global environmental solutions

Siyanda Ferrochrome Project

# Waste Assessment

# For Compliance with the National Environmental Management: Waste Act, 2008 (Act 59 of 2008)

SLR Project No.: 710.19057.00010

Report No.: 01

September 2016

Siyanda Chrome Smelting Company (Pty) Ltd

Siyanda Ferrochrome Project

Waste Assessment

For Compliance with the National Environmental Management:

Waste Act, 2008 (Act 59 of 2008)

SLR Project No.: 710.19057.00010

Report No.: 01

September 2016

Siyanda Chrome Smelting Company (Pty) Ltd

**DOCUMENT INFORMATION**

| | |
|---|---|
| **Title** | Waste Assessment: Siyanda Ferrochrome Project |
| **Project Manager** | Caitlin Hird |
| **Project Manager e-mail** | chird@slrconsulting.com |
| **Author** | Jenny Ellerton |
| **Reviewer** | Terry Harck |
| **Client** | Siyanda Chrome Smelting Company (Pty) Ltd |
| **Date last saved** | 2016/08/19 02:20:00 PM |
| **Keywords** | Waste Assessment, National Norms and Standards, Waste type, Landfill Class |
| **Project Number** | 710.19057.00010 |
| **Report Number** | 01 |
| **Status** | DRAFT |
| **Issue Date** | September 2016 |

## EXECUTIVE SUMMARY

A waste assessment for the Siyanda Ferrochrome Project has been undertaken in terms of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEM:WA), Regulation 8 of GN R. 634 of 2013, which references the following associated National Norms and Standards:

- National Norms and Standards for the assessment of waste for landfill disposal (GN R.635 of 2013); and
- National Norms and Standards for disposal of waste to landfill (GN R. 636 of 2013).

The project will process chrome concentrate to produce ferrochrome. Two (2) waste types will be generated through the ferrochrome smelting process; a slag and a baghouse dust.

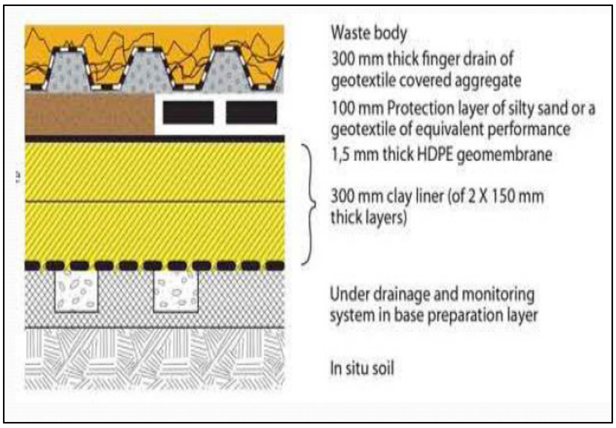
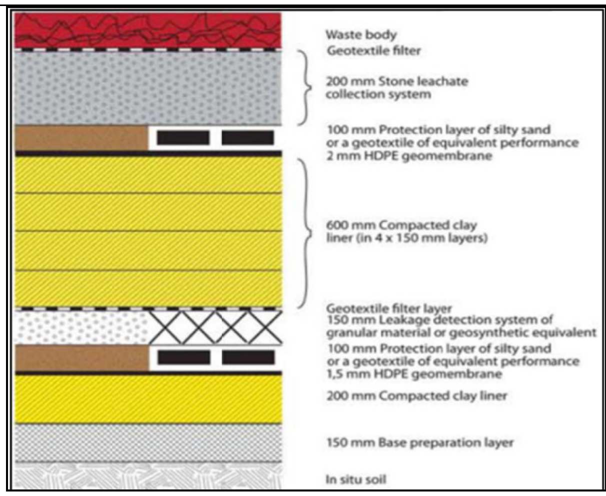
Samples of slag were provided to SLR from a project specific pilot plant. Slag samples tested as part of this assessment are therefore considered to be a good indication of the actual slag that will be produced by the project.

A baghouse dust sample was obtained from Mogale Alloys. The raw material used to create the Mogale baghouse is not specific to Siyanda, although is similar in that the chrome concentrate comes (in both cases) from the Bushveld Igneous Complex. The smelter process is fully representative of the proposed Siyanda smelter. Therefore, the sample referred to in this report as “Mogale DC Baghouse” has been used as a proxy sample for the Siyanda baghouse dust.

