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

Audit date: 14 August 2017
Report date: 29 September 2017
Report Number: 770-ZANAMSA-2017
## General Information

<table>
<thead>
<tr>
<th>Report Name:</th>
<th>External Audit Report for the Coke Oven Clean Gas and Water Project (COCGAW) ROD</th>
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</thead>
<tbody>
<tr>
<td>Environmental auditor</td>
<td>Zantow Environmental Consulting Services CC</td>
</tr>
<tr>
<td></td>
<td>22 Delius Street, SW 5</td>
</tr>
<tr>
<td></td>
<td>Vanderbijlpark</td>
</tr>
<tr>
<td></td>
<td>PO Box 3858</td>
</tr>
<tr>
<td></td>
<td>Vanderbijlpark, 1911</td>
</tr>
<tr>
<td>Contact Person:</td>
<td>Riette Landsberg</td>
</tr>
<tr>
<td></td>
<td>Tel: 079 692 1808</td>
</tr>
<tr>
<td></td>
<td>Fax: 016 932 4976</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:riette@zantow.co.za">riette@zantow.co.za</a></td>
</tr>
<tr>
<td>Client:</td>
<td>ArcelorMittal South Africa Vanderbijlpark Works</td>
</tr>
<tr>
<td></td>
<td>Contact Person: Environmental Control Officer (ECO)</td>
</tr>
<tr>
<td></td>
<td>Terrence Wilson</td>
</tr>
<tr>
<td></td>
<td>Tel: 016 889 3255</td>
</tr>
<tr>
<td></td>
<td>Fax: 016 889 2058</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:Terrence.wilson@arcelormittal.com">Terrence.wilson@arcelormittal.com</a></td>
</tr>
<tr>
<td>Report compiled by:</td>
<td>Riette Landsberg</td>
</tr>
<tr>
<td>Report date:</td>
<td>29 September 2017</td>
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<tr>
<td>Status</td>
<td>Final</td>
</tr>
<tr>
<td>Reference number</td>
<td>GAUT 002/02-03/138</td>
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</tbody>
</table>
EXECUTIVE SUMMARY

Zantow Environmental Consulting Services CC (Zantow Environmental) was appointed by ArcelorMittal to conduct an independent compliance audit on its Record of Decision (RoD) (GAUT 002/02-03/138) 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 included:
- Documentation review
- Compilation of audit checklist/questionnaire for site visit;
- Site Visit (Conducted on the 14th of August 2017); and
- Compilation of compliance audit report.

Table 1 sets out the compliance with the RoD conditions and where non-compliances were recorded the auditor ranked the specific non-compliances in terms of the following criteria:
- Minor Issues
- Moderate Issues
- Critical Issues
- Historical issues

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 outdated and could not deliver 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 to comply 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 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 at the end of 2010 due to technical and mechanical difficulties. From 2011, 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.

The major concern is that the plant is not fully operational and ArcelorMittal is not removing sulphur from the coke oven gas which leads to the release of emissions from the facility to the environment. The other non-compliances recorded in terms of the authorisation relates to fugitive emissions control. A number of measures and projects have been implemented to reduce fugitive emissions.

The following recommendations are made to achieve compliance with the ROD;
- Re-commission the Sulphur removal section of Gas Cleaning plant and ensure the required measures are implemented to continuously operate the plant. (ArcelorMittal, ASAP)
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)
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PART 1: AUDIT INFORMATION

1.1 Introduction

Zantow Environmental was appointed by ArcelorMittal to conduct an independent compliance audit on its RoD (GAUT 002/02-03/138) which was received from GDACE, now the GDARD on the 21st of March 2004.

The methodology followed for conducting the compliance assessment audit included:
- Documentation review
- Compilation of audit checklist/questionnaire for site visit;
- Site Visit (Conducted on the 14th of August 2017); and
- Compilation of compliance audit report.

1.2 Background and project status

ArcelorMittal Vanderbijlpark Works operates 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 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 of 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 sent 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 and directed to a Claus Reactor to remove sulphur from the gas stream. 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 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, 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. An investigation was undertaken at the end of 2015 by external specialists to analyse the plant and propose a strategy to repair and re-commission the plant. Different options were provided to ArcelorMittal. The tender process for the technical design of the required upgrades is currently in process. Once the designs have been received and approved, the project team will present the restoration plan for fund allocation.
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.

