EXTERNAL AUDIT REPORT IN FULLFILLMENT OF THE ENVIRONMENTAL AUTHORISATION FOR THE COKE OVEN CLEAN GAS AND WATER PROJECT AT ARCELORMITTAL SOUTH AFRICA VANDERBIJLPARK WORKS


Audit date: 13th February 2015
Report date: 11th March 2015
# General Information

<table>
<thead>
<tr>
<th><strong>Report Name:</strong></th>
<th>External Audit Report for the Coke Oven Clean Gas and Water Project (COCGAW) ROD</th>
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<tbody>
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<td>Zantow Environmental Consulting Services CC</td>
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<td><strong>Client:</strong></td>
<td>ArcelorMittal South Africa Vanderbijlpark Works</td>
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<td><strong>Report compiled by:</strong></td>
<td>Trevor Hallatt</td>
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<tr>
<td><strong>Date:</strong></td>
<td>11th March 2015</td>
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</table>
EXECUTIVE SUMMARY

Zantow Environmental Consulting Services CC was contracted by ArcelorMittal to conduct an independent Compliance Audit on the record of decision (RoD) which was received from the Gauteng Department of Agriculture, Conservation and Environment (GDACE, now the Gauteng Department of Agriculture and Rural Development, “GDARD”) on the 21st March 2004.

The methodology followed for conducting the compliance assessment audit can be described as

- Document review
- Compilation of audit checklist/questionnaire for site visit;
- Site Visit (Conducted on the 13th February 2015);
- Documentation Audit (16th February 2015) and
- Compilation of compliance audit report.

ArcelorMittal Vanderbijlpark Works operate 5 coke batteries to produce metallurgical coke for the Blast Furnaces on site. Coke is an important input material into the iron making process. During the coke making process, gas and other by-products are formed. The Coke Batteries were built between 1945 and 1985 and the gas and water cleaning technologies were considered out dated and could not deliver a clean gas which resulted in various maintenance issues and other implications. ArcelorMittal commenced with the Coke Oven Clean Gas and Water Project (COCGAW) in the early 2000’s in order to install new technology that would enable them to clean the coke oven gas for re-use in the works as fuel gas and also complying with Environmental Best Practice Standards internationally.

The project scope is technical and complex and included various improvements and changes to the existing plant as well as the installation of new infrastructure. The project aimed to improve the current controls at the batteries, improve the gas collecting mains, upgrade of the primary cooling to improve naphthalene removal, installation of a new chiller plant, installation of a distillation plant and a sulphur removal plant. The water portion included the installation of new tar decanters, a gravel filter plant and scrubbers.

The construction of the plant commenced in 2005 and commissioned in 2010 at the cost of more than R330 million. The project faced numerous delays and challenges. In 2010 the plant ran successfully and proved significant sulphur reduction in terms of emissions. Unfortunately the plant was shut down end of 2010 due to technical and mechanical difficulties. From 2011 up to date ArcelorMittal repaired the identified fault in the process and then attempted to re-commission the facility on a few occasions. The plant has not run for more than a few days at end without interruption. Currently the gas is only partially cleaned but no sulphur removal is taking place.

Table 1 sets out the compliance with the authorisation conditions and where non-compliances were recorded, the auditor contextualised the non-compliance in terms of the intensity. This equates to an objective view of the seriousness of the non-compliance and also then leads to recommendations where moderate to critical non-compliances have been observed.

The major concern is that the plant is not operational and ArcelorMittal is not cleaning the gas which leads to the release of emissions from the facility to the environment. Other non-compliances recorded in terms of the authorisation mostly related to the groundwater monitoring requirements that are not met and fugitive emissions control. A number of measures and projects have been implemented to reduce fugitive emissions – progress is evident in the fugitive emission graphs.

The following recommendations are made to improve compliance to the ROD;

- Commission the Gas Cleaning plant and ensure the required measures are implemented to continuously operate the plant. (ArcelorMittal, ASAP)
• Monitoring of ground water at borehole CO-3D cannot be undertaken as the borehole no longer exists. Finalise the plans to drill an alternative suitable borehole that could be used for the same purpose envisaged and align the relevant legal requirements. (ECO, Dec 2015)

• Exposure monitoring indicates that further fugitive emission mitigation measures are required. Although ArcelorMittal supplies specialised PPE and has implemented management measures to mitigate employee exposure, it is recommended that the additional fugitive emission reduction projects as identified by ArcelorMittal be prioritised and implemented. (ArcelorMittal, as per project schedule)

• Review and revise the Environmental Management Programme (EMP) to align it with legal requirement as stipulated in Appendix 4 of GNR 982 in GG 38282 (ECO).

• The second phase of the water cleaning system will commence in 2015 which includes the installation of an ammonia stripping plant to remove ammonia from the wastewater emanating from the coke oven. The phase of the project was part of the initial project scope as approved by GDARD. The relevant documents such as the EMP and site plans must be reviewed to adequately address the stripper plant prior to the commissioning thereof. (ECO)

• During the audit it was found that the bund around the gravel filter plant is compromised and water is flowing onto soil next to the plant (Appendix B). The organisation must repair the bund wall around the Gravel Filter plant to prevent water from entering the storm water drainage system or to contaminate groundwater.

Further to the legal compliance issues, observations were also raised where there is a possibility to improve on the environmental practises. These are not legal requirements and ArcelorMittal should investigate the feasibility of implementation in context with the current situation and available resources.

The following observations were made;

• It is recommended that the identified projects (caustic dosing, potential bio-treatment plant etc.) be reviewed and prioritised in order to improve the quality of the water used for quenching.

• It is recommended that ArcelorMittal finalises the actions from the Ground Water Management Plan and implement the remediation measures as required at the Tar Plant and Coke Plant.
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1. INTRODUCTION

Zantow Environmental Consulting Services CC was contracted by ArcelorMittal to conduct an independent Compliance Audit on the Record of Decision (RoD) which was received from the Gauteng Department of Agriculture, Conservation and Environment (GDACE), now the Gauteng Department of Agriculture and Rural Development (GDARD) on the 21st March 2004.

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2. BACKGROUND AND PROJECT STATUS

ArcelorMittal Vanderbijlpark Works operate 5 coke batteries to produce metallurgical coke for the Blast Furnaces on site. Coke is an important input material into the iron making process. During the coke making process, gas and other by-products are formed. The Coke Batteries were built between 1945 and 1985 and the gas and water cleaning technologies were considered out dated and could not deliver a clean gas which resulted in various maintenance issues and other implications. ArcelorMittal commenced with the Coke Oven Clean Gas and Water Project (COCGAW) in the early 2000’s in order to install new technology that would enable them to clean the coke oven gas for re-use in the works as fuel gas more efficiently and also complying with Environmental Best Practice Standards internationally.

The project scope is technical and complex and included various improvements and changes to existing plant as well as the installation of new infrastructure. The project aimed to improve the current controls at the batteries, improve the gas collecting mains, upgrade of the primary cooling to improve naphthalene removal, installation of a new chiller plant, installation of a distillation plant and a sulphur removal plant. The water portion included the installation of new tar decanters, a gravel filter plant and scrubbers. The primary purpose of the Elementary Sulphur and Stripper Plants are to remove H2S and NH3 vapours in the Coke Oven gas.

The plant consists the 2 main parts:

- Stripper Plant, enriched water from the gas plant scrubbers containing H2S and NH3, are distilled in columns heated with low pressure steam. Thus releasing the H2S and NH3 as vapours via the vapour condensers to reduce water content and then these vapours are send to the Elementary Sulphur Plant.
- Elementary Sulphur Plant, where the vapours from the Stripper plant are burned in the Crack Reactor at a temperature of about 1150°C. The hot vapours are forced through the catalyst inside the Crack Reactor and then through the waste heat boiler train. The boiler train consists of a High Pressure waste heat boiler connected to a steam drum and the Low Pressure boiler with its Sulphur Condenser.

The construction of the plant commenced in 2005 and commissioned in 2010 at the cost of more than R 330 million. The project was faced with numerous delays and challenges. In 2010 the plant ran successfully and proved significant sulphur reduction in terms of emissions. Unfortunately the plant was shut down end of 2010 due to technical and mechanical difficulties. From 2011 up to date ArcelorMittal repaired the identified fault in the process and the attempted to re-commission the facility. The plant has not run for more than a few days at end without interruption. Currently the gas is only partially cleaned but no sulphur removal is taking place. The organisation has initiated a process to source expert advice to analyse the plant for possible solutions.
The Environmental Authorisation condition 3.4.b requires that a bi-annual compliance audit be undertaken by an independent external auditor and the audit report submitted to the Department. This report is concluded in fulfilment of this condition.

3. PART 1: Audit Information

3.1. Date of Audit

External Audit date: 13th February 2015
Report date: 11th March 2015

3.2. Audit Criteria / Scope of Work

The scope of work entailed conducting a compliance audit to verify compliance to the Environmental Authorisation (ROD) conditions as per condition 3.4.b. The bi-annual environmental performance audit must be conducted by an independent auditor and must be submitted to the department 30 days after the audit has been conducted.

The following documents and or information were considered in order to determine compliance with the conditions of the ROD:

- Environmental Authorisation
- Amendment applications and amended ROD’s
- External and internal audit reports
- Various database monitoring results made available / presented during the audit
- Monitoring reports / data
- Procedures and the electronic Environmental Management System (EMS)
- Relevant communications between ArcelorMittal, Authorities and I & APs
- Applicable South African Environmental Legislation.