The four (4) samples (three (3) samples of slag and one (1) sample of baghouse dust were submitted to an accredited laboratory for analysis of chemical substances likely to occur in the waste: metal ions and inorganic anions and that fulfilled the requirements of the waste assessment. The samples were assessed in terms of GN R. 635 to determine the waste type and in terms of GN R. 636 to establish the landfill class (liner requirements). Results of the assessment are presented in the table below.

| Sample ID | Waste Type | Reason for Classification | Landfill Class |
|---|---|---|---|
| SLAG Tap 42 | Type 3 | Total Concentrations: As, Ba, Ni, F | Class C |
| SLAG Tap 75 | Type 3 | Total Concentrations: Ba, Ni | Class C |
| SLAG Tap 82 | Type 3 | Total Concentrations: Ba, Ni | Class C |
| Mogale DC Baghouse | Type 1 | Total Concentrations: Zn | Class A |

The lining requirements for a Class C and Class A disposal facility are as follows:

<table>
<tr>
<td>
</td>
<td>
</td>
</tr>
<tr>
<td>Class C: Slag</td>
<td>Class A: Baghouse Dust</td>
</tr>
</table>

The results are considered acceptable for the purpose of this level of assessment and there is no reason not to proceed with the project provided that the waste facility design, as determined by this assessment and any impact mitigation measures, as determined by the water specialists, are implemented.

# WASTE ASSESSMENT
# SIYANDA FERROCHROME PROJECT

## CONTENTS



## LIST OF FIGURES



## LIST OF TABLES



## LIST OF APPENDICES

# ACRONYMS AND ABBREVIATIONS

Below a list of acronyms and abbreviations used in this report.

| Acronyms / Abbreviations | Definition |
|---|---|
| EIA | Environmental Impact Assessment |
| EMPr | Environmental Management Programme |
| DEA | Department of Environmental Affairs |
| DWS | Department of Water and Sanitation |
| IAP | Interested and affected Parties |
| LC | Leachable Concentrations |
| LCT | Leachable Concentrations Threshold |
| MPRDA | Mineral & Petroleum Resources Development Act |
| NEM:WA | National Environmental Management: Waste Act |
| SANS | South African National Standards |
| TC | Total Concentration |
| TCT | Total Concentration Threshold |
| TSF | Tailings Storage Facility |
| WCMR | Waste Classification and Management Regulations |

**NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA) REGULATIONS (2014) APPENDIX 6: SPECIALIST REPORTING REQUIREMENTS CHECKLIST**

Below is a checklist showing information required by specialists in terms of Appendix 6 of NEMA

| Item | NEMA Regulations (2014): Appendix 6 | Relevant Section in Report |
|---|---|---|
| 1(a)(i) | Details of the specialist who prepared the report | Section 7, Page 11<br>Appendix A |
| 1(a)(ii) | The expertise of that person to compile a specialist report including a curriculum vitae | Appendix A |
| 1(b | A declaration that the person is independent in a form as may be specified by the competent authority | Section 7, Page 11 |
| 1(c) | An indication of the scope of, and the purpose for which, the report was prepared | Section 1.2,Page 1 |
| 1(d) | The date and season of the site investigation and the relevance of the season to the outcome of the assessment | N/A |
| 1(e) | A description of the methodology adopted in preparing the report or carrying out the specialised process | Section 2, Page 2 |
| 1(f) | The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure | N/A |
| 1(g) | An identification of any areas to be avoided, including buffers | N/A |
| 1(h) | A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | N/A |
| 1(i) | A description of any assumptions made and any uncertainties or gaps in knowledge; | Section 6, Page 11 |
| 1(j) | A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment | Section 4, Page 8 |
| 1(k) | Any mitigation measures for inclusion in the EMPr | N/A |
| 1(l) | Any conditions for inclusion in the environmental authorisation | N/A |
| 1(m) | Any monitoring requirements for inclusion in the EMPr or environmental authorisation | N/A |
| 1(n)(i) | A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and | Section 5, Page 10 |
| 1(n)(ii) | If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan | N/A |
| 1(o) | A description of any consultation process that was undertaken during the course of carrying out the study | Section 2.3, Page 3 |
| 1(p) | A summary and copies if any comments that were received during any consultation process | Section 2.3, Page 3 |
| 1(q) | Any other information requested by the competent authority. | Section 2.3, Page 3 |

# WASTE ASSESSMENT
# SIYANDA FERROCHROME PROJECT

## 1 INTRODUCTION

SLR Consulting (Africa) (Pty) Limited ("SLR") has been appointed by Siyanda Chrome Smelting Company (Pty) Ltd ("SCSC") to undertake an assessment of waste material for the proposed Siyanda Chrome Smelter, in terms of relevant waste legislation.