1.3 Date of Audit

External Audit date: - 14th of August 2017
Draft report date: - 31st of August 2017
Final report date: - 29th September 2017

1.4 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 finalised.

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.

In light of the above, the auditor has, in addition to indicating compliance and non-compliance, ranked the specific non-compliances 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,
- 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
Historic Issues

- No physical environmental harm – administrative in nature
- Historic non-compliance, out the company currently in control of compliance control
- No administrative or other remedy available to rectify the situation
- No further action required

1.5 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 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 where handled
- Details of the discharges

1.6 Level of audit findings

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 non-compliance and observations. These are defined as follows:

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 a non-compliance, but which does not represent Best Practice. Recommendations could be stated for potential non-compliances.

**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.

1.7 **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.

1.8 **Declaration**

I, **Riette Landsberg**, 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.

____________________
Riette Landsberg
Environmental Specialist
1. PART 2: AUDIT FINDINGS

2.1 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. An investigation was undertaken at the end of 2015 by external specialists to analyse the plant and propose a strategy to repair and re-commission the plant. Approval of funds for the technical design of extensive upgrades of the project is currently underway. Once funds have been allocated the sulphur plant will be refurbished and other infrastructure such as the ammonia stripper will be installed. 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 comprises complex processes with limited to no local technology expertise.

2.2 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>
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<tr>
<th>Recommendation</th>
<th>Status 2016</th>
<th>Status 2017</th>
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<tbody>
<tr>
<td>Condition: 3.2,g.1 - Compliant. Monitoring results indicate that the H₂S emissions are below the limits. ArcelorMittal indicated that the coal has been changed to a lower Sulphur percentage coal which led to an improvement. The Sulphur removal plant must still be commissioned.</td>
<td>Non-compliant. H₂S emissions are exceeding the limit. An investigation was undertaken at the end of 2015 by external specialists to analyse the plant and propose a strategy to repair and re-commission the plant. Different options were provided to ArcelorMittal and the company is currently investigating the feasibility thereof. Approval of funds for the extensive upgrade of the project is currently underway. Once funds have been allocated the sulphur plant will be refurbished and other infrastructure such as the ammonia stripper will be installed.</td>
<td>Unresolved. H₂S emissions are exceeding the limit. The project is currently in the funds approval process for the technical design of the required infrastructure upgrades.</td>
</tr>
<tr>
<td>Un-cleaned gas is being flared due to the non-operational Sulphur Plant. H₂S emissions exceed the required limit but have shown a decrease over time. The decrease may be contributed to a change in coal supplies with a lower sulphur content. Repairs to the plant have been prioritised.</td>
<td>The status remains unchanged. Un-cleaned gas is being flared due to the non-operational Sulphur Plant.</td>
<td>Unresolved. Un-cleaned gas is being flared due to the non-operational Sulphur Plant.</td>
</tr>
<tr>
<td>The gas cleaning plant needs to be re-commissioned and the required measures implemented to continuously operate the plant. Experts have initiated a process to assess the plant in order to generate solutions for the operational deficiencies. ArcelorMittal expects a full report</td>
<td>An investigation was undertaken at the end of 2015 by external specialists to analyse the plant and propose a strategy to repair and re-commission the plant. Different options were provided to ArcelorMittal and the company is currently investigating the feasibility thereof. Approval of funds for the extensive upgrade</td>
<td>Unresolved. Approval of funds process for the technical design of extensive upgrades of the project is currently underway. Once funds have been allocated the sulphur plant will be refurbished and other infrastructure such as the ammonia stripper will be installed.</td>
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Recommendation | Status 2016 | Status 2017
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regarding the assessment by end 2015. | of the project is currently underway. Once funds have been allocated the sulphur plant will be refurbished and other infrastructure such as the ammonia stripper will be installed. | 

The issue with regards to borehole CO-3D still stands. Monitoring is however done at CO-1D also located at the coke ovens as an alternative and the organisation is awaiting monitoring data.

The organisation has recently approached a contractor to install new boreholes to replace CO-3D. The WUL should be amended to include the new boreholes after installation has been completed. The facility is in process to place an order.

The contractor has initiated with the installation of the replacement borehole and monitoring will commence on completion.

Resolved.

Monitoring borehole CO-3D was replaced by the drilling of a new borehole within the same location. Monitoring of the new borehole is undertaken at the required timeframes.

Partially resolved.

Monitoring borehole CO-3D was replaced by the drilling of a new borehole within the same location. Monitoring of the new borehole is undertaken at the required timeframes.