3.3. Audit Methodology

In order to clarify terms and definitions with reference to the international standard ISO 19011:2002(E) Guidelines for quality and/or environmental management systems auditing - Audit “FINDINGS” are defined as “results of the evaluation of the collected audit evidence against audit criteria”. The definition has a note stating “audit findings can indicate either conformity or nonconformity with audit criteria or opportunities for improvement”. General or specific findings are presented as observations or opportunities for improvement. To clarify reporting - the findings will be called and presented as non-compliance, potential / partial non-compliance and observations. These are defined as follows:

Compliance
Full compliance achieved with documented or audited proof of compliance available. No further actions are required.

Non-compliance
Non-compliance is the most severe type of finding. A non-compliance will indicate legal non-compliance to the relevant legislation, license and/or records of decisions conditions. Where appropriate the audit report could contain recommendations regarding non-compliance and specified/agreed target dates for the implementation.

Potential or partial non-compliance
A potential or partial non-compliance refers to a deviation from a legal requirement, a standard specification, or a planned arrangement which does not constitute non-compliance, but which does not
represent Best Practice. Recommendations could be stated for potential non-compliances. It can also refer to conflicting of nonsensical conditions in a license that cannot be complied with, but still needs to be resolved.

**Observation**

An observation refers to a deviation from best practice and includes observations of opportunities for improvement. Recommendations could be stated for observations but will not have specified target dates. This has been included for the benefit of management and while not being of immediate priority, can be included in the self-improvement cycle of environmental management.

During the inspection it was however found that some conditions are generic, impractical and / or contradictory. There was therefore a need to rank the identified non-compliance or partial compliance findings in terms of the following criteria:

**Critical Issues**

- There is a critical failure against legal requirements or management response that presents an immediate or significant risk that could result in prosecution and /or adverse legal finding due to failure to meet regulatory requirements;
- Could result in immediate injury or serious injury or environmental harm;
- Could result in prolonged business outage; and/or
- Could result in serious damage to the project’s reputation.
- Critical issues must be addressed immediately and all activities resulting in negative critical findings must cease until such time as the issue has been rectified.

**Moderate Issues**

- There is a substantial failure to meet the environmental requirements for the project or license condition,
- There is a possibility of substantial environmental degradation and/or pollution and/or
- Objective evidence was observed raising doubt as to the integrity of data or records inspected.

**Minor Issues**

- Isolated observations demonstrating that full compliance to the environmental requirements on site have not been, or will not be, fully achieved.
- No physical environmental harm

**3.4. Objectives**

To carry out an independent compliance audit including:

- Inspection of operations and confirm compliance to the Authorisation
- Verify the effectiveness of impact management and mitigation.
- Assess allocations of responsibilities and actions.
- Report observations for further investigation and action.
- Specifically state whether conditions are adhered to.
- Make recommendations where appropriate.
- Prepare an audit report for submission to the relevant authorities.

As part of the conditions of the ROD issued for the COCGAW project, bi-annual environmental performance audits are required to be conducted by an independent, accredited auditor. The objective of these audits are to provide a status quo report on the COCGAW project in line with the requirements of the ROD more specifically condition 3.2.b which required the following reporting:

- Specifically state if the conditions of the ROD and EMP are adhered to;
• Include an interpretation of all available data and test results regarding the operation of the site and all its impacts on the environment
• Volume water treated, re-used, discharged and reduction in water use
• Results of improved air and water quality achieved
• Air quality monitoring and reporting regime
• Discussion on groundwater treatment
• Discussion on implementation of recommendations
• Results of groundwater and surface water monitoring
• Quantities of by-products produced
• Carousel system for tar handling
• Preventative Maintenance Plan
• Major Incidents
• Waste Management
• Monitoring of boreholes
• Details of the failure of the treatment system and how these were handled
• Details of the discharges

3.5. Independent Assessor

The role of the Independent Environmental Assessor is to provide independent, objective and professional advice on the environmental compliance of the COCGAW Project, with specific reference to the respective ROD conditions. Specific duties of the auditor include the following:

• Review and assess in an independent, objective and professional manner all aspects related to the ROD conditions;
• Conduct a random site inspection if deemed necessary; and
• Provide feedback on the assessment results to ArcelorMittal.

3.6. Comments from previous audit reports

The status of recommendations or proposed mitigation measures as set out in the previous audit report is as follows;

<table>
<thead>
<tr>
<th>Finding and mitigation measure as per Aug 2014 external audit</th>
<th>Status</th>
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<tbody>
<tr>
<td>3.2.g.1 “The Sulphur Plant is not operational. H₂S emissions are exceeding the limit and repairs to the plant have been prioritised. It was noted that it takes approximately three weeks for the plant to heat to the required temperature and leaks are only visible once the plant is operational.”</td>
<td>The status is unchanged and the condition remains a non-compliance. A high level meeting was held to evaluate potential solutions to commission the plant. The organisation has initiated a process to source expert advice to examine the plant and to propose potential solutions.</td>
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<td>3.2.g.4 SO₂ reduction not achieved as plant is not operational</td>
<td>The status is unchanged and the condition remains a non-compliance.</td>
</tr>
<tr>
<td>Un-cleaned gas is being flared due to the non-operational Sulphur Plant. H₂S emissions are exceeding the limit and repairs to the plant have been prioritised. It was noted that it takes approximately three weeks for the plant to heat to the required temperature and leaks are only visible once the plant is operational.</td>
<td>The status is unchanged and the condition remains a non-compliance. Recent monitoring showed a slight reduction in H₂S production. This may be ascribed to recent change in coal supplies with lower sulphur content.</td>
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<tr>
<td>Commission the Gas Cleaning plant and ensure the required measures are implemented to continuously operate the plant. (ArcelorMittal, ASAP)</td>
<td>The plant has not been commissioned to date and the recommendation therefore still stands. The organisation has initiated a process to source expert advice to...</td>
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</table>
The facility reported that a total assessment will be undertaken and regardless of cost and resources the plant will be repaired.

Monitoring of ground water at borehole CO-3D cannot be undertaken as the borehole no longer exists. It is recommended that ArcelorMittal propose an alternative suitable borehole that could be used for the same purpose envisaged and align the relevant legal requirements. No organic quality data was available for review. The samples were repeatedly taken in December 2013 but the analysis has not been obtained from the external laboratory to date. (ECO, July 2015)

Exposure monitoring indicates that further fugitive emission mitigation measures are required. It is recommended that the additional fugitive emission reduction projects as identified by ArcelorMittal be prioritised and implemented. (ArcelorMittal, as per project schedule)

The management of tar sludge (coal tar and ash) hazardous waste storage area needs to be improved as spillage of tar sludge was observed outside the bunded area. ArcelorMittal should take into consideration the new Norms and Standards for the Storage of Waste and other best practices.

Although a process has commenced to evaluate potential solutions, the same issues remain due to the fact that the gas cleaning plant is not operational.

3.7. Declaration of independence

I, Trevor Hallatt, as an independent consultant compiled this audit report and declare that it correctly reflects the findings made at the time of the audit. I further declare that I,

Act as an independent consultant;

- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and the National Environmental Management Waste Act;
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, will present the results and conclusion within the associated document to the best of my professional judgement.

Trevor Hallatt
Environmental Specialist
3.8. Assumptions and limitations

The observations and findings made during the audit were during a specific time frame and on-site conditions may vary throughout the year. Therefore, changing circumstances throughout the year may differ and deliver different results. The results pertain only to on-site conditions at the time of the audit.

4. PART 2: Audit Findings

4.1. Positive observations/findings

ArcelorMittal Executive Committee (Exco) consisting of the facilities top management on executive level, has prioritised the re-commissioning of the gas cleaning plant. They are currently in the process of sourcing expert advice to generate a sustainable solution for the plant. The progress is reported to the Exco on a regular basis and the Exco has committed resources to solve the problems experienced. This illustrates that the facility is taking the issue seriously. It should be noted that the Coke Oven Gas and Water Cleaning plant and technology is the only of its kind in South Africa and there is therefore no local experience or knowledge or service providers other than the trained in house ArcelorMittal employees.

The gravel filter plant commissioned in 2013 seems to be performing well and has delivered very good oil and suspended solid removal rates. The second phase of the water treatment system will commence in 2016 which includes the installation of an ammonia stripper to remove ammonia from coke oven process water.

The administrative compliance management of the RoD is well managed and ArcelorMittal proactive seeks to comply with conditions and regularly interact with the authorities in this regard.

4.2. Compliance to the License conditions

In general ArcelorMittal is not complying fully with the authorisation as the plant is not fully operational. The gas cleaning plant aims to deliver many environmental benefits in terms of emission reduction, which is not realised until the Elemental Sulphur plant is repaired and re-commissioned. The plant has not been fully operational due to technical and mechanical failure(s) for the last four years which seems excessive for a new plant constructed less than 10 years ago and which has operated for less than 12 months consecutively.

Other than the non-compliances relating to the down time of the plant, non-compliance relates to ground water monitoring requirements and fugitive emissions control. A few observations have been made in light of the continued improvement drive. Table 1 addresses compliance to each relevant condition in the environmental authorisation.
### 4.3. Authorisation Conditions Assessment

<table>
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<tr>
<th>RoD Cond.</th>
<th>ROD Requirement</th>
<th>Status</th>
<th>Compliance Status</th>
<th>Intensity of non-compliance</th>
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<tr>
<td>3.1</td>
<td>The authorisation applies in respect of the upgrading and operation of coke oven gas (COG) and water cleaning systems at the existing coke ovens… Specific details regarding the project scope as per condition 3.1.1a-c and 3.1.2a-k</td>
<td>Various changes were made and approved by GDARD. In the last reporting period, the gravel filter plant was constructed according to the scope. The caustic dosing infrastructure is planned for construction in 2015. On completion of the last infrastructure requirements the water can be sent to the BF Gas cleaning system as planned originally and therefore cleaner water used for quenching. ArcelorMittal reported that the last outstanding items to be constructed is towards improving the works water balance and does not influence the plants operability. Instead of the water being treated and re-used in the BF Gas cleaning system, the water is used at the coke ovens to quench with. The second phase of the water cleaning system will commence in 2016 which includes the installation of an ammonia stripping plant to remove ammonia from the coke oven process water. The relevant documents such as the site layout plans and the EMP must be revised to include the new facility’s specifications prior to commencement.</td>
<td>Compliant</td>
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| 3.2       | An updated project schedule must be submitted to the department 30 (thirty) days prior to the commencement of construction activities. The schedule must clearly indicate the different phases of construction activities. The schedule must clearly indicate the different phases of construction and commissioning and decommissioning (i.e. expected dates of commissioning of specific completed parts of the COG and water treatment systems). | Project schedule was submitted to the Department as required with the relevant items attached. The following information was submitted with the initial notification:  
- Answers to specific items in the ROD  
- EMP – construction phase  
- Layout drawings (pipes, demolished infrastructure, tanks and containment areas)  
- Diagram for storm water and spillage management  
- HIRA  
- Aspect and Impact register  
- Project Schedule | Compliant | |

**3.2 Specific Conditions**
The organisation should consider informing the department of their intentions to commence with the ammonia stripping plant, 30 days prior to construction as a courtesy.

The plant was commissioned on the 22nd January 2010 and the department informed accordingly. The Sulphur cleaning section of the plant has unfortunately been shut down due to mechanical and maintenance problems since December 2010. The facility has sent numerous letters to inform the department of expected start up again only to send an update that the start-up was not successful.

In one of the last letters ArcelorMittal informed the department that they will notify them when start-up has been successful and the plant could run stable for a period of time.

A detailed Environmental Management Plan (EMP) for the implementation of the project must be submitted to the Department for approval 30 (thirty) calendar days prior to the commencement of construction activities. The EMP must specifically include, inter alia:

- An auditable plan for monitoring all facets of the COG and water cleaning project, implementation and operation, including decommissioning of all underground sumps, piping (underground and overhead), obsolete infrastructure.

EMP submitted for construction as stipulated above. ArcelorMittal submitted an operational EMP on the 3rd November 2008 and an updated Operational plan on the 19th March 2012. ArcelorMittal followed up on the EMP approval from GDARD without any response other than acknowledgement of receipt per email from the department.

Although the EMP contains relevant measures to manage potential impacts, it does not contain all elements required by regulations published under the National Environmental Management Act (No. 107 of 1998). It is recommended that the organisation revise the EMP to include all elements stipulated in Appendix 4 of GN.R. 982. The EMP should also be updated prior to the commissioning of the ammonia stripping plant to manage potential impacts associated with the new facility.

The decommissioning of infrastructure was addressed in the construction EMP which was approved by the department. The operational EMP contains auditable elements relating to the COCGAW project.

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<tbody>
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<td>(b)</td>
<td>The Department must be informed of both start of construction and the start of commissioning at least 30 (thirty) calendar days prior to the commencement thereof.</td>
<td>The plant was commissioned on the 22nd January 2010 and the department informed accordingly. The Sulphur cleaning section of the plant has unfortunately been shut down due to mechanical and maintenance problems since December 2010. The facility has sent numerous letters to inform the department of expected start up again only to send an update that the start-up was not successful. In one of the last letters ArcelorMittal informed the department that they will notify them when start-up has been successful and the plant could run stable for a period of time.</td>
<td>Compliant</td>
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<td>A detailed Environmental Management Plan (EMP) for the implementation of the project must be submitted to the Department for approval 30 (thirty) calendar days prior to the commencement of construction activities. The EMP must specifically include, inter alia:</td>
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<td>Compliant</td>
<td>Observation</td>
</tr>
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<td>• HAZOP The organisation should consider informing the department of their intentions to commence with the ammonia stripping plant, 30 days prior to construction as a courtesy.</td>
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<td>machinery, plants e.g. the benzol plant, ammonium sulphate plant, tar remediation required, and any remedial measures to be implemented.</td>
<td>Surface monitoring is being undertaken in line with the requirements of the water use license issued to the Works. During the previous audit, it was established that no groundwater monitoring is conducted at CO-3D as the borehole is damaged. However, ArcelorMittal continued with monitoring at CO-1D as an alternative borehole. The organisation has recently approached a contractor to install new boreholes to replace CO-3D. The WULA should be amended to include the new boreholes after installation has been completed. Ground water results and analyses are discussed in Section 5 of the report.</td>
<td>Partial Compliance</td>
<td>Minor</td>
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<td><strong>•</strong> A proposed surface and ground water monitoring regime, which will be in line with the DWAF Water Licence. The graphically represented results of this monitoring are to be included in a bi-annual audit, which must be submitted to this Department for review to determine if the removal measures have been successful or if further remediation is required.</td>
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<td></td>
<td><strong>•</strong> Proposed methods of reducing spillage at the quench towers.</td>
<td>The EMP addresses the spillages at the quench towers. ArcelorMittal reportedly installed an alarm system at all the quench towers to warn operators of high sump levels. No spillages reported during the current audit period and no spillages noted during the site visit.</td>
<td>Compliant</td>
<td></td>
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<td></td>
<td><strong>•</strong> The EMP must include an air quality monitoring program based on the requirements of 3.2 (g).</td>
<td>The EMP that has been submitted to the Department includes an air quality monitoring programme which meets the requirements set out by the condition 3.2 (g) of the Rod.</td>
<td>Compliant</td>
<td></td>
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<td><strong>•</strong> A diagram indicating all unpaved areas, including, bunds and storm water channels, and any areas identified for storm water and surface water management. Plans must be developed to ensure that all surfaces are protected from spillage and erosion, and that dust in the area of coke ovens is reduced</td>
<td>Diagram available and submitted to the Department with the first bi-annual Environmental Performance Audit conducted in June 2010.</td>
<td>Compliant</td>
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<td>• A proposal to address significant pollution from cooling tower sumps</td>
<td>General operating procedures are included in the EMP. The sumps are within bunded areas and a bio-dosing program in place to reduce potential microbial health risks.</td>
<td>Compliant</td>
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<td>• Handling procedures of sulphur and other by-products produced.</td>
<td>EMP updated to include handling of all by-products, including coke breeze as per previous audit report recommendation. No sulphur currently generated.</td>
<td>Compliant</td>
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<td>• A waste management plan pertaining to any waste from the treatment process not re-used or sold as by-products, including expected columns and classification, the disposal thereof and waste manifest system.</td>
<td>The project specific EMP provides waste generation management measures in addition to the ArcelorMittal waste management plan for the industrial complex</td>
<td>Compliant</td>
<td></td>
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<td>(d)</td>
<td>A copy of the detailed HAZOP study to be conducted during the detail design phase of the project must be submitted to the Department 30 (thirty) calendar days before commissioning commences. The HAZOP must specifically include risks related to commissioning or decommissioning of any equipment, failure of treatment systems due to inefficient operation etc., emergency and shutdown, incidents such as spills, and potential discharges to the environment (air, water and land) must propose operational and emergency procedures accordingly.</td>
<td>HAZOP study completed and available and was submitted as stipulated above.</td>
<td>Compliant</td>
<td></td>
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<td>(e)</td>
<td>An auditable Preventative Maintenance Plan must be developed to ensure all water systems and environmentally critical equipment such as exhausters, ESP’s, scrubbers and strippers are maintained as required. This plan must be auditable and must conform to the original equipment manufacturer (OEM) specifications. The management of IVS are to commit to the budget to undertake the required preventative</td>
<td>An amendment Application concerning external verification of PMP, dated 29 July 2009, was submitted on 7 Aug 2009. Critical maintenance requirements have been identified and are captured on the “SAP” system for tracking and action. A job cards is created and managed on “SAP”. The exhauster was chosen as an example. The last job card was dated the 20th February 2015 (see Appendix C). From the job card and additional</td>
<td>Compliant</td>
<td>Observation</td>
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<td>maintenance.</td>
<td>information provided it seems as if the maintenance plans are implemented sufficiently. The fact that the plant is not operational for the last three years might indicate that the preventative maintenance plan implemented is not effective. The corrective measures and maintenance undertaken to re-commission the plant is reactive in nature which is contradictory with the philosophy of preventative maintenance. ArcelorMittal motivates that the issues experienced with the plant relates back to the construction materials and or project contractors used rather than maintenance. During the previous audit, it was recommended that the facility considers sourcing expert advice into the full repair from the start of the process to the finish and implement best practice maintenance plans. The organisation has recently held a high level meeting to discuss options to repair the plant. They are currently in the process to source experts in the field..</td>
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<td>(f)</td>
<td>Final design plans for new and upgraded containment areas (sumps, tar decanters etc.) buffer tanks and chemical storage tanks as well as proof of the Department of Water Affairs and Forestry’s (DWAF) approval thereof as applicable, must be provided 30 (thirty) calendar days prior to the commencement of construction thereof. The above design plans must include information on specific pollution prevention measures (e.g. bunding &amp; liners), compliance with relevant SABS standards (specifically tanks), the sourcing of particular, materials as required (e.g. clay for liners), time-frames for construction, and exact location on site.</td>
<td>The designs were submitted to GDARD at a meeting as reflected in communication with the Department. The drawings was resubmitted to DWA and followed up by ArcelorMittal on many occasions. The facilities were already constructed and the approval thereof would therefore be superfluous at this stage. No further action is recommended on this matter. The plans should be upgraded prior to the commissioning of the ammonia stripping plant.</td>
<td>Compliant</td>
<td></td>
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</tbody>
</table>
The following air quality management, monitoring and reporting regime must be implemented and reported on in the bi-annual environmental performance audits as applicable. Note the emissions sampling (as required) is not required for each of the seven coke oven stacks, but may be conducted on a single stack representative of the whole plant (a short motivation for using a particular stack in terms of physical and gas flow characteristics similarly to other stacks, differences between stacks etc. must be provided). Note that conditions relevant to coke ovens themselves are applicable to all coke oven batteries on site (i.e. no 1, 3, 4, 6, 7, 8, 9).