### 1.1 LEGISLATION

The Department of Environmental Affairs (DEA) has revised the South African waste assessment system under the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEMWA). The Waste Classification and Management Regulations (WCMR) (GN R. 634 of 2013) were published in August 2013 and set out the requirements for the assessment of waste for disposal. The WCMR references the following Norms and Standards with regards to waste assessment:

- National Norms and Standards for the assessment of waste for landfill disposal (GN R.635 of 2013); and
- National Norms and Standards for disposal of waste to landfill (GN R. 636 of 2013).

### 1.2 OBJECTIVES

The objectives of this assessment are:

- To determine the 'waste type' of waste material in terms of GN R.635 of 2013
- To determine the 'landfill class', and thus, liner specifications for the waste material un terms of GN R.636 of 2013.

### 1.3 REPORT STRUCTURE

The report has been divided accordingly:

- Section 2 summarises the assessment approach.
- Section 3 details the sampling and analysis.
- Section 4 presents the results of the assessment.
- Section 5 concludes the assessment.
- Section 6 presents the limitations and assumptions of the assessment.

# 2 ASSESSMENT APPROACH

This section presents a description of the approach taken in order Siyanda Waste material in term of the Waste Classification and Management Regulations (WCMR).

## 2.1 IN ACCORDANCE WITH GN R. 635 OF 2013

In terms of Regulation 8 (1)(a) of the Waste Classification and Management Regulations (WCMR), waste generators must ensure that their waste is assessed in accordance with the Norms and Standards for Assessment of Waste for Landfill Disposal (GN R. 635) prior to the disposal of the waste to landfill.

### 2.1.1 TOTAL CONCENTRATIONS

The Total Concentration (TC) of chemical substances specified in Section 6 of GN R. 635 that are known to occur, likely to occur or can reasonably be expected to occur must be determined. The TC of the chemical substances is compared to the total concentration threshold (TCT) limits specified in Section 6 of GN R. 635.

### 2.1.2 LEACHABLE CONCENTRATIONS

The Leachable Concentrations (LC) of the chemical substances must be determined and compared to the leachable concentration threshold (LCT) limits specified in Section 6 of GN R. 635.

### 2.1.3 ASSESSMENT

The TC and LC limits of elements and chemical substances in the waste material exceeding the corresponding TCT and LCT limits will determine the specific waste type according to Section 7 of GN R. 635. Figure 2-1 presents a flow diagram of the general process to be followed to determine the waste type.

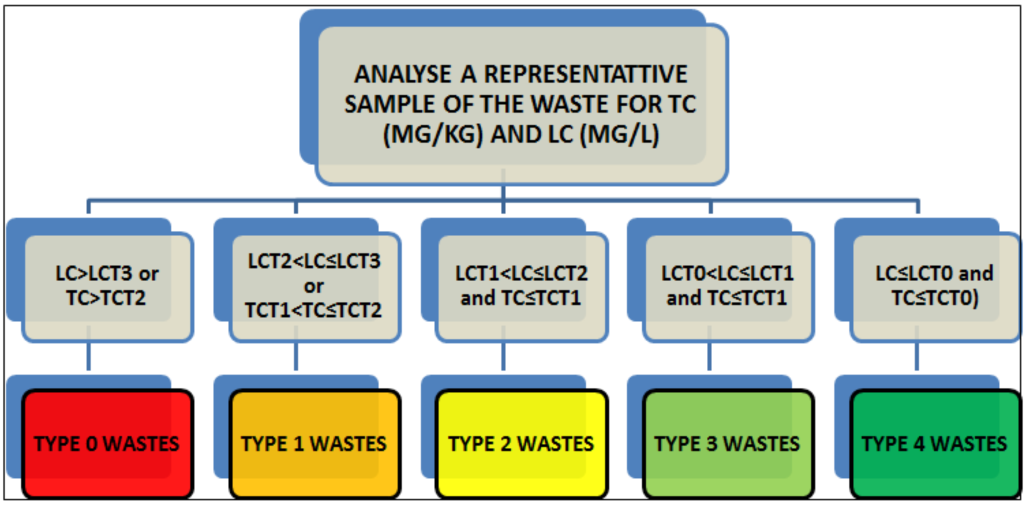



**FIGURE 2-1: FLOW DIAGRAM FOR ASSESSING WASTE IN TERMS OF GN R. 635 OF 2013**

## 2.2 IN ACCORDANCE WITH GN R. 636 OF 2013

In terms of Regulation 8 (1)(b) of the WCMR, waste generators must ensure that the disposal of their waste to landfill is done in accordance with the Norms and Standards for Disposal of Waste to Landfill (GN R. 636).