This is a long term action and the recommendations are therefore still valid.

ArcelorMittal has however implemented management and mitigation measures such as efficient gasmasks to protect employees and reduce exposure.

Other measures have commenced in 2016 to reduce fugitive emissions, including a battery tightening and charge emission reduction projects. The effectiveness of these measures should be assessed to determine whether it is sufficient to mitigate fugitive emissions.

Partially resolved.

The status remains unchanged. The implementation of the proposed measures such as the tightening of batteries and charge emission reduction projects are still underway.

The effectiveness of these measures should be assessed to determine whether it is sufficient to mitigate fugitive emissions.

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

### 2.3 Compliance to the RoD conditions

In general ArcelorMittal is not complying fully with the authorisation as the sulphur plant is not operational as per the designs. The gas cleaning plant aims to deliver many environmental benefits in terms of emission reduction, which will not be 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 few 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 mainly to 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.
2.4 Authorisation Conditions Assessment

Table 1: Compliance to the RoD conditions

<table>
<thead>
<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 3.1.1.a-c and 3.1.2.a-k.</td>
<td>Various changes were made and approved by GDARD. The gravel filter plant was the last infrastructure constructed according to the scope. On completion of the remaining infrastructure requirements, there is an option of diverting cleaned water to the BF Gas cleaning system as planned originally and therefore cleaner water used for quenching. The approval of funds process for the technical design required for the extensive upgrade of the project is currently underway. Once funds have been allocated, post the technical design stage, the sulphur plant will be refurbished and other infrastructure such as the ammonia stripper will be installed.</td>
<td>Compliant</td>
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3.2 Specific Conditions

| 3.2 (a)   | 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). | A 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  
- HAZOP | Compliant |                             |
<table>
<thead>
<tr>
<th>RoD Cond.</th>
<th>ROD Requirement</th>
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<th>Compliance Status</th>
<th>Intensity of non-compliance</th>
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<tr>
<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 22\textsuperscript{nd} 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. The status remains the same.</td>
<td>Compliant</td>
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<td>(c)</td>
<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, <em>inter a</em></td>
<td>The EMP was submitted for construction as required. ArcelorMittal submitted an operational EMP on the 3\textsuperscript{rd} November 2008 followed by an updated Operational plan on the 19\textsuperscript{th} March 2012. ArcelorMittal followed up on the EMP approval from GDARD without any response other than acknowledgement of receipt per email from the department.</td>
<td>Compliant</td>
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<td>• 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 machinery, plants e.g. the benzol plant, ammonium sulphate plant, tar remediation required, and any remedial measures to be implemented.</td>
<td>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.</td>
<td>Compliant</td>
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<td>• A proposed surface and ground water monitoring regime, which will be in line with the DWAF Water Licence. The graphically represented results of this</td>
<td>Surface monitoring is being undertaken in line with the requirements of the water use license issued to the Works.</td>
<td>Compliant</td>
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<tr>
<td>RoD Cond.</td>
<td>ROD Requirement</td>
<td>Status</td>
<td>Compliance Status</td>
<td>Intensity of non-compliance</td>
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<tr>
<td>14</td>
<td>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>
<td>During the previous audit dated February 2017 it was established that no groundwater monitoring is conducted at CO-3D as the borehole was damaged. However, ArcelorMittal continued with monitoring at CO-1D as an alternative borehole. Since then a new borehole was drilled to replace borehole CO-3D. Groundwater monitoring results and analyses are discussed in Section 3 of the report.</td>
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<td>• 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>
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<td>• 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>
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<td>• 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>The diagram is 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>The EMP was updated to include handling of all by-products, including coke breeze as per previous audit report recommendation. No sulphur is currently generated due to non-</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 procedure for the industrial Works.</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>A HAZOP study was completed in September 2002 and was submitted 29th of May 2003 to the Department.</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 maintenance. A discussion on the implementation of and compliance within the maintenance plan must be included in the bi-annual audit reports.</td>
<td>An amendment Application concerning external verification of the Preventative Maintenance Plan (PMP), dated 29 July 2009, was submitted to the department on 7 Aug 2009. Critical maintenance requirements have been identified and are captured on the “SAP” system for tracking and action. Job cards are created and managed on “SAP”. The detarrers were chosen as an example. The last job card was dated the 10th August 2017. From the job card and additional information provided it seems as if the maintenance plans are implemented sufficiently. An investigation has been undertaken by external specialists to analyse the state of the plant and to develop a strategy to repair and re-commission the plant. The approval of funds</td>
<td>Compliant</td>
<td>Observation</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 were resubmitted to DWAS 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. Plans for the upgrade project should be timeously submitted to the Department for approval.</td>
<td>Compliant</td>
<td></td>
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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. <strong>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</strong></td>
<td>The facility has 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. Batteries 4, 8 and 9 were chosen as the current Coke Strategy for the Works indicates 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 explained the aim is 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>
<td></td>
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- 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
- The latest monitoring results indicate the H₂S content of the gas exceeded the maximum limit of 1.5mg/Nm³
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<td>are to be graphically represented and included in the bi-annual audit report. The H&lt;sub&gt;2&lt;/sub&gt;S content of the gas must be between 0.8 and 1.5 g/Nm&lt;sup&gt;3&lt;/sup&gt;.</td>
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<td>• 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 results of this monitoring must be included in the bi-annual audit.</td>
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<td>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.</td>
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<td>Compliant</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></td>
<td>Partial Compliance</td>
<td>Moderate</td>
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<td>Battery doors are on a maintenance schedule and are checked on a daily basis. Repairs are done continuously. A copy of the door maintenance schedule was made available for review and it was concluded that maintenance is undertaken on a daily basis.</td>
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<td>It was observed during the site visit that the occasional door is still burning and smoking. The commitment from the facility was however also observed to repair and maintain the equipment as far as possible.</td>
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<td>The fugitive emissions are monitored according to the internationally accepted standards and recorded.</td>
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<td>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 fugitive battery emissions as a cumulative source. ArcelorMittal has implemented management and mitigation measures such as specialised face masks and other measures to protect employees and reduce exposure. Other measures such as the introduction of battery tightening and charge emission reduction projects have also been implemented and are still underway. The effectiveness of these measures should be assessed to</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.</td>
<td>Compliant</td>
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<td>• The following must be undertaken within 6 months of the commissioning of the various 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.</td>
<td>The relevant information was submitted. The implementation of the Gravel Filter Plant and the caustic dosing (Ammonia Stripping) infrastructure 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.</td>
<td>Compliant</td>
<td>Observation</td>
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<td>• 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</td>
<td>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.</td>
<td>Compliance</td>
<td>Observation</td>
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<td>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.</td>
<td>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>
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<td>An investigation was undertaken at the end of 2015 by external specialists to analyse the plant and propose a strategy to repair and re-commission the plant. The approval of funds process for the technical design of the extensive upgrades of the project is currently underway. Once funds have been allocated, post design stage, the sulphur plant will be refurbished and other infrastructure such as the ammonia stripper will be installed.</td>
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<td>• 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 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>
<td>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.</td>
<td>Compliant</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</td>
<td>The works has developed a Coke Strategy for the short, medium and long term. The facility also implements additional Emission Reduction Plans in line with the Atmospheric Emissions License. The approval of funds process for the technical design of</td>
<td>Compliant</td>
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<td>(h)</td>
<td>Battery Stacks – Background information for proposed standards (February, 2001)</td>
<td>extensive upgrades of the project is currently underway. Once funds have been allocated, post design stage, the sulphur plant will be refurbished and other infrastructure such as the ammonia stripper will be installed.</td>
<td>Non Compliance</td>
<td>Moderate</td>
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<td>(i)</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 Sulphur 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 an 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 has been non-operational for an extended period of time due to equipment failure and significant repairs and replacements are required.</td>
<td>Compliant</td>
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<td>(j)</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. No incidence related to the project has been recorded during the audit period.</td>
<td>Compliant</td>
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<td>(k)</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, should they occur, can be diverted to the coke plant sump and are therefore contained.</td>
<td>Compliant</td>
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<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</td>
<td>Submission of application was 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 and Sanitation (DWAS) was the competent authority at the time.</td>
<td>Compliant</td>
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<td>of the COG and water cleaning project.</td>
<td>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 Dams 2 and 3 is 100% complete and Dam 1 about 60% complete. Soil is being remediated in-situ.</td>
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<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 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>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. All known active sources from the area have been eliminated and since inception of remedial actions, around 2007, which formed part of the original groundwater management plan, significant progress has been made in this regard ArcelorMittal stated that it is their intention to remodel the groundwater dynamics for the entire site to assess the success of remedial actions undertaken in the past decade. This modelling will tie in with the greater contaminated land assessment for the Works, which will be submitted to the DEA and DWS. For optimal results it is recommended that an action plan be drafted in line with recommendations and findings made within the contaminated land assessment.</td>
<td>Compliant</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

- **(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 changes made during the reporting period.  
  
  Compliant

- **(b)** 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.  
  
  No notices have been received in the current reporting period.  
  
  Compliant

- **(c)** 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  
  
  The Department was notified of the name change in 2007 and change of contact person in February 2012. No other changes and associated amendments are outstanding in the current reporting period.  
  
  Compliant
### ROD Requirement

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<td>Whom the rights accrue that the conditions contained herein are binding on them.</td>
<td>The department was 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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<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 of assessing and/or monitoring compliance with the conditions contained in this document at all reasonable times.</td>
<td>No departmental inspections were undertaken during the audit period, however ArcelorMittal operates under an open door policy. Should a request be received form the department for a site inspection access will be granted a required.</td>
<td>Compliant</td>
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<td>(h)</td>
<td>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.</td>
<td>No additional non-compliances have been registered 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.</td>
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### 3.4 Reporting

3.4 (a) A summarised quarterly progress report on the implementation of the COG and water cleaning report must be submitted to ArcelorMittal received a letter from GDARD on the 8th February 2010 stating quarterly audits must continue but doesn't need to | Compliant                     |}

**Legend:**
- **Compliant:** All conditions met.
- **Non-compliant:** Conditions not met.
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<td>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:</td>
<td>be submitted anymore. The quarterly audits were available and on record, the last report was generated in June 2017.</td>
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|          |  - 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),  
     - Any steps taken to rectify areas of non-compliance with environmental requirements. |                                                                                                                                                                                                     |                  |
| (b)      | 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): "…" | The last external audit was conducted by GCS Water & Environmental Consultants in March 2017. A copy of the final report was available for review and found to be compliant to the requirements of this condition.  
This audit report was structured to comply with the conditions and the specific items to be addressed are discussed in more detail under Section 3. | Compliant         |
2. PART 3: INFORMATION ASSESSMENT

3.1 Water and Waste Water

The 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 was able to maintain their zero effluent status until 2011 until 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.

![Figure 1 Updated Vanderbijlpark Works Water Balance](image)

As can be seen in Figure 3, there was some effluent discharged from 2016 to date. The facility reported the relevant discharges to the competent authority and the matter falls outside the scope of this audit. An average of 65% reduction of water abstraction since 2005 has been achieved.
The coke ovens are however only a portion of the facility’s 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 in 2013 and the treatment of waste water in this process is shown to be effective. 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 potential re-use of the treated coal water in the BF Gas cleaning plant.

![Figure 4: Coke plant water balance](image)

**Figure 4: Coke plant water balance**

![Gravel Filter Effectiveness for Suspended Solids](chart)

**Figure 5: Gravel Filter Effectiveness for Suspended Solids (March 2017 to August 2017)**
The Caustic dosing system will be constructed as part of the extensive upgrade of the project and will further improve the internal water balance and management of the effluent. Regardless of the internal process, from an environmental perspective, no effluent is discharged during normal situations and therefore the impact of the water and effluent management is negligible.

3.2 Groundwater

Groundwater monitoring and management is conducted according to the Work’s Water Use License. The groundwater management plan has been finalized and peer reviewed to confirm assumptions and evaluate proposed recommendations. ArcelorMittal stated that it is their intention to remodel the groundwater dynamics for the entire site to assess the success of remedial actions undertaken in the past decade. This modelling will tie in with the greater contaminated land assessment for the Works, which will be submitted to the DEA and DWS, after which planning for potential remediation can commence. Currently, groundwater is not actively pumped or treated at the coke plant. The following graphs show the results of the groundwater monitoring.

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

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

The boreholes are required to be monitored for inorganic elements and organic elements.
Figure 7: NW-8D NH3 and NO3

Figure 8: NW-8D Electric Conductivity

Figure 9: NW-8D SO4
Figure 10: CO-1D groundwater data (NH3 and NO3)

Figure 11: CO-1D groundwater data (SO4)

Figure 12: CO-1D groundwater data (EC)
From the analysis, it is clear the groundwater qualities in the specific areas are highly variable. This is expected according to the original 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 poor quality.

Upon finalisation of the works-wide contaminated land assessment, the approval of potential recommended remedial actions should be pursued with DEA and DWS and implemented to ensure no adverse effects to off-site receptors.

Monitoring of Borehole CO-3D (as per WUL requirement) was not undertaken at the same frequency as NW-8D due to damage. As such a new borehole was established within the vicinity of the original CO-3D. Monitoring of the new borehole commenced in April 2017 and will be used for future monitoring requirements.

### 3.3 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.

Storm water flow is measured continuously and the EC is also monitored at selected points and is used to detect potential spills into the storm water drains.

![Coke Oven Buffer Sump Levels](image)

**Figure 13: Coke plant sump level**

### 3.4 Air quality monitoring

Air quality monitoring, management and reporting is conducted according to the Atmospheric Emissions License (AEL), the ROD and the Air quality monitoring report compiled 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 H₂S concentrations in the Coke Oven Gas can be improved upon with re-operation of the Sulphur plant.
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 Stacks SO₂ emissions (mg/Nm³)
Figure 16: Coke battery #4 stack dust emissions

Figure 17: Coke battery #6 stack dust emissions

Figure 18: Coke battery #7 stack dust emissions
Fugitive Emissions

Fugitive emissions are a concern at coke battery operations in general. 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. It should be noted that ArcelorMittal has implemented various emission reduction projects, 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. From review of the data, the ambient air quality in terms of H₂S is not considered a major issue around the facility.
The coke oven gas plants main effect would be a reduction in SO$_2$. As the plant is not operational it was deemed unnecessary to include a full discussion on the SO$_2$ ambient air quality data monitored by the facility. Once the plant has been re-commissioned the SO$_2$ ambient data must be compared with the SO$_2$ ambient data measured prior to commissioning.

3.5 Waste and By-products monitoring

The following shows the different management techniques applied to the various waste streams generated at the ArcelorMittal Vanderbijlpark Works.

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposed Internally</td>
<td>52.02 %</td>
</tr>
<tr>
<td>Re-used or Recycled internally</td>
<td>11.41 %</td>
</tr>
<tr>
<td>Re-used or Recycled Externally</td>
<td>31.17 %</td>
</tr>
<tr>
<td>Disposed externally (hazardous waste)</td>
<td>0.63 %</td>
</tr>
<tr>
<td>Stored for re-use internally</td>
<td>4.77 %</td>
</tr>
</tbody>
</table>

The Coke Ovens basically generates Coke Breeze, liquid raw tar and tar sludge as by-products and waste streams. Liquid tar generated is pumped to the tar plant for further processing.

![Raw Tar to AMCC](image)

Figure 21: Raw Tar
Tar sludge is generated and mixed with coal dross 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. No liquid sulphur has been generated during the audit period as the plant is off line.

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 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 500 ton/month is transported by railway to the sinter plant for recycling.
No sulphur is being produced currently as the sulphur 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 commences again, the sulphur will be sold to third parties.

3.6 Specialist Studies Recommendations

*Discussion on the implementation 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>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 initiated. A bund wall has been constructed around the tar sludge recycling area and was confirmed during the site visit.</td>
</tr>
</tbody>
</table>
### RECOMMENDATION FROM SPECIALIST STUDIES

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Feedback</th>
</tr>
</thead>
<tbody>
<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.
  - Investigation underway.
  - All known active sources from the area have been eliminated and since inception of remedial actions, around 2007, which formed part of the original groundwater management plan, significant progress has been made in this regard. As such, it was decided to remodel the groundwater dynamics for the entire site to assess the success of remedial actions undertaken in the past decade. This modelling will tie in with the greater contaminated land assessment for the Works, which will dictate possible contaminated land and groundwater initiatives going forward.

- 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 the monitoring borehole network completed in 2010. Supplementary monitoring boreholes have been equipped with caps. A new borehole was drilled to replace the damaged borehole CO-3D.

- 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.
  - All known active sources from the area have been eliminated and since inception of remedial actions, around 2007, which formed part of the original groundwater management plan, significant progress has been made in this regard. As such, it was decided to remodel the groundwater dynamics for the entire site to assess the success of remedial actions undertaken in the past decade. This modelling will tie in with the greater contaminated land assessment for the Works, which will dictate possible contaminated land and groundwater initiatives going forward.
<table>
<thead>
<tr>
<th>RECOMMENDATION FROM SPECIALIST STUDIES</th>
<th>FEEDBACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>A numerical groundwater flow and contaminant transport model should be developed.</td>
<td>Modelling conducted as part of the original Groundwater Management Plan. Remodelling will be conducted in 2017.</td>
</tr>
<tr>
<td>Surface water</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>Noted.</td>
</tr>
<tr>
<td>A detailed Environmental Management Plan covering <em>inter alia</em> surface water management should be drafted and made binding on ArcelorMittal South Africa Vanderbijlpark Works.</td>
<td>An EMP was submitted to GDARD. An EMP was updated as per the Air Quality Monitoring Plan recommendations and submitted to authorities for approval. The EMP has been upgraded to align it with new legal requirements.</td>
</tr>
<tr>
<td>The existing Coke and Gas Cleaning Plant surface water-monitoring programme should continue.</td>
<td>The monitoring programme will continue as per the Water Use Licence.</td>
</tr>
<tr>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td>Air Quality</td>
<td></td>
</tr>
<tr>
<td>Install an additional PM10 and gaseous sampler (SO$_2$, NO$_x$ and H$_2$S) within the zone of impact directly south of the MSVS site to monitor the impact on the surrounding communities.</td>
<td>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.</td>
</tr>
<tr>
<td>The monitoring of H$_2$S should act as a performance indicator to monitor the reductions in ambient H$_2$S concentrations.</td>
<td>Results reported in the first bi-annual report. It must be noted that it is expected to have a reduction of SO$_2$ rather than H$_2$S. This is because the H$_2$S contained in the gas used as a fuel at the works will be transformed to SO$_2$ emissions when burned.</td>
</tr>
<tr>
<td>The emission rates of the most significant pollutants need to be measured.</td>
<td>Results reported in the first bi-annual report.</td>
</tr>
<tr>
<td>Recommendations from Air Quality Monitoring Plan</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td>Liaison with DEA required.</td>
</tr>
<tr>
<td>Measurement of benzene, NH$_3$, H$_2$S and volatiles in accordance with OHS Act to continue.</td>
<td>Occupational Hygiene Department to ensure that these measurements are conducted.</td>
</tr>
</tbody>
</table>
### RECOMMENDATION FROM SPECIALIST STUDIES

<table>
<thead>
<tr>
<th>RECOMMENDATION FROM SPECIALIST STUDIES</th>
<th>FEEDBACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement of H2S before and after gas cleaning to be conducted on a quarterly basis to verify conformance to RoD Condition 3.2(g).</td>
<td>Currently conducted for an indication of H2S levels in coke oven gas.</td>
</tr>
<tr>
<td>Weekly analysis of quench water quality for comparison with future Minimum Emission Standards</td>
<td>Samples analysed on a weekly basis.</td>
</tr>
</tbody>
</table>

### 3.7 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.

### 3.8 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)

An investigation was undertaken at the end of 2015 by external specialists to analyse the plant and propose a strategy to repair and re-commission the plant. Different options were provided to ArcelorMittal and they are currently investigating the feasibility thereof. The Projects Department is currently in the process of evaluating tenders from specialists to conduct integrity checks of the gas plant equipment, including vessels, heat exchangers, pipes, trestles, exhausters etc. An enquiry for the technical design required for implementation of the actions identified as part of the specialist assessment to determine the deficiencies of the Plant has also been issued. The detailed engineering design component of the project is expected to take in the region of a year, thus manufacturing, installation and commissioning of the upgrades is planned to commence in 2018 subsequent to the funds approval process.

### 3. CONCLUSION AND RECOMMENDATIONS

Zantow Environmental Consulting Services CC (Zantow Environmental) was appointed by ArcelorMittal to conduct an independent compliance audit on its Record of Decision (RoD) (GAUT 002/02-03/138) 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 included;
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 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 to comply 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 at the end of 2010 due to technical and mechanical difficulties. From 2011, 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.

The major concern is that the plant is not fully operational and ArcelorMittal is not removing sulphur from the coke oven gas which leads to the release of emissions from the facility to the environment. Other non-compliances recorded in terms of the authorisation relates to fugitive emissions control. A number of measures and projects have been implemented to reduce fugitive emissions.

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

- Re-commission the Sulpur removal section of Gas Cleaning plant and ensure the required measures are implemented to continuously operate the plant. \textit{(ArcelorMittal, ASAP)}
- 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. \textit{(ArcelorMittal, as per project schedule)}