The facility chosen a representative stack for some sampling based on the age and performance of the battery. The “worst” performing battery was chosen from a precautionary approach for continuous or regular monitoring of dust and gas. Battery 4, 8 and 9 was chosen as the Coke Strategy for the Works indicate that these 3 batteries will most likely be in operation for longer opposed to the other batteries with a shorter remaining life span. The facility argued that they wish to collect data on the remaining batteries which will remain in operation in order to have a long term trend for these batteries, both approaches are reasonable.

The concentrations of the following constituents of the cleaned Coke Oven Gas must be monitored before and after combustion in the coke ovens. The results are to be graphically represented and included in the bi-annual audit report. The H₂S content of the gas must be between 0.8 and 1.5 g/Nm³.

The Sulphur Plant is not operational and therefore very limited sulphur removal is taking place. H₂S emissions are exceeding the limit and repairs to the plant have been prioritised. It was noted that it takes approximately three weeks for the plant to heat to the required temperature and leaks are only visible once the plant is operational.

Monitoring conducted when the plant was operational in 2010 indicated that the facility is able to comply with the condition with the Sulphur plant is operational.

During the previous audit it was found that monitoring indicated that the H₂S levels in the gas is around 2.2 g/Nm³. Recent results showed that concentrations have decreased to about 1.9 g/Nm³. The decrease may be ascribed to a recent change in coal suppliers with lower sulphur content. However, the H₂S concentrations still exceed the threshold of 1.5 g/Nm³.

The emissions from the stacks of the coke ovens must be monitored for dioxin and furan emissions within 6 months of decommissioning of the benzole plant. The benzole plant has been decommissioned. Results from dioxin and furan emission monitoring have previously been submitted in 2006. The results confirmed that Dioxins and Furans are not of a concern at the Coke Battery stacks.

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<td>(g)</td>
<td>The following air quality management, monitoring and reporting regime must be implemented and reported on in the bi-annual environmental performance audits as applicable. Note the emissions sampling (as required) is not required for each of the seven coke oven stacks, but may be conducted on a single stack representative of the whole plant (a short motivation for using a particular stack in terms of physical and gas flow characteristics similarly to other stacks, differences between stacks etc. must be provided). Note that conditions relevant to coke ovens themselves are applicable to all coke oven batteries on site (i.e. no 1, 3, 4, 6, 7, 8, 9). The facility chosen a representative stack for some sampling based on the age and performance of the battery. The “worst” performing battery was chosen from a precautionary approach for continuous or regular monitoring of dust and gas. Battery 4, 8 and 9 was chosen as the Coke Strategy for the Works indicate that these 3 batteries will most likely be in operation for longer opposed to the other batteries with a shorter remaining life span. The facility argued that they wish to collect data on the remaining batteries which will remain in operation in order to have a long term trend for these batteries, both approaches are reasonable.</td>
<td>Compliant</td>
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<td>results of this monitoring must be included in the bi-annual audit.</td>
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<td>A plan for door maintenance/ replacement of all the coke batteries (No.) and progress in achieving reduced fugitive emissions has to be developed. The plan must be supported by the results of personal monitors, and actual measurements at respective areas of the coke ovens.</td>
<td>Battery doors are on a maintenance schedule and are checked on a daily basis. Repairs are done continuously. Refer to Appendix A for the Battery Door Maintenance Program. It was observed during the site visit that there are a lot of doors still burning and smoking. The commitment from the facility was however also observed to repair and maintain the equipment as best as possible. The fugitive emissions are monitored according to the internationally accepted standards and recorded. The month report for January to July 2014 is detailed in Section 5 of the report. Exposure monitoring at the batteries indicates that additional fugitive emission mitigation measures are required, above that already implemented. This can however not be attributed only towards doors but rather the battery emissions as a cumulative source. ArcelorMittal has however implemented management and mitigation measures such as specialised face masks to protect employees and reduce exposure.</td>
<td>Partial Compliance</td>
<td>Moderate</td>
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<td>The assumptions regarding improved air quality made with respect to this project must be confirmed by actual ambient air quality monitoring. The improvements must be discussed in the bi-annual environmental performance audit reports. Attention must be paid to recommendation contained in the air quality report to install additional PM10 and gaseous samplers within the zone of impact directly south of the IVS site.</td>
<td>Ambient air quality monitoring is conducted and the assumptions were assessed during the period when the plant was operational. Additional ambient PM10 and gas monitoring stations were installed as recommended. No comment can be made currently on the compliance as the plant is not operational currently.</td>
<td>Compliant</td>
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<td>The following must be undertaken within 6 months of the commissioning of the carious...</td>
<td>The relevant information was submitted.</td>
<td>Compliant</td>
<td>Observation</td>
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External ROD Audit