GN R. 636 sets out the landfill classification (Class A to D) and containment barrier design for each waste type as determined by the waste assessment in accordance with GN R. 635. These are presented in Table 2-1 below.

Section 3(2)(d) of GN R. 636 sets out the alternative elements of proven equivalent performance which can be considered when applying for a waste management licence for a disposal site.

## 2.3 CONSULTATION PROCESS

As part of the Environmental Impact Assessment (EIA) Scoping process, regulatory authorities and Interested and Affected Parties (IAPs) were consulted. Table 2-2 below presents the issued raised with respect to the waste assessment.

**TABLE 2-1: LANDFILL DISPOSAL REQUIREMENTS DETAILED IN THE NATIONAL NORMS AND STANDARDS FOR DISPOSAL OF WASTE TO LANDFILL (GN R. 636).**

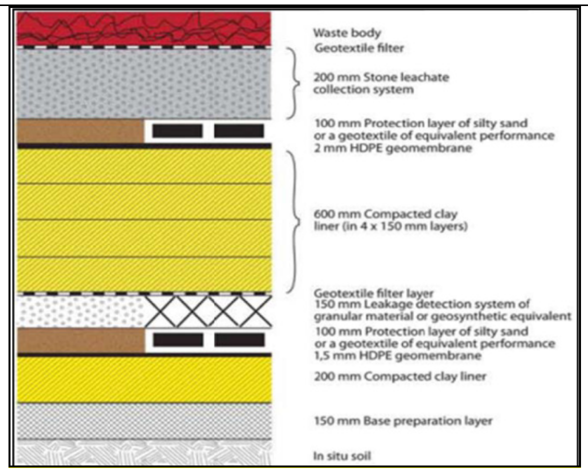
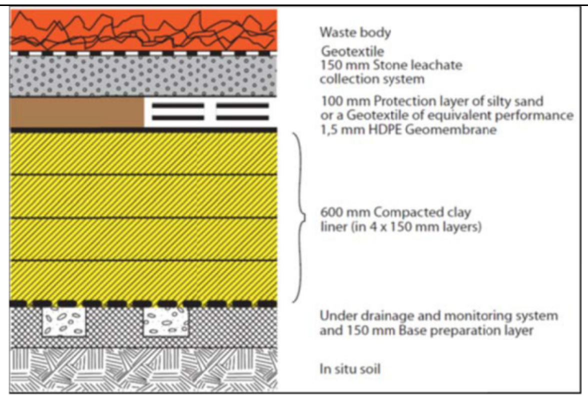
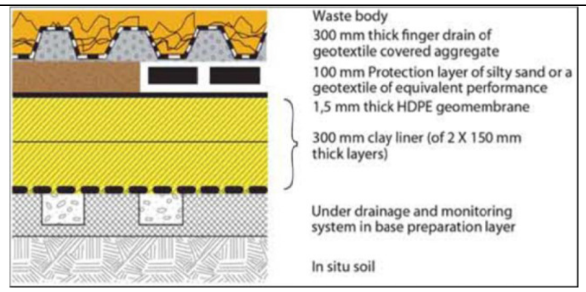
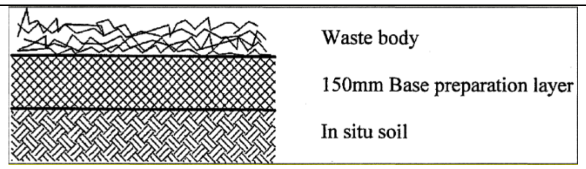
| Waste Type | Listed Wastes | Landfill Disposal requirements | Landfill Design specifications |
|---|---|---|---|
| Type 0 | None | The disposal of Type 0 waste is not allowed to landfill. These wastes must be treated before being reassessed for landfill disposal. | n/a |
| Type 1 | NA | Type 1 waste may only be disposed of at a Class A Landfill. |  |
| Type 2 | Domestic Waste.<br>Business waste not containing hazardous waste or hazardous chemicals.<br>Non-infectious animal carcasses.<br>Garden Waste. | Type 2 waste may only be disposed of at a Class B Landfill. |  |
| Type 3 | Post-consumer packaging.<br>Waste tyres. | Type 3 waste may only be disposed of at a Class C Landfill |  |
| Type 4 | Building and demolition waste not containing hazardous waste or hazardous chemicals.<br>Excavated earth material not containing hazardous waste or hazardous chemicals. | Type 4 waste may only be disposed of at a Class D Landfill |  |

**TABLE 2-2: ISSUES RAISED BY REGULATORY AUTHORITIES AND IAPS AS PART OF THE SCOPING PROCESS**

| Issue Raised | By Whom and When | Response given by Project Team | Section of Report in which issue is raised |
|---|---|---|---|
| Our civil design team will be reviewing the proposed slag dump design and I emphasize the importance of a liner in accordance with the new regulations | Comments raided by Makahane Rudzani (DES) at the authority site visit – meting, Swartklip Rec Centre, 23rd July 2015 | The Engineering design for the mineralised waste facilities will form part of the EIA which will be submitted for your departments review | Section 4.1, Page 8 |
| 1. Two separate facilities should be developed for the disposal of slag and baghouse dust, respectively.<br>A key related motivator for waste separation is that by having separate waste streams one can maximise the possibilities for using/selling/reprocessing the materials and limiting disposal to land. In the case where disposal is unavoidable, there is a greater likelihood of recovering the material later if it is not mixed or contaminated.<br>In this regard, the first cell of the baghouse dust facility would be designed with a Class A liner (Type 1 waste) and the first cell of the slag dump facility would be designed with a Class C liner (Type 3 waste).<br>Should test work on the project specific material result in a more favourable waste type determination then the remaining part of the facilities could be built according to reduced barrier system requirements. Of the three options, this option carries the least permitting risk.<br><br>2. If waste must be co-disposed then the first cell should have a Class A liner catering for a Type 1 waste. Should test work on the project specific material result in a more favourable waste type determination then the remaining part of the facility could be built according to reduced barrier system requirements. Co-disposal may however limit the options available for re-using, selling, and/or reprocessing.<br><br>3. A motivation can be submitted to co-dispose the waste onto a single mineralised waste facility with a Class C liner system catering for a Type 3 waste. Of the three options, this option carries the most permitting risks because it requires the regulators to accept a risk based discussion that considers the waste disposal ratios, potential for leachate, potential for water contamination, and all associated mitigation and management measures. Moreover, should test work on the project specific material result in a less favourable waste type determination then the remaining part of the facility would have to be built according to a higher level of barrier system and there would be a question about the first cell being under-designed and inadequate. This poses additional risk management issues that would have to be detailed in scenario specific plans as part of the EIA submission.<br><br>It should be noted that although the DEA can provide input and advise on the EIA related submission, the ultimate decision on the liner/barrier system design would be made by DWS. | Comment by Zama Mtembu, meeting held with DEA Waste Directorate, 14th April 2016 | It is understood that in the interest of ensuring the greatest possible opportunity for re-using / recycling waste, waste types should be kept separate and ideally, co-disposal should not be considered further. It is also understood that by SLR that this carries the least permitting risk. In this regard, waste types will be kept separate and the design work will be undertaken in support of two different facilities | Section 4, Page 8 |

# 3 SAMPLING AND ANALYSIS

The following section describes how samples were generated and the methods undertaken to characterise the waste material.

## 3.1 PROCESS OVERVIEW AND WASTE PROCESS

At this stage in project planning, it is expected that incoming chrome concentrate material will be sourced from Union Section (Swartklip) mine and possibly also from other mines in the region.

Two (2) waste types will be generated through the ferrochrome process; a slag and a baghouse dust (BHD). It is proposed that the wastes will be disposed of in two (2) separate facilities. The slag will be disposed of in molten form and the baghouse dust will be disposed of in a wetted slurry form in a slurry storage facility or within permeable bags in a tradition tailings storage facility (TSF) type facility.

## 3.2 SAMPLE GENERATION

Samples of slag and baghouse have been provided for testing and described in the following sections.

### 3.2.1 SLAG

MINTEK developed a pilot plant which consisted of a furnace operated in a batch-wise fashion with a pre-determined amount of feed material being fed into the furnace followed by a furnace tap. Tapping of the furnace entails opening of the slag taphole to let the slag out (this slag is collected in ladles and generally slow-cooled). The slag tap is followed by a metal tap where the metal produced is tapped out of the furnace through a dedicated taphole, into refractory-lined ladles. During February 2015, MINTEK provided SLR with three slag samples as follows:

- Tap 42 was generated during the condition smelting the low grade chromite with 13% limestone addition and no silica.
- Tap 75 was generated during smelting of the low grade chromite with a 5% limestone addition.
- Tap 82 was generated during fluxless smelting of the low grade chