infrastructure or processes. Not undertaking an MOC assessment is a dismissible disciplinary offence. This procedure is audited by PSM (Process Safety Management - either SASOL or external contractors) and DQS (ISO Auditors) annually. Examples of MOCs were sighted and reviewed. Examples of MOC exercises undertaken such as replacing cyanide 1 secondary tank and EDC tank removal: Midlands hazardous waste storage facility were sighted.

From July 2015, the WMS (Work Management System) has been implemented. An electronic Plant Condition Management Software (PCMS) system is used for statutory inspections and record keeping. The SAP (multinational software development and consulting corporation) system is used as the work and task capture system. Activities include planned inspections and generation of maintenance orders. This system contains full equipment histories. The Electronic planned maintenance system (PMS) was demonstrated to the auditor and on-screen checks were made on PM schedules and histories, for cyanide tanks, pumps, pipes, valves and bunds.

Both Cyanide 1 and 2 plants are equipped with Delta V software, updating the old Rosemount RS3 system (both are Digital Control Systems). Certification of instruments is done using certified, calibrated instruments to check the operational instruments. Process calibration is done, based on works orders automatically generated in the SAP PMS schedules. External certification is done on the Druck (pressure equipment calibration equipment) and the Gammatrol (radiation-based instrumentation calibration) units. Significant changes to process parameters are subject to a MOC process. Equipment is calibrated according to a documented schedule. Calibration certificates were sampled and found to be up to date. Eleven technicians are trained in the calibration methods and their competency certificates were sampled and checked.

Two procedures, “Management of Water and Waste Water on the Sasol 1 and Midland sites”, and “Midlands Effluent Control Works Instruction – High Cyanide from Cyanide Plant”, are used in conjunction with a water balance model to prevent unauthorized/unregulated discharge to the environment of any cyanide solution or cyanide-contaminated water. Critical scenarios were identified and appropriate procedures have been developed to prevent discharge to the environment. The water balance model was updated in September 2018, confirming dam capacities, updating inflow areas and including revised rainfall data. Cyanide waste is disposed of, by contract, to a specialist service operator who operates the Holfontein licenced hazardous waste disposal site. The Latest Holfontein external company waste disposal service supplier accreditation assessment report was sighted, dated August 2018 indicating no significant soot findings. A significant waste stream is various grades of soot and this is transported to Holfontein

in a membrane-lined, sealed bag because of potential risk of auto-ignition of soot and high cyanide contents. All waste is transported in a closed container due to the classification. Scrap metal is decontaminated before being sent to scrap metals dealer as per contract, for smelting.

The solid cyanide storage facility is situated within the Sasol Sasolburg site and is an emergency stock for dissolving when production stops. It was verified that the centre roof ventilation openings in the solid store are waterproof. It was further verified during the site visit that the solid cyanide store roof is designed to route water to the outside of the sheeting and bund. The store is equipped with a bund wall inside to prevent water from ingressing to the store floor. Doors are fitted to all entries and the building is locked. No water may be used for fire extinguishing and signage prohibiting the use of water in case of fires was observed (use of dry powder type A, B C fire extinguishers at the store was verified during the site inspection). No solid cyanide is produced or stored in the cyanide production plants. The liquid cyanide storage tanks are equipped with ventilation pipes to atmosphere as well as returning gas to the process.

Sasol does not transport solid cyanide to end users, only liquid sodium cyanide solution. Bulk tankers are designed, labelled and operated as per South African legal standards for bulk tankers and hazardous substances transport. The tankers are operated by a Cyanide Code compliant third-party transporter, Tanker Services.

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

The operation is	X in full compliance with	Production Practice 1.3
	<input type="checkbox"/> in substantial compliance with	
	<input type="checkbox"/> not in compliance with	

Summarize the basis for this Finding/Deficiencies Identified:

The Shift Manager's Handover Logbook is used to record variances, on-going observations and inspections by shift staff. The Tanker Loader Handover Log books, also in place, include checklists for shift handover covering operations, maintenance and personnel. (2016 and 2018 records were sampled and reviewed. All deviations are loaded as SAP (German-based European multinational software corporation that makes enterprise software to manage business operations) job requests and closed out in SAP.

The facility uses the SAP PMS (Planned Maintenance System) system to schedule and control inspection, monitoring, and maintenance of production facilities. Statutory Inspections (10 yearly) are undertaken by the Sasol, on-site, Statutory Inspection Authority (SIA). Weekly operational inspection checklists include looking for leaks and rust. Tanks are subject to 5 yearly visual external inspections and ten yearly full internal inspections (statutory) for all tanks. The engineering procedure, Inspection of Atmospheric Above Ground Storage Tanks, includes integrity, corrosion, leakage and bunds. All deviations are loaded as SAP job requests and closed out in the SAP system.

All bunds are included on the SAP PMS system and are inspected annually. Site inspection showed bunds were in good condition with evidence of on-going repairs and maintenance.

Daily operational inspections by checklist include pipes, valves, and pumps and include looking for leaks, noise, and corrosion. Pumps are inspected using the SAP system on a daily basis for leakage, glands, mechanical seals, noise and general condition, bolts, seal levels, seal pressure, oil levels, guards, cavitations, space is left for comments and notification including job card numbers. Safety relief valves are included on the SAP system on a 3-yearly frequency. Tank and pipe thickness testing is carried out as per schedule. The pipeline inspections for Cyanide 2 pipeline from plant to final product storage were sampled in February 2016, January 2017 and it was noted that the 2018 inspection is scheduled for 14 December 2018.

All inspections are documented and include the date of the inspection, the name of the inspector, and any observed deficiencies. The nature and date of corrective actions are documented, and records are retained. The on-going formal failure mode analyses and legal requirements and the daily “Plan Do Reviews”, together, are deemed adequate to ensure that inspection frequencies are sufficient to confirm that equipment is functioning within design parameters.

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** **Production Practice 2.1**
 in substantial compliance with
 not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

The plant only produces liquid sodium cyanide, shipped in bulk tankers to the end users. The procedures include the required PPE and pre-work inspections for the work. The use of a standby person (the “buddy”) is included in the specific procedures (e.g. Permit to Work Procedure) where a standby person is required. Operational and Maintenance Procedures sampled and reviewed included: - Sasol Group Procedure for Permit to Work Procedure, Management of Change (MOC), Offloading of an overloaded tanker, Decontamination procedure for the cyanide plant, the Maintenance Work Instruction for breaking into lines and swinging of Goggle plates, and the Laundry Service on the Cyanide Plant procedure. The Sasol Group Procedure for Permit to Work Procedure includes the requirement for a risk assessment, supported by a specific task risk assessment by the artisan before they carry out the job. The procedures routinely include normal, abnormal (non-routine) and emergency scenarios, required personal protective equipment (PPE), risks, emergency conditions and abnormal conditions, as well as protective measures, actions and responses. Non-routine and emergency operations are covered by the Sasol Group Procedure for Work Permit Procedure and the Emergency Management Risk Assessment. (The current assessment covering the Cyanide plants is dated 2015 and the next review is due in 2020.) Sasol has a Management of Change Procedure which is used for any changes to equipment, infrastructure or processes. Not undertaking an MOC assessment, when appropriate, is a dismissible disciplinary offence.

New communication structures started on 1 July 2014. Mini business meetings have been held for two years and replaced previous structures, following implementation of Project Phoenix. Project Phoenix resulted in changing communication to continue to include worker input in the form of the daily assurance meeting where safety forms a regular agenda item. Operators can raise issues relating to procedures at the daily shift meetings. Similarly, the daily maintenance meetings will include safety and procedures. Quarterly SHE meetings are also conducted which also provide opportunities for inputs. A Quality practitioner has been appointed for the Cyanide Plant to manage document issues and procedure update and control. Procedures are updated and circulated electronically to all staff on the plants who have the opportunity to comment appropriately. All staff on the plant have access to email.

There is a procedure for monitoring of the stacks at Cyanide 1 and 2 Plants. It requires monitoring of gaseous emissions to demonstrate compliance with the permit conditions and specifies monitoring of Hydrogen cyanide gas, amongst others. Hydrogen cyanide (HCN) gas emissions are limited to 15 ppm derived from the National Environmental Management (NEM): Air Quality Act (with a trigger warning at 6ppm). Data from 1 March 2015 to 1 October 2018 was sampled

with all results being below limits of detection for both stacks at Cyanide 1 and 2. The previous limit of detection was 1 ppm. The test method was improved in 2016 to a limit of detection of below 0.5 ppm.) Historical data show all values are below 1 ppm, an annual third-party verification sample was implemented and values of below 0.5 ppm were reported. Cyanide 1 and 2 stack results were sighted with one value at 1 ppm, and the rest all below limits of detection. The third party Mintek verification results (Mintek is an autonomous research and development organisation specialising in all aspects of mineral processing, extractive metallurgy and related technology.) are measured at 0.1 mg/m³ and the results indicate lower values than the SASOL internal results.

In addition, six IBRID portable gas monitors are used to ensure that workers are not exposed to hydrogen cyanide during the course of any operations that may cause the release of hydrogen cyanide as defined by the risk assessment for the job. No fixed monitors are used. The portable monitors are sent for calibration weekly but the manufacturer's recommendation is six monthly calibrations. Sighted records for 2018 confirming regular calibration. The cyanide monitors are equipped with a deactivation function to prevent the monitor being used if not calibrated on time or if faulty.

Worker exposures are governed by risk assessments and health risk surveys which influence the writing of procedures and work instructions which include relevant PPE and mitigation controls. Any "hot spots" are activity driven rather than area based, e.g. breaking into pipelines, draining the bag house, sampling activities and certain vessel entries.

The site wide radio system was upgraded to a digital trunked mobile radio system from an open channel system. This improves communication with the control room in case of emergencies. The use of the standby (the "Buddy") is included in the specific procedures where a standby is required. This was confirmed through reviewing the Procedure for work permits and completed work permits.

Employees receive annual medicals, pre-employment medicals, and exit medicals, and routine surveillance medicals are also undertaken. Staff are blocked from entering the site at the security gate if it is not recorded that they have had an up to date medical.

The site has a cyanide specific laundry. Cyanide plant personnel are issued with overalls and work clothing which is returned at the end of the shift to be rinsed (pre-laundered) on the plant from where it is sent to an outsourced contractor for final washing. Laundering of work clothes forms a part of the decontamination procedure. Employees are required to change overalls after all spills or splashes. If visitors or contractors have clothing contaminated, it will be washed in the cyanide laundry. The effluent from the laundry is returned to the plant for processing.

The signage at the three entrance gates/accesses to the plants warn of cyanide and hazardous materials, no smoking, eating and drinking or open flames and specify PPE requirements. There is a procedure for symbolic safety signs, colour coding and emergency showers in place. Sasol uses SANS (South African National Standards) standards for PPE signage. "Use of Goggles" areas are delimited by yellow painting on handrails. The use of appropriate signage including Safety Data Sheets (SDSs) display boards and the use of signage prohibiting smoking, eating, and drinking and open flames in the appropriate areas was verified during the site inspection. The auditors noted the standard of signage during the site inspection as excellent.

The on-line induction video includes reference to prohibitions of smoking, eating and drinking and open flames.

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

The operation is in full compliance with in substantial compliance with Production Practice 2.2

not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

The 'Procedure for level 1 emergency, level 2 emergency, or level 3 emergency conditions on the cyanide plants' was sighted and details the actions to be undertaken in the event of an emergency on site to ensure there is a rapid and effective response to a potential cyanide exposure. (Level 1 is within the plant, level 2 is site wide and level 3 is outside the site boundary.) The Works Emergency Action Plan (site procedure) is referenced in the plant procedure for Level 2 and 3 emergencies and the Area Emergency Action Plan is referred to in the plant procedure. The reviewed and re-signed (5 April 2018) Cyanide Treatment Protocol is in place at the clinic and the external hospitals are familiar with the protocol.

Operational shift inspections are undertaken covering fire extinguishers, eye wash bottles and boxes, fire hydrants, utility points and safety showers. Reports are done by exception. The plants moved from a paper-based system to an electronic system with more detail on the specific equipment and the ability to highlight deviations and when the inspection was not carried out. Safety showers form part of the monthly visual inspections. Showers are repaired when defective. Monthly inspection sheets which include fire extinguishers, safety showers, and eye wash boxes and bottles were sampled and reviewed.

The Sasol internal fire station inspects fire extinguishers annually and inspection reports for 2016 and 2017 were reviewed. The reports mention deviations only. A 'Procedure for the inspection and maintenance of fire and life supporting equipment' is in place. A Fire Protection Survey (including maintenance, pressure testing and servicing) is conducted every 2½ years with the latest Report for the Cyanide Plant undertaken 22 Dec 2017 being sighted. During the site inspections, the installation and use of showers and non-acidic powder fire extinguishers on the plant and at the dry cyanide store was observed and confirmed.

Oxygen and resuscitators were observed at the control room for use in an emergency. The antidote is held in a dedicated refrigerator in the Control Room. In addition, a cyanide medical treatment kit is also held in the Control Room. Both of these are only administered by the doctor attending the emergency. Potable water is readily available. Cyanide poisoning alarm points are located on Cyanide 1 and 2 Plants and are tested monthly on the 1st Friday of each month. A radio communication system is in place for plant-based communications.

The Clinic Emergency Room is fitted with defibrillators, oxygen points, beds, standby oxygen cylinders, and points on a portable oxygen distributor. It was reported that five sets of Tripacks and one set of Dicobalt EDETATE antidotes are available in the fridge in the Clinic pharmacy. If the plant cyanide alarm is set off, an alarm is automatically triggered in the Clinic. The ambulance from the Fire Department is then directed to a safe location for receipt of any affected personnel once it reaches the plant. Communication between the clinic and plant is via telephone. Trained staff at the Clinic include registered nurses and doctors on dayshift and 1 nurse and 1 doctor on standby after hours. The clinic can treat 16 patients in beds and 42 on oxygen points.

Cyanide first aid equipment consists of first aid boxes, SCBA (Self-contained breathing apparatus) sets, and emergency escape chairs. First aid boxes are maintained and replenished by the Complex's medical station. Operational shift inspections cover cyanide antidote, first aid boxes, cyanide antidote fridge, and the poisoning alarms. Equipment is inspected shiftly and monthly. SCBA sets (checked annually) and medical oxygen are checked by the Complex Fire Station and medical oxygen replenished by Afrox (contractor).

The reviewed and re-signed (5 April 2018) cyanide first aid protocol is available in the clinic emergency room and the cyanide emergency treatment kit is in the control room. The business language of the plants is English and all procedures and information materials are in English. The plants moved to electronic SDSs (Safety Data Sheets) available to all on the Intranet Bubble

Document Management System Portal and this was confirmed. All employees are computer literate and have access to computers.

Tanks and pipes are clearly marked using a stencil signage format. Cyanide is identified with flow direction indicated on pipes, all tanks (including new tanks and associated pipelines) are labelled.

A procedure is in place for transporting patients during day clinic hours to the on-site clinic and after clinic hours to the Netcare at Vaal Park hospital off site. Patients can also be transported to Fezingsubentombi District Hospital. A Mutual Aid Agreement between SASOL, NATREF, Karbochem, Safripol, Omnia and Metsimaholo local municipality, signed during November and December 2016, was sighted. This agreement covers emergency services (Ambulance and Fire Services). A Procedure details responses to minor and major exposures to cyanide. Emergencies are decontaminated at the plant and the hospital is equipped with the appropriate PPE and a specific cyanide emergency sealed bag. At the clinic, a water hose is available outside at the ambulance receiving bay, a shower and bath in the emergency room are also available for decontamination. The clinic and hospitals assume that the emergency team will deliver a decontaminated patient to the ambulance, unless otherwise notified.

Clinic staff are trained in the 1, 2 and 3 level-based emergency plan. Cyanide protocol training was given by the Clinic doctor to clinic staff and hospital staff. (training records were sighted for 2/11/2018 on site (11 medical staff attended) and similar hospital training at Netcare at Vaal Park Hospital dated 5/4/2018 (19 medical staff attended). Also sighted were training records for Fezingsubentombi District Hospital cyanide training dated 1 Nov 2018 attended by 17 hospital medical staff. The clinic senior staff and management liaises verbally with Netcare at Vaal Park Hospital and Fezingsubentombi District Hospital to ensure that they have adequate staff, equipment and expertise.

Mock drills are undertaken on a regular basis for Level 1, 2 and 3 incidents. Records for these drills were sampled with the following being noted:

Level 1:

- 28 October 2018: HCN toxic gas release due to fire at the solid cyanide store. The report includes activity time line, deviations observed, and actions to correct deviations, responsible person and target date.
- March 2018: Gas exposure at cyanide 1 Stream 2 reaction. The report notes deviations, and things that went well. A post briefing was held. The Foreman and EMS will be responsible for communicating back to training where appropriate. The drill stopped at the clinic door.
- 25 January 2017: Ammonia release from bulk storage tank. The report includes activities that went well as well as deviations. One example was an Operator who struggled to find the key to the fire hydrant box - key boxes were fitted to the boxes as corrective action.
- 19 June 2016: HCN gas overwhelmed an operator while draining a bag filter. The deviation was that the operator was not sure how to do first aid and the first aid training was re-scheduled for the operator.

Levels 2 and 3

- 10 October 2017: Emergency on Ammonia Storage tank rupturing. The detailed final report was sighted which included positive aspects, and concerns from feedback by participants. A comprehensive list of participants was also sighted. Corrective actions from the drill included a series of repeat drills, and practicing effective communications which was one of the major improvement points emerging from the drill.

- An offsite cyanide tanker spill was conducted in March 2018 at the Greenlands bridge just after the tollgate on the N1 motorway. The detailed report includes main conclusions, and outcomes.

There is a Sasol Group procedure in place, 'Group Procedure for SHE Incident Management', covering incident investigation and documentation relating to reporting, investigation and corrective actions which was reviewed.



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 with
 in substantial compliance with Production Practice 3.1
 not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

It is possible for the facility to have a direct discharge to surface water. This does not normally occur, as effluent water and storm water within the cyanide plants is captured in the lined, concrete containment pits (A, B, C, D) prior to being returned to the plants to be used in the process. If Pit D is full, overflow will pass to the CAP Dams. Water from the CAP Dams is passed to the discharge from the site via the South Channel.

A cyanide discharge is an abnormal and infrequent event. The discharge does not exceed the water standards during normal rainfall, but exceedances may occur during excessive rains. A high rainfall incident occurred during February 2017 which was reported to the National Department of Water Affairs and Sanitation. The discharge is controlled upstream through an internal service levels agreement between the cyanide plants and the Sasol complex utility department.

A probabilistic water balance, including dams A, B, C, D and the CAP dams is used to simulate and manage rainfall scenarios to prevent direct discharges. The model includes: - spillage scenarios, the effect of dilution on the dams during rainstorm events, the 1:50 year, 24 hour rain event, and tank volumes to enable simulation of a tank failure.

As there is no established Mixing Zone, the discharge itself must contain less than 0.022 mg/l free or WAD cyanide at the T1 sampling point (the discharge point). A graph of samples, including check samples from MINTEK, was sighted and most values are less than 0.022 mg/l free cyanide. Values downstream of the discharge are measured and it was confirmed that the values since the last recertification audit are less than 0.022mg/l free cyanide. There is no evidence to confirm an indirect discharge. The levels of free cyanide between T5 (upstream) and T6 (downstream) shows little difference indicating insignificant or no discharge of cyanide levels from the site. There is no evidence of indirect discharge to surface water.

There is no numerical standard established by the applicable jurisdiction for WAD cyanide or any other species of cyanide in groundwater, therefore there are no compliance points below or down gradient of the facility. There are no identified beneficial uses of the groundwater in the area, i.e. no boreholes that are extracting water for drinking purposes or stock watering.

Currently, there is no identified beneficial use for groundwater, designated by the authorities. An extensive monitoring borehole network for groundwater monitoring exists across the site. The cyanide contamination leaving the site does not appear to be related to activities at the Cyanide 1 and 2 Plants. An IGS (Institute of Groundwater Studies, University of the Free State) report, Groundwater Quality Monitoring at Sasolburg Operations (Dry Season Report) dated October 2015, and an SRK Environmental Report dated October 2015 entitled, "Assessment of Contaminated Land at the Midland Cyanide Plant, Sasolburg, and FS Province", were sighted whose groundwater and soil studies concluded that soil and groundwater risks from cyanide are low. The values from boreholes are all less than 0.1 mg/l total cyanide. Activities are still in place to remediate historical groundwater pollution unrelated to current Cyanide plants' activities. Borehole results are monitored.

There is a procedure for monitoring of the stacks at Cyanide 1 and 2 Plants. It requires monitoring of gaseous emissions to demonstrate compliance with the permit conditions and specifies

monitoring of Hydrogen cyanide gas, amongst others. Hydrogen cyanide (HCN) gas emissions are limited to 15ppm derived from the National Environmental Management (NEM): Air Quality Act (with a trigger warning at 6ppm). Data from 1 March 2015 to 1 October 2018 was sampled with all results being below limits of detection for both stacks at Cyanide 1 and 2. The previous limit of detection was 1 ppm. The test method was improved in 2016 to a limit of detection of below 0.5 ppm. Historical data shows all values are below 1 ppm, and an annual third-party verification sample was implemented and values of below 0.5 ppm were reported. Cyanide 1 and 2 stack results were sighted with one value at 1 ppm, and the rest all below limits of detection. The third party Mintek verification results (Mintek is an autonomous research and development organisation specialising in all aspects of mineral processing, extractive metallurgy and related technology.) are measured at 0.1 mg/m3 and the results indicate lower values than the SASOL internal results.

Currently the site monitors for cyanide in groundwater up and down gradient of the site. Surface water monitoring is only down gradient of the site as up gradient flows are low and intermittent and not from a significant water course. Groundwater monitoring for cyanide is conducted six monthly for boreholes where the boreholes contain water. Stack emissions are monitored twice daily at 04h00 and 16h00. Surface water sampling is through continuous on-line monitoring, 4 hourly samples, daily samples and external third-party (Mintek) monthly samples. Frequencies are reviewed on a case by case basis with consideration of performance, normal, abnormal and emergency conditions or other factors which might influence results. Monitoring for cyanide in surface and ground water conducted at frequencies dictated by water licence requirements and which are deemed to be 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 with
 in substantial compliance with Production Practice 4.1
 not in compliance with

Summarize the basis for this Finding/Deficiencies Identified:

Plant specific induction training is given to all new employees. Plant hazard awareness training is conducted every 3 years for all employees. Contractors receive plant induction training every time they come onto the plant for work. Training includes induction training, plant specific training, special skills training, and work instructions including hazards associated with the respective tasks. Training is continually reviewed and revised and PSM (Process Safety Management) requirements from the wider site are also included in the work instructions. Use is made of the spare shift to provide additional or to reinforce training. Refresher training is scheduled in the training matrix. Induction training contents changed to a SASOL generic induction which is not specific. But Plant specific induction includes plant detail and cyanide information. Refresher on the specific job is done every time a permit is issued for a job. Pre-Task risk assessments are done before every task commences. This was confirmed during the employee interviews.

The training matrix includes plant hazard awareness training (with refresher training every 3 years). The Engineering and Process training matrices were also checked and confirmed the

matrices are up to date and includes the plant specific induction and refreshers. It was also confirmed that the interviewees records are up to date. The training matrices flag training 2 months (mechanical) and 3 months (process) before the training expires. Contractors are given induction by the plant and records are kept in a separate filing system.

A standardised PPE training module is in place covering the entire SASOL operations. Every works instruction indicates what PPE is required. PPE training is covered in the Permit to Work process or if identified during the pre-task risk assessments. PPE signage is in place for each specific area. Decontamination is discussed as part of the pre-task risk assessments.

The Training Matrices includes all employees and the training requirements for the various jobs. Linked to the matrix is the employee's individual profile with the training to be undertaken and the progress completed. Competency assessments are undertaken by experienced plant personnel. Training of replacement staff is done through a structured program supported by training quality control systems and records. Experiential requirements for each job are documented, backed up with a personal development plan (PDP) and succession plan for each employee. The training is provided by appropriately qualified personnel.

In Production, an extra shift was put in place and every 5 weeks a specific shift is trained. The training is done every week for a different shift. Theoretical training is refreshed every 3 years and is evaluated using an e-learning system. Practical training is done by the foreman using works instructions. In Mechanical, mechanical baseline training is received on the person's trade, PJOs (Planned Job Observations) are done on each task in the field and specific training is done, as identified and needed. Training is done as per the training matrix which was confirmed electronically.

Employees are trained, assessed and declared competent according to National Qualifications Framework (NQF) unit standards applying to Chemical manufacture. New or transferred employees must be "passed out" on new work or tasks to be undertaken. The pass out process is included in the procedure, which was observed for the 'Training and development of Mining reagents cyanide plant personnel'. New or transferred employees are also mentored by competent staff.

Discussions have been held with the Foremen to explore ways to provide them with additional skills for their training functions. A document has been developed which will be Incorporated into existing procedures and processes at a later stage. (Discussion Session: Foreman Support in their Training Role. Cyanide plant, Ref: Plant Specific training procedure, Guidelines 2015) Contractors are not given access to the site unless they have completed the required training. After theoretical training, an employee is given an assessment test. Practical training in the plant is checked by the training officer and the appropriate shift foremen. The Shift foreman will monitor progress and return an employee for additional training, if necessary. Planned job observations (PJOs) are used to check worker competency. The standard for each Foreman is to undertake at least one PJO per month. Competency assessments are done by experienced plant personnel. Training records include competency declarations. Competency declarations are backed up by PJO's, and other records of competency determination.

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

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



Summarize the basis for this Finding/Deficiencies Identified:

The procedure to be followed in the event of a cyanide release is “Procedure for Level 1, 2 or 3 emergency condition on the Cyanide Plant”. Employees are made aware of this during induction training. The training is checked during planned exercises/mock drills. The planned exercises/mock drills cover health, safety and environmental scenarios. Contractors are covered by fulltime SASOL officials while on site. All staff receive emergency preparedness training every 2 years and this was confirmed in the training matrices.

Level 1 procedure is within the plant. All plant staff are trained in level 1 emergencies as per “Procedure for Level 1, 2 or 3 emergency conditions on the Cyanide Plant”. In the case of Site wide-Emergency Services Level 1 training, joint training sessions with plant staff are held on a shiftly basis, covering all 5 shifts as per training plan covering all the Midland Sites, including the cyanide plant. A monthly report is issued by Emergency Services. The training covers both cyanide releases and worker exposure to cyanide. Level 2 and 3 procedures are applicable site wide and are the joint responsibility of the Plants and Emergency Services and training includes plant area emergency procedures. The Sasol Emergency Fire Team training matrix covering a comprehensive emergency service training program was sighted.

A feedback (post mortem) meeting is held after emergency exercises and recommendations are made. The post mortem report, including recommendations, is fed back to the Training Department.

Training records are held throughout the working life of the employee with full records covering trainer, courses attended, dates, and performance and test results. The training matrix contains the electronic training records on training scheduled and completed for all cyanide plant employees. Training hard copy records are retained and are being recorded on the SAP electronic system, prior to being archived.

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.

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

Summarize the basis for this Finding/Deficiencies Identified:

The ‘Procedure for Level 1 emergency, Level 2 emergency, or Level 3 emergency conditions on the cyanide plant’ was sighted and details the actions to be undertaken in the event of an emergency on site to ensure there is a rapid and effective response to a potential cyanide exposure or cyanide liquid or gas release. (Level 1 is within the plants, Level 2 is site wide and Level 3 is outside site boundary.) The Works Emergency Action Plan (site procedure) is referenced to in the plant procedure for Level 2 and 3 emergencies and the Area Emergency Action Plan is referred to in the plant procedure.

Cyanide Exposure is covered in a specific Protocol, the Cyanide exposure emergency care procedure. This is cross-referenced in Emergency Response Plans. Administration of cyanide

antidotes is done under the sole control of a medical doctor or via a paramedic under a doctor's instruction.

The Works Emergency Action Plan includes all the relevant scenarios that have been identified, along with the appropriate response or plant procedure. As the site is a part of a larger chemicals complex, personnel will not be evacuated from the site. They will either be sent to self-contained emergency gathering rooms (e.g., gas releases) or for other occurrences, they may be sent to emergency assembly points outside. The Works Emergency Action Plan is referenced to in the plant procedure for level 2 and 3 emergencies that might require communities to stay indoors as opposed to evacuating. There is a procedure covering use of emergency assembly points and gathering rooms. Community evacuation is the responsibility of the police and is an off-site function. The external Sasolburg Emergency Response Plan contains actions for community evacuation.

There are procedures in place covering reporting, investigating and recording of cyanide incidents; and clean up, Remediation and waste disposal associated with Cyanide incidents on and off site.

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

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

Summarize the basis for this Finding/Deficiencies Identified:

All emergency response documents for SASOL are quality controlled by a dedicated Quality Practitioner who has a specific document control function. The emergency documentation is circulated to all for comment, as a part of the document management process. All employees on site have access to electronic documents and are computer literate.

SASOL has conducted a stakeholder perception survey completed by IPSOS a global market research company (IPSOS) of Government, fence line communities and NGO's in July 2018. This detailed survey covered many aspects of SASOL as a major chemicals production complex. Cyanide was included as a small part of the survey. Reputation levels covering social investment, transformation, environment, stakeholder engagement and communication, leadership, and governance were included. The Company is still in the process of evaluating the results and there has been a mix of positive and negative reactions particularly in the areas of environment and stakeholder engagement in the local community. The information from this survey will be used to guide and modify improvement opportunities with the local community.

Focussed communication groups and "one-on-ones" are now used to communicate with stakeholders and to gather information and detailed perceptions.

A number of community interactions between Nov 2016 and June 2017 were conducted e.g. meetings with church groups, representatives of Vaal Triangle AIRSHED priority area, the multi stakeholder reference group and the BEA (Business Environment Assessment) on air quality, community youth group. A site visit was held at the cyanide plant dated 9 May 2018, including local science teachers. Presentations were given on cyanide-related issues including cyanide chemistry and a site tour.

SASOL organises a two yearly "Techno-X" event (date 14 - 17 August 2018) aimed at school children which presents science-based projects and activities and careers guidance using material from the SASOL process and production activities to illustrate career possibilities and to raise awareness of science as a career. The exhibition is held at Sasolburg every two years but also rotates with SASOL Secunda Operations. Cyanide is included in the subjects covered.



Various communication methods were used to access informal communities such as "Amelia" and "Iraq". These methods include "snapper frames" (information boards), news items for radio, where possible, and community meetings. All communication to external parties is handled by Sasol Corporate Affairs Department.

During emergency exercises, external agencies such as the Fire Brigade, ambulances, site clinic, Netcare Hospital in Vaal Park, South African Police Service and traffic authorities are involved and participate in post mortem discussions, as appropriate. There is a Mutual Aid agreement in place with the local authority, Karbochem, NATREF, Omnia, the SASOL Complex, and Safripol. Electronic copies of various meetings and agendas were sampled and sighted. Furthermore, documentation from the Disaster Management Advisory Forum Meetings were reviewed. Minutes of the SEMF (Sasolburg Emergency Management Forum) Technical Sub Committee Meeting held on the 29th May 2018 at the Vergasser – Sasolburg Operations were also reviewed. Meetings included members of all the mutual aid representative companies.

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

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

Summarize the basis for this Finding/Deficiencies Identified:

Primary responders and their back-ups, and their roles and responsibilities are clearly identified in the emergency response plan and procedures and call outs and contact details are readily available. The emergency response team list included in the "red files" (emergency response files located in the emergency gathering rooms and the Foreman's office). Emergency equipment inventories and their checking and inspection requirements are included in procedures. All plant personnel receive emergency preparedness training every two years and this was confirmed in the training matrix. The central SASOL emergency services team receives specialised on-going training which was confirmed during a site inspection and review of their training matrix.

The cyanide facility is part of a much larger Sasol chemical complex (Midland Complex) which has its own emergency response and support facilities. Roles and responsibilities for outside responders are part of the Complex's Emergency Procedures. In view of the diversity of activities on the Complex, a Mutual aid agreement is in place with the local authority, Carbochem, NATREF, Omnia, SASOL Plant, Safripo. Community members do not have specific roles in emergency procedures.

During emergency exercises, external agencies such as Fire Brigade, ambulances, site clinic, Netcare Hospital in Vaal Park, South African Police Service and traffic authorities are involved and participate in post mortem discussions, as appropriate. The exercise planning process for level 2 and 3 emergencies will include representation from the area and external responders and local industries for level 3.

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

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



Summarize the basis for this Finding/Deficiencies Identified:

The Sasol Group Communication Procedure is adhered to and referenced in the 'Works Emergency Action Plan'. The Corporate Affairs member of the Works Emergency Team is responsible for managing external communication and information flow as per the 'Group Crisis Communication Guidelines'. There are four named persons within the guidelines who are the primary contact persons. In the event of an emergency the on-site clinic and the control room for Cyanide 1 and 2 Plants are directly in contact via telephone.

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 with
 in substantial compliance with
 not in compliance with

Production Practice 5.5

Summarize the basis for this Finding/Deficiencies Identified:

The Sasol remediation procedures cover the Sasol Sasolburg Complex, including the two Cyanide Production Plants and include clean up, remediation and waste disposal associated with cyanide incidents on and off-site. No chemicals are used in the neutralisation of cyanide contaminated media. Contaminated media such as soil is disposed of at a licenced hazardous waste disposal site.

The need for environmental monitoring to identify the extent and effects of a release, including sampling methodologies, are included in the Sasol remediation procedures. Where possible, the current monitoring locations would be used as the most likely locations for monitoring surface water and ground water, otherwise the location of the monitoring points would form part of the investigation. Surface water sampling is through continuous on-line monitoring, 4 hourly samples, daily samples and external third-party monthly samples. Frequencies are reviewed on a case by case basis with consideration of performance, normal, abnormal and emergency conditions or other factors which might influence results.

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

The operation is in full compliance with
 in substantial compliance with
 not in compliance with

Production Practice 5.6

Summarize the basis for this Finding/Deficiencies Identified:

All documentation, including emergency response procedures, are reviewed on a three yearly basis. More frequent review would be prompted by actual incidents, findings from drill exercises or legislative requirements. Procedures require that plant drills (Level 1) be carried every second month, and Level 2 drills annually, according to the Emergency Management Schedule, with Level 3 drills, being conducted every three years. Procedures will be amended as results of drills and events indicate, or as appropriate.