GAUT 002/02-03/138

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|          | treatment plants. Results must be included in the first bi-annual environmental audit report, together a plan for remediation should these emissions be significant.  
  o Monitoring for ammonia and hydrogen sulphate fumes from the tar decanters and liquid sumps and storage tanks.  
  o Monitoring for benzene must be undertaken at the flushing liquor storage tanks.  
  Sampling frequency and parameters for sampling of the cooling water tower emissions in the steam must be anticipated and sampling of the steam must be undertaken to determine the impact on the environment of the present cooling process, determine of mitigation measures are required, and to develop reduction plans accordingly. | The implementation of the Gravel Filter Plant and the caustic dosing infrastructure planned for 2015 is part of the medium to long term plan to enable the facility to adapt its internal water balance and improve on quenching practices.  
The facility implemented the relevant water monitoring program and the data is available. | Compliant | Observation |
|          | The composition of the approximately 15% of treated COG that would be flared as well as the gas flare temperature must be determined and reported on in the first bi-annual environmental audit report. A discussion on the effective treatment of gas through flaring, and a plan to reduce the need for flaring the remaining 15% of COG must also be provided in the first audit. | The gas quality was reported on in the first bi-annual audit report as required.  
Partially cleaned gas is being flared due to the non-operational Sulphur Plant. The condition can therefore not be assessed.  
Repairs to the plant have been prioritised. It was noted that it takes approximately three weeks for the plant to heat to the required temperature and leaks are only visible once the plant is operational.  
The organisation is has initiated a process to source expert advice to prepare the facility. | Compliant | |
<p>|          | Based on the assumptions made in the air quality report, and the results of the actual isokinetic sampling and personal monitoring, a plan must be developed with proposals on | Airshed Planning Professionals was commissioned in 2011 to conduct the required assessment and develop the air quality monitoring plan for the Coke Ovens. The report was submitted as required. | Compliant | |</p>
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<td>future emissions sampling, including the frequency thereof and the constituents to be sampled for. This work must be undertaken by an external expert and a report with recommendations must be submitted with the first bi-annual report. In order to ensure early detection of issues to be addressed and ensure the efficiency of treatment equipment, relevant air quality monitoring of COG must be undertaken after each step of commissioning a specific treatment technology.</td>
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<td>• Based on emission results further emission reduction programs may have to be developed. These plans must consider internal standards and best practice, such as the US EPA's Final rule to reduce toxic emissions from coke ovens (February, 2003) and NESHAP for Coke Ovens: Pushing, Quenching and Battery Stacks – Background information for proposed standards (February, 2001)</td>
<td></td>
<td>Compliant</td>
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<td>(h)</td>
<td>The flaring of un-cleaned gas at the relevant flares is only permissible during upset conditions when Claus Reactor is shut down for inspection/ maintenance for 3 weeks every three years, and must be undertaken at temperatures and atmospheric mixing conditions conductive to maximum dispersion of pollutants.</td>
<td>The plant is not operational and therefore partially cleaned gas is flared when there is no use for it in the rest of the works as energy source. From an environmental perspective the SO₂ emissions load is the same whether the un-cleaned gas is flared or combusted at another plant for fuel or energy source. The Claus reactor is however now off for more than 4 years due to equipment failure and significant repairs and replacements required.</td>
<td>Non-compliant</td>
<td>Moderate</td>
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<td>(i)</td>
<td>Detailed up to date records must be kept of all incidents and complaints pertaining to the COG and water cleaning project, how these were managed, and the recurrence thereof prevented. These records must be made available to the Department within 14 (fourteen) calendar days upon written request by the Department.</td>
<td>Incidents are registered in the Work’s internal reporting system and/or noted in ECO reports/incident register.</td>
<td>Compliant</td>
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<td>(j)</td>
<td>This Department and the Department of Water Affairs and Forestry must be informed of any major environmental and pollution incidents relating to the COG and water cleaning project within 24 (twenty four) hours of such incidents occurring.</td>
<td>No major or emergency incidents reported in the reporting period. Spills diverted to coke plant sump therefore contained.</td>
<td>Compliant</td>
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<td>(k)</td>
<td>The use of existing Maturation Dams for the storage or disposal of any effluent/ sludge/ waste is prohibited as form 6 months after commissioning of the completed coke oven by-products plant. An application for authorisation and draft plan for decommissioning and rehabilitation of the existing Maturation Dams must be submitted to the Department within 120 (one hundred and twenty) calendar days of commissioning of the COG and water cleaning project.</td>
<td>Submission of application not met, however it was reported to the authorities. The Water Use License (WUL) and the COCGAW Project ROD had conflicting dates relating to the Maturation Ponds. ArcelorMittal notified GDARD that the timeframes as stipulated in the WUL will be followed as the Department of Water Affairs (DWA) was the competent authority at the time. The Department of Environmental Affairs (DEA) issued a Waste Management License for the decommissioning of the maturation ponds in February 2012. The facility implemented various process changes in order to cease the use of the dams. The dams were taken out of operation in 2008, two years before the COCGAW project was commissioned which is commendable. The remediation of the maturation ponds are progressing very well. The dam consisted out of 3 dams of which the remediation of Dam 3 is approximately 100% complete, Dam 2 approximately 90% complete and Dam 1 about 25% complete. Soil is being remediated in-situ.</td>
<td>Compliant</td>
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<td>(l)</td>
<td>Planning with respect to addressing existing groundwater contamination identified in the Coke Plant area must continue. Confirmation of, or plans for, abstraction and or treatment of contaminated ground</td>
<td>The specialist investigations and development of a Final Ground Water Management Plan (including a specific investigation at the Coke and Tar plant) completed in May 2011 and was peer reviewed in 2012.</td>
<td>Compliant</td>
<td></td>
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<td>water or septic pollutants, including the feasibility of abstracting contaminated groundwater from the aquifer underlying the site as a source of water supply to the process, needs to be considered. Progress with respect to this matter must be reported on in the quarterly progress reports and bi-annual environmental performance audits thereafter.</td>
<td>ArcelorMittal is in process to develop a prioritised action plan and investigating alternative technical solutions, pending the approval of DWA. At the time of the audit, DWA has not formally responded to the GWMP submitted and ArcelorMittal stated that they are attempting to incorporate the GWMP into the WUL review period in 2015.</td>
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<td>(m)</td>
<td>The recommendations contained in the specialist studies submitted in support of the application for authorisation of the COG and water cleaning project are regarded as an extraction of the conditions of those authorisation. Implementation of or compliance with these recommendations must be discussed as part of the quarterly progress reports and bi-annual environmental performance audits thereafter.</td>
<td>Compliance to the specialist recommendations are detailed in Table 2 below and compliance is generally good.</td>
<td>Compliant</td>
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<td>(n)</td>
<td>An independent Environmental Control Officer (ECO) with an understanding of the coke oven operational and treatment process must be appointed for the duration of construction and commissioning, to monitor and report on compliance with the conditions of this authorisation.</td>
<td>Terrence Wilson from ArcelorMittal has been appointed as the ECO.</td>
<td>Compliant</td>
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3.3 General Conditions

<p>| 3.3 (a) | Any changes to or deviations from the project description set out in this letter must be approved in writing by the Department before such changes or deviations may be effected. In assessing whether to grant such approval or not, the Department may request such information as it deems necessary to evaluate the significance and impacts of such changes or deviations. | No changed made in the reporting period. The new Ammonia tripping that is planned for 2016 is also included under the scope.                                                                                                                                                                                                     | Compliant         |                            |</p>
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<td>(b)</td>
<td>This Department may review the conditions contained in this letter from time to time and may by notice in writing to the applicant, amend, add or remove a condition.</td>
<td>No notices received in the current reporting period.</td>
<td>Compliant</td>
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<td>(c)</td>
<td>The applicant must notify the Department in writing at least 30 (thirty) days prior to the change of ownership, project developer or the alienation of any similar rights for the activity described in this letter. The applicant must furnish a copy of this document to the new owner, developer or person to whom the rights accrue and inform the new owner, developer or person to whom the rights accrue that the conditions contained herein are binding on them.</td>
<td>Department notified of name change in 2007 and change of contact person in February 2012. No other changes and associated amendments outstanding in the current reporting period.</td>
<td>Compliant</td>
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<td>(d)</td>
<td>Where any of the applicants contact details change, including the name of the responsible person, the physical or personal address and/ or telephonic details, the applicant must notify the Department as soon as the new details become known to the applicant.</td>
<td>Department notified of name change in 2007 and change of contact person in February 2012. No other changes and associated amendments outstanding in the current reporting period.</td>
<td>Compliant</td>
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<td>(e)</td>
<td>Authorization for the activity is granted in terms of the Environmental Conservation Act, 1989 (Act 73 of 1989) only and does not exempt the holder from compliance with other relevant legislation.</td>
<td>ArcelorMittal is aware of other relevant legislation and receives relevant updates regularly. The facility has a legal register in place with sufficient legal advisors to ensure they are aware of their legal requirements.</td>
<td>Compliant</td>
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</tr>
<tr>
<td>(f)</td>
<td>The applicant shall be responsible for ensuring compliance with the conditions contained in this letter by any person acting on his behalf, including but not limited to an agent, servant, or employee or any other person rendering a service to the applicant in respect to the activity, including but not limited to contractors and consultants.</td>
<td>An environmental control officer has been appointed to ensure compliance with conditions of the authorisation and ensure contractors are informed of requirements.</td>
<td>Compliant</td>
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<td>(g)</td>
<td>Departmental officers shall be given access to the property referred to in 1 above for the purpose</td>
<td>The department inspects the property regularly and no issues have been</td>
<td>Compliant</td>
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### RoD Cond. | ROD Requirement | Status | Compliance Status | Intensity of non-compliance
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| | assessing and/ or monitoring compliance with the conditions contained in this document at all reasonable times. | noted in this regard. |  | 
|h| The applicant must notify the department within 24 (twenty four) hours if any condition of this authorisation cannot, or is not, adhered to. The notification must be supplemented with reasons for non-compliance. | No additional non-compliances for the reporting period. The non-compliance and problems associated with the Elementary Sulphur Plant have been reported to the relevant authorities and have been highlighted as part of this audit. | Compliant | 

### 3.4 Reporting

A summarised quarterly progress report on the implementation of the COG and waster cleaning report must be submitted to the Department, the first report being due 90 (ninety) calendar days after the construction commences, and every 90 (ninety) calendar days thereafter. These progress reports must address inter alia, the following:

- Up to date scheduling of implementation and associated time frames,
- Records of any major incidents (see 3.2 (i) above)
- Decommissioning of infrastructure,
- Rehabilitation and disposal of contaminated waste material (soil, decommissioned equipment etc.) including the quantity and classification (general/hazardous) thereof.
- Commissioning of any treatment infrastructure,
- Results on the monitoring of efficiency of commissioned treatment infrastructure,
- Monitoring of activities in terms of the environmental management plan (See 3.2 (c) above),

ArcelorMittal received a letter from GDARD dated the 8th February 2010 stating quarterly audits must continue but doesn't need to be submitted anymore.

The quarterly audits was available and on record

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<td>• Any steps taken to rectify areas of non-compliance with environmental requirements.</td>
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<td>(b)</td>
<td>Bi-annual Environmental Performance Audit conducted by an independent, accredited auditor must be submitted to the Department for review, the first audit being due 6 (six) months after commissioning of the COG and water cleaning project, and every 6 (six) months thereafter. The bi-annual audit must include, inter alia, the following (results in graph format as applicable):“…”</td>
<td>The last external audit was conducted by Zantow Environmental in February 2014. This audit report has been structured to comply with the conditions and the specific items to be addressed are discussed in more detail under Section 5</td>
<td>Compliant</td>
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5. SPECIFIC ITEMS TO BE ADDRESSED IN TERMS OF CONDITION 3.4.b

5.1. Water and Waste Water

*Volume of water treated, volume re-used, volume discharged and reduced in volume of fresh intake achieved, i.e. updated water balance for the site.*

ArcelorMittal Vanderbijlpark Works is a zero effluent discharge facility as required in their Water Use License since the end of 2005. Prior to this, treated effluent was discharged from the works through the Rietspruit canal into the Rietspruit River which flows into the Vaal River.

The facility constructed and commissioned the Main Treatment Plant (MTP) as well as upgraded the existing Central Effluent Treatment Plant (CETP) in December 2005. This enabled ArcelorMittal to significantly decrease the raw water abstraction with approximately 50%. The MTP enabled ArcelorMittal Vanderbijlpark Works to treat its process effluent water that was previously discharged subject to the Water Use Licence applicable at the time. After treatment the water is re-used in the process. The facility has maintained their zero effluent status until 2011 when the system could no longer cope with the demand for high quality water and the excess low quality water was discharged. The discharge continued until end of July 2012 where after the zero effluent status was re-instituted. The facility installed additional salt removal capacity and made various process changes in order to optimise the system and reported during the audit that the water balance of the Works are not very tolerable of upsets.

The updated water balance for the Works is illustrated in the figure below.

![Updated Vanderbijlpark Works Water Balance](image_url)

As can be seen in Figure 2 there was some effluent discharged in 2014. The facility reported the relevant discharges to the competent authority and the matter falls outside the scope of this audit.
The facility has reduced the water fresh water abstraction even more in the last 12 months. An overall of 65% reduction of water abstraction since 2005 has now been achieved.

The coke ovens are however only a portion of the facilities water balance. The coke ovens create coal water as a by-product from the reduction of the coal to coke. The coal water and other sources of effluent water are directed to the oil skimmer where some mechanical oil skimming occurs. The effluent is then pumped to the quench tower quench tower sump and used as quenching water.

The Coke Plant water balance is set out below;
The Gravel Filter plant has been installed and commissioned. The gravel filter plant is part of the original design scope of the project to clean the coal water in order to avoid quenching with dirty water and enable the re-use of the treated coal water in the BF Gas cleaning plant. The gravel filter was commissioned in 2013 and the treatment of waste water in this process is shown to be effective. The results for oil removal are shown in figure 5 and have delivered on average more than a 59% oil removal rate and a 72% removal rate in terms of suspended solid in the waste water.
The Caustic dosing part of the water treatment is aimed to be constructed in 2015 which will further improve the internal water balance and management of the effluent. Regardless of the internal process, from an environmental perspective, no effluent is discharge during normal situations and therefore the impact of the water and effluent management is negligible.

5.2. Ground water

"Discussion on ground water treatment (volumes, pollution, stabilisation etc.),

Monitoring of relevant boreholes with respect to detecting any leaks/pollution from all facets of the COG and waster cleaning."

Groundwater monitoring and management is being conducted according to the Water Use License (WUL). The groundwater management plan has been finalized and peer reviewed to confirm assumptions and evaluate proposed recommendations, after which planning for remediation can commence. The facility is in process to determine the legal requirements before commencing with the relevant mitigation measures. Currently groundwater is not actively pumped or treated at the coke plant.

ArcelorMittal Vanderbijlpark Works has an extensive ground water monitoring network as can be clearly seen from the aerial photograph below.

![Ground water monitoring](image)

**Figure 6 Locations of all existing boreholes**

Monitoring data is available from the year 2000 to date. The longer term trends indicate an overall improvement in the ground water conditions in terms of inorganics and a stable organic source. It's important to note that there are currently no external groundwater users that are impacted upon by the ground water impacts from historic activities although the groundwater census was completed some time...
ago. ArcelorMittal has recently completed a holistic Ground Water Management Plan through the appointment of Golder Associates and had the plan externally peer reviewed. The license holder is waiting for the approval of the GWMP by DWA.

To assess the ground water quality boreholes in terms of the COCGAW Project will not make sense without the understanding of the bigger picture. The groundwater at site has been impacted on over many years and is not specifically related to the COCGAW project. The impact on the groundwater at the coke batteries relates to the coke battery activities and the tar plant before the COCGAW was even installed. The ground water monitoring results downstream from the new site is therefore not indicative of the impact of the new site but rather from the historic operations.

The boreholes listed the WUL relating to the Coke Ovens are;

<table>
<thead>
<tr>
<th>COKE PLANT AND SUMP</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>COKE PLANT AND SUMP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NW -8D</td>
<td>-82937.49Y</td>
<td>2949579.08X</td>
<td>Biannual</td>
</tr>
<tr>
<td>CO-3D</td>
<td>-81247.45Y</td>
<td>2949626.41X</td>
<td>Biannual</td>
</tr>
</tbody>
</table>

The boreholes are required to be monitored for inorganic elements and organic elements. The groundwater has been impacted on in terms of inorganic contaminants from various sources which relate mainly to legacy waste handling practices, historic unlined facilities etc. The major risk in terms of contamination from Coke Ovens is organic contamination. The Gas and Water Plant main contaminants may be ammonia and sulphur as well as organic elements. The water use license requires bi-annual monitoring of inorganic elements and annual monitoring or organic elements. The elements listed in the WUL which must be monitored for organic constituents is tabled below. Borehole CO-3D has been damaged and therefore no monitoring was done. ArcelorMittal however sampled an alternative borehole CO-1D also located in the coke oven plant as an alternative and the organic ground water analysis was available. The environmental management team has contacted a contractor to drill a new borehole that will replace CO-3D.

<table>
<thead>
<tr>
<th>Polycyclic Aromatic Hydrocarbons</th>
<th>Volatile Organic compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2- Methylphenol</td>
<td>Cresols</td>
</tr>
<tr>
<td>4-Methylphenol</td>
<td>Toluene</td>
</tr>
<tr>
<td>2,4- Dimethylphenol (Xylenols)</td>
<td>Ethylbenzene</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>M.P-Xylene</td>
</tr>
<tr>
<td>2-Methylnaphthalene</td>
<td>O-Xylene</td>
</tr>
<tr>
<td>Dibenzo-furan</td>
<td>Styrene</td>
</tr>
<tr>
<td>Fluorene</td>
<td></td>
</tr>
<tr>
<td>Phenanthrene</td>
<td></td>
</tr>
<tr>
<td>Phenol</td>
<td></td>
</tr>
</tbody>
</table>
Figure 7 NW-8D NH3 and NO3

Figure 8 NW-8D Electric Conductivity
Figure 9 CO-1D groundwater data (NH3 and NO3)

Figure 10 CO-1D groundwater data (SO2)
From the analysis it is clear the groundwater in the specific areas are deteriorating. This is expected according to the Groundwater Management Plan as the plume moves and dilutes over distances. The impact measured cannot be attributed towards the COCGAW specifically and from a source and scale perspective is most likely not the major cause of the contamination.

The approval of the overall Ground Water Management Plan should be pursued with Water Affairs and implemented to ensure no adverse effects to off-site receptors.

5.3. **Surface water**

In the event of process upset conditions, contaminated surface water can be diverted to the Coke Plant sump. The coke plant sump is a buffer dam and water from the dam can be reclaimed again for re-use as and when there is sufficient capacity in the system. The levels of the coke plant sump is managed and measured to ensure the sump does not overflow.

Clean storm water is measured at the coke plant storm water drain but is combined with other areas inflows. The flow is measured continuously and the EC is also monitored and used to detect potential spills into the storm water drains.
5.4. Air quality monitoring

Air quality monitoring, management and reporting conducted according to the Atmospheric Emissions License (AEL), the ROD and the Air quality monitoring report by Airshed Planning Professionals.

Coke Oven Gas quality

The COCGAW plant aims to remove impurities from the gas which includes the removal of sulphur in the Claus Reactor. Due to the fact that the plant is not operational sulphur removal does not occur and the H$_2$S concentrations in the Coke Oven Gas are therefore exceeding the limit. The gas is measured at the two gas plants and reported below.
Coke Oven Stack Emissions

The partially cleaned gas is used as a fuel source at various users within the facility. The coke oven gas is distributed to the users which are able to utilise coke oven gas as energy source. The Coke Batteries are also a major user of the coke oven gas. The gas is combusted and emitted to atmosphere. The coke battery stacks performance in terms of gas and dust is stipulated below;
Figure 15 Coke Battery Stack Dust Emissions
Fugitive Emissions

Fugitive Emissions is a major concern at coke battery operations. The ROD required that a monitoring plan be developed to monitor and then improve the fugitive emission sources from the batteries. ArcelorMittal appointed Airshed Planning Professionals in 2011 to undertake such an investigation and recommend the monitoring requirements.

Fugitive emissions by nature are a difficult element to monitor. The monitoring system that was put in place by ArcelorMittal is commendable. The different sources of fugitive emissions are addressed in the fugitive emissions monitoring plan which includes the doors, pipes and charging times and smoke observed.

The occupational health monitoring undertaken in terms of the Occupational Health and Safety Act can be used as a monitoring program as well to determine the effectiveness of the mitigation measures implemented. The last available occupational health survey has indicated that additional fugitive emission mitigation measures are required. ArcelorMittal has however implemented management and mitigation measures to protect employees and reduce exposure.

Ambient Air quality

The ambient air quality around the facility is monitored by ArcelorMittal at four locations around the works. There is no limit for H2S in terms of ambient air quality but it is generally known that H2S has a distinct rotten egg smell which literature indicates can be detected as low as 45 ppb but health risks only above 40 ppm. It is clear that the ambient air quality in terms of H2S is not considered a major issue around the facility after review of the data.

The coke oven gas plants main effect would be a reduction in SO2. As the plant is not operational it was deemed unnecessary to include a full discussion on the SO2 ambient air quality data monitored by the facility. Once the plant has been commissioned the SO2 ambient data must be compared with the SO2 ambient data measured prior to commissioning.

5.5. Waste and By-products monitoring

Quantities and handling of all by-products produced (sulphur, tar, etc.)

Quantity of waste generated and the management thereof,

Report on the success of carousel system being implemented for the collection of tar for tar decanters (first audit only), as well as the method used to return the tar to the coke ovens. A mechanism to collect spillages to indicate when the collection vessels are full,

The ArcelorMittal Vanderbijlpark Works disposed some 847 816 tons in 2013 at the G:L:B+ waste site. ArcelorMittal has implemented various projects over many years to ensure a large portion of the waste generated is recycled or re-used. The overall waste statistics (domestic and metallurgical combined) is summarised below.

<table>
<thead>
<tr>
<th>Disposition Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposed Internally</td>
<td>41.8 %</td>
</tr>
<tr>
<td>Re-used or Recycled internally</td>
<td>10.9 %</td>
</tr>
<tr>
<td>Re-used or Recycled Externally</td>
<td>41.7 %</td>
</tr>
<tr>
<td>Disposed externally (hazardous waste)</td>
<td>0.3 %</td>
</tr>
<tr>
<td>Stored for re-use internally</td>
<td>14.6 %</td>
</tr>
</tbody>
</table>
The Coke Ovens generates basically Coke Breeze, Liquid raw tar and tar sludge as by-product and waste streams.

Raw tar is formed during the coking process when the coal is heated in an oxygen free environment for several hours. The tar is routed from the Collecting Main via pipeline to the tar separator where the liquid tar is separated from the liquor. The liquor is re-routed back into the system while the liquid tar is directed into tar tanks which are then pumped through to Coke and Chemicals where it is stored temporarily in tanks before being used as a raw material for the manufacture of other products. All tar is therefore processed and none of the tar is disposed of.

As with the raw tar, the tar sludge is a waste stream that is created during the coking process. The by-products of the coking process are directed into a storage device known as a tar separator. From here the liquid raw tar is pumped via pipeline to coke and chemicals. The tar sludge is collected from the bottom of the Tar Separator and is disposed of firstly into carousel buckets. The spout from the Separator is low enough to keep spillages to a minimum when the sludge is emptied into the carousel. The carousel buckets once ready for off-loading are taken by forklift to an area where the sludge is then mixed with coke breeze at a temporary storage area from where it is collected by Enviroserv and disposed at Holfontein H:H Waste Disposal site. Safe disposal certificates are kept for the loads as removed.

![Coal tar and ash - Works](image-url)

Figure 16 Coal tar and ash
ArcelorMittal reported that the facility has constructed a plant to recycle and re-use the tar sludge back into the coke battery plant. The tar sludge is captured by the existing carousels system and is transported with the forklift to the new tar sludge recycling plant. The tar sludge is mixed in with the coal and used in the coke making process again. The recycling facility has been commissioned with the anticipated outcome of a reduction/elimination of the disposal of hazardous waste.

Coke breeze is generated during the quenching process. Water is sprayed onto the hot coals when it is pushed out of the ovens. The coke breeze collects at the base of the quench tower. Some of the coke breeze is used for mixing with the tar sludge but the larger bulk, approximately 14 200 ton/month is transported by railway to the sinter plant for recycling.
No sulphur is being produced currently as the gas cleaning plant is not operational. A market has already been established for the sulphur by-product and ArcelorMittal indicated that as soon as they have re-commissioned the plant and sulphur production commenced again, the sulphur will be sold to third parties.

5.6. Specialist Studies Recommendations

Discussion on the implementation (or not) of recommendations as contained in the Scoring Report and Specialist Studies,

<table>
<thead>
<tr>
<th>RECOMMENDATION FROM SPECIALIST STUDIES</th>
<th>FEEDBACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td></td>
</tr>
<tr>
<td>Balancing tanks to be installed prior to battery process water treatment facilities</td>
<td>Upgraded 4 x 1000 m³ settling tanks prior to battery process water treatment. This will give sufficient buffer capacity to balance any process upsets in front of the treatment process – Completed</td>
</tr>
<tr>
<td>Monitor concentrations of cleaned COG and report.</td>
<td>Results reported in the first bi-annual report.</td>
</tr>
<tr>
<td>Monitor ambient levels of NH₃, H₂S and benzene, and take appropriate actions (as described in EIR) if found to be significant.</td>
<td>Results reported in the first bi-annual report.</td>
</tr>
<tr>
<td>The effluent stream sent to the Blast Furnaces should not be heated to the point where the NH₃ is stripped and released to atmosphere.</td>
<td>Investigation completed. The water is currently not used at the BF Gas cleaning system but used as coke quench water. The proposed ammonia stripper will remove ammonia from the process water, eliminating the concern.</td>
</tr>
<tr>
<td>All tar sludge should be returned to the coke ovens with the coal charge, using mechanical means and not by hand.</td>
<td>The tar-sludge recycling project has been implemented.</td>
</tr>
<tr>
<td>RECOMMENDATION FROM SPECIALIST STUDIES</td>
<td>FEEDBACK</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>All solid waste should be classified according to the Minimum Requirements and disposed of accordingly. Records should be maintained of all waste sent offsite.</td>
<td>Implementation completed. Records are available.</td>
</tr>
<tr>
<td>Scheduled preventative maintenance plan on all water systems to ensure segregation of process water, rainwater and indirect cooling water streams.</td>
<td>PMP implemented for all environmentally critical equipment.</td>
</tr>
</tbody>
</table>

**Groundwater**

- The feasibility of abstracting contaminated groundwater from the aquifer underlying the site, as a source of water supply to the process should be investigated.  
  - The final ground water management plan for the Works has been completed and requires approval from DWA.  

- The option of development of drains in the form of trenches to abstract the contaminated groundwater from the shallow perched aquifer system as part of the foundation design and groundwater containment/remediation options should be investigated.  
  - Same as above.  

- The water in the cooling tower sumps should be sampled and analysed to determine the quality.  
  - Done – results available  

- The existing monitoring boreholes should be properly capped to prevent contamination from surface soils and dust with samples that are taken in the boreholes.  
  - Upgrade of monitoring borehole network completed in 2010. Supplementary monitoring boreholes have been equipped with caps. New boreholes will be drilled to replace the damaged boreholes.  

- The construction of the monitoring boreholes should be reviewed to confirm whether the borehole construction material influences the values for iron and manganese in the groundwater in the Coke Ovens area.  
  - Completed.  
  
  Golder Associates Africa (Pty) Ltd conducted a study to assess the monitoring network.  

- The resident groundwater pollution should be managed.  
  - On-going. A localised soil and groundwater contamination study was completed.  

- A numerical groundwater flow and contaminant transport model should be developed.  
  - Modelling conducted as part of the Groundwater Management Plan.  

**Surface water**

- The mitigating measures for the construction and operational phase, as proposed in the document, should be made binding on ArcelorMittal South Africa Vanderbijlpark Works, its employees and external contractors.  
  - Noted.  

- A detailed Environmental Management Plan covering *inter alia* surface water management should be drafted and made binding on ArcelorMittal South Africa Vanderbijlpark Works.  
  - EMP submitted to GDARD. EMP updated as per Air Quality Monitoring Plan recommendations and submitted to authorities for approval. The EMP will be upgraded to align it with new legal requirements.  

- The existing Coke and Gas Cleaning Plant surface water-monitoring programme should continue.  
  - Monitoring programme will continue as per the Water Use Licence.  

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The process and products associated with the recycling of surplus water from the Coking Plant to the Blast Furnace need to be further investigated, in order to determine any potential negative impacts.

**Air Quality**

Install an additional PM10 and gaseous sampler (SO2, NOx and H2S) within the zone of impact directly south of the MSVS site to monitor the impact on the surrounding communities.

The monitoring of H2S should act as a performance indicator to monitor the reductions in ambient H2S concentrations.

The emission rates of the most significant pollutants need to be measured.

**Recommendations from Air Quality Monitoring Plan**

Monitoring of fugitive emissions from Batteries i.t.o. EPA Method 303. Accreditation of in-house training to be investigated subsequent to the Department of Environmental Affair’s (DEA’s) finalization of an emission monitoring accreditation scheme.

Measurement of benzene, NH3, H2S and volatiles in accordance with OHS Act to continue.

Measurement of H2S before and after gas cleaning to be conducted on a quarterly basis to verify conformance to RoD Condition 3.2(g).

Weekly analysis of quench water quality for comparison with future Minimum Emission Standards

**FEEDBACK**

Surplus water is to be re-used in the coke making process. Should the need arise to direct surplus water to the Blast Furnaces, these items will be investigated.

Completed. Two ambient air monitoring stations were installed south and south-east of ArcelorMittal Vanderbijlpark Works during 2004. The third monitoring station at the northern boundary of the site was installed in 2007.

Results reported in the first bi-annual report. It must be noted that it is expected to have a reduction of SO2 rather than H2S. This is because the H2S contained in the gas used as a fuel at the works will be transformed to SO2 emissions when burned.

Results reported in the first bi-annual report.

Liaison with DEA required.

Occupational Hygiene Department to ensure that these measurements are conducted.

Currently conducted for an indication of H2S levels in coke oven gas.

Samples analysed on a weekly basis.

**5.7. Complaints and Incidents**

ArcelorMittal has a complaints procedure in place. The register is kept on site and was reviewed. None of the complaints received related to the COCGAW project.

The facility has an electronic incident management system (PIVOT) which manages the incidents. The system facilitates the investigation and mitigation measures between different responsible parties. The incident report was reviewed and none of the environmental incidents related to the COCGAW project.
5.8. **Plant Performance and environmental improvements achieved**

The plant is not operational and therefore the environmental reductions in terms of water and air could not be realised. The plant failures experienced to date is set out below:

- Vapour Condenser Gaskets Failure (2011) – Repaired
- Sulphur Condenser Tube Failure (2011) – plugged 14/256 tubes
- Low Pressure Boiler Tube Failure (2011) – replace 5 bottom rows
- GP # 6 Cooling tower fire (2011 – 2012) – Repair (2.5mil)
- High Pressure Boiler Crack (2012) – Specialised repair (38 Bar vessel)
- Sulphur Condenser Tube Failure (2012) – Re-tube and Weld
- Electrostatic Tar Precipitator repairs (2012 – 2013) – various repairs
- Sulphur Condenser Line (2013) – Repaired
- Low Pressure Boiler Tube complete replacement – Completed
- Ammonia Stripper Column (2013) – Specialised repair (Titanium vessel)
- Ammonia Stripper Plant (2016) – planned commencement

The facility is currently still doing repairs, related to gas lines, the main burner and sulphur loading pumps, and crack reactor at the Elemental Sulphur plant.

6. **CONCLUSION AND RECOMMENDATIONS**

Condition 10.2 of the ROD, requires that an annual Environmental Audit be undertaken by an independent external auditor and the audit report submitted to the DEA. This report is the eight audit report in fulfilment of this requirement.

The construction of the plant commenced in 2005 and commissioned in 2010 at the cost of more than R 330 million. The project faced numerous delays and challenges. In 2010 the plant ran successfully and proved significant sulphur reduction in terms of emissions. Unfortunately the plant was shut down end of 2010 due to technical and mechanical difficulties. From 2011 up to date ArcelorMittal repaired the identified fault in the process and the attempted to re-commission the facility on a few occasions. The plant has not run for more than a few days at end without interruption. Currently the gas is only partially cleaned but no sulphur removal is taking place.

Table 1 sets out the compliance with the authorisation conditions and where non-compliances were recorded, the auditor contextualised the non-compliance in terms of the intensity. This equates to an objective view of the seriousness of the non-compliance and also then leads to recommendations where moderate to critical non-compliances have been observed.

The major concern is that the plant is not operational and ArcelorMittal is not cleaning the gas which leads to the release of emissions from the facility to the environment. Other non-compliances recorded in terms of the authorisation mostly related to the groundwater monitoring requirements that are not met and fugitive emissions control. A number of measures and projects have been implemented to reduce fugitive emissions – progress is evident in the fugitive emission graphs.

The following recommendations are made to improve compliance to the ROD:

- Commission the Gas Cleaning plant and ensure the required measures are implemented to continuously operate the plant. ([ArcelorMittal, ASAP](#))
- Monitoring of ground water at borehole CO-3D cannot be undertaken as the borehole no longer exists. Finalise the plans to drill an alternative suitable borehole that could be used for the same purpose envisaged and align the relevant legal requirements. ([ECO, Dec 2015](#))
• Exposure monitoring indicates that further fugitive emission mitigation measures are required. Although ArcelorMittal supplies specialised PPE and has implemented management measures to mitigate employee exposure, it is recommended that the additional fugitive emission reduction projects as identified by ArcelorMittal be prioritised and implemented. *(ArcelorMittal, as per project schedule)*

• Review and revise the Environmental Management Programme (EMPr) to align it with legal requirement as stipulated in Appendix 4 of GNR 982 in GG 38282 *(ECO)*.

• The second phase of the water cleaning system will commence in 2015 which includes the installation of an ammonia stripping plant to remove ammonia from the wastewater emanating from the coke oven. The phase of the project was part of the initial project scope as approved by GDARD. The relevant documents such as the EMP and site plans must be reviewed to adequately address the stripper plant prior to the commissioning thereof. *(ECO)*

• During the audit it was found that the bund around the gravel filter plant is compromised and water is flowing onto soil next to the plant *(Appendix B)*. The organisation must repair the bund wall around the Gravel Filter plant to prevent water from entering the storm water drainage system or to contaminated groundwater.

Further to the legal compliance issues, observations were also raised where there is a possibility to improve on the environmental practises. These are not legal requirements and ArcelorMittal should investigate the feasibility of implementation in context with the current situation and available resources.

The following observations were made:

• It is recommended that the identified projects (caustic dosing, potential bio-treatment plant etc.) be reviewed and prioritised in order to improve the quality of the water used for quenching.

• It is recommended that ArcelorMittal finalises the actions from the Ground Water Management Plan and implement the remediation measures as required at the Tar Plant and Coke Plant.
## Appendices

### Appendix A

#### DEVIATIONS ON INSPECTIONS OF BATTERY DOORS

<table>
<thead>
<tr>
<th>P/S</th>
<th>DOORS</th>
<th>HEADS</th>
<th>CHECK/D</th>
<th>KLIETS</th>
<th>SADDLES</th>
<th>DOOR HOOKS</th>
<th>SUN LINTELS</th>
<th>APRONS</th>
<th>C/S</th>
<th>DOORS</th>
<th>KLIETS</th>
<th>SADDLES</th>
<th>DOOR HOOKS</th>
<th>SUN LINTELS</th>
<th>APRONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 BATT INSPECTION</td>
<td>P/S</td>
<td>0</td>
<td>15</td>
<td>17</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>C/S</td>
<td>0</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5 BATT INSPECTION</td>
<td>P/S</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>C/S</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6 BATT INSPECTION</td>
<td>P/S</td>
<td>0</td>
<td>16</td>
<td>16</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>C/S</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>7 BATT INSPECTION</td>
<td>P/S</td>
<td>0</td>
<td>25</td>
<td>24</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>18</td>
<td>1</td>
<td>C/S</td>
<td>0</td>
<td>9</td>
<td>10</td>
<td>5</td>
<td>23</td>
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<tr>
<td>8 BATT INSPECTION</td>
<td>P/S</td>
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<td>21</td>
<td>21</td>
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<tr>
<td>TOTAL DEVIATIONS</td>
<td>P/S</td>
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<td>79</td>
<td>80</td>
<td>6</td>
<td>8</td>
<td>2</td>
<td>50</td>
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<td>0</td>
<td>37</td>
<td>17</td>
<td>6</td>
<td>56</td>
</tr>
</tbody>
</table>

Figure 19: On-going coke oven door maintenance
Appendix B

Damaged bund around gravel filter plant
Appendix C

Job card for exhauster

Plant Maintenance Work Order Header

Planning Plant: SF01
Vanderbijlpark Works

BEFORE STARTING THE JOB, ASK YOURSELF THE FOLLOWING QUESTIONS

I  Is the equipment isolated? (Mechanical, Electrical, Area)
W  Am I wearing the correct P.P.E., what else should I use?
O  What other party must know we are working here?
R  Are the right tools available and safe for use?
K  Have I discussed the known hazards with the team?
A  What in the area could endanger our safety?
F  Are specific procedures or instructions applicable?
E  Have I communicated effectively with the team?

Does this job have an Environmental impact? (Y/N)
If "Y" describe impact
What precautions will be put in place to prevent/limit the impact?

Maint Plant: SFKN Coke Oven By-products
Date Printed: 2015.02.09

Plant Maintenance Work Order Header

N/Plan Nr: V23853
Order Nr: 924852538

Notification Nr:

W/O Type: PM02 PM: Equipment Maint Plan generated Order

Funct Loc:

ABC IND: C
ABC IND: C
ABC IND: A
ABC IND: A

Description: (Short)

PM Planner grp: MCB
Main work centre: ICN82FIT SF01
System Condition: 0
Priority: 2
Status: Activity Type: 003
Basic Start Date: 2015.02.16
Basic Start Time: 07:00:00

Planning Related Information

Byproducts B-block
Filter
Running Producing
Sched - Future Need
REL NFGAT PRC SFTC
Cond. Monitoring / Inspection
Basic End Date: 2015.02.16
Basic End Time: 08:00:00

Equipment Installed/Dismantled: C. Labuschagne

Equipment Number Dismantled: Coke Ovens
Equipment Number Installed: By Products
**Operations Long Text**

**1. Check readings.**
- Oil pressure high
  - __Kpa
- Oil pressure low
  - __Kpa
- Steam pressure controlled
  - __Kpa
  - Check speed on the rev. counter __rpm

**2. Check oil flow.**
- Check oil return flow
  - Yes __, No __
- Check bearing water flow
  - Yes __, No __

**3. Check vibration on Turbine.**
- DE Bearing
  - Vertical
    - __mm/sec
  - Horizontal
    - __mm/sec
  - Axial
    - __mm/sec
- NDM Bearing
  - Vertical
    - __mm/sec
  - Horizontal
    - __mm/sec
  - Axial
    - __mm/sec

**4. Check vibration on Exhauster.**
- DE Bearing
<table>
<thead>
<tr>
<th>Vertical</th>
<th>147 mm/sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal</td>
<td>mm/sec</td>
</tr>
<tr>
<td>Axial</td>
<td>mm/sec</td>
</tr>
<tr>
<td>NDE Bearing</td>
<td>Vertical</td>
</tr>
<tr>
<td>Horizontal</td>
<td>139 mm/sec</td>
</tr>
<tr>
<td>Axial</td>
<td>mm/sec</td>
</tr>
</tbody>
</table>

5. Check Bearing temperature.
   - Bearing no.1, Turbine: 46°C Deg.C
   - Bearing no.2, Turbine: 46°C Deg.C
   - Bearing no1, Exhauster: 69°C Deg.C
   - Bearing no.2, Exhauster: 64°C Deg.C

6. Check for steam leaks.
7. Check for oil leaks.
8. CHECK OIL LEVEL IN TANK, OK
   - YES ✔ NO
   - OIL NEEDED: 0 (LITERS REQUIRED)

---End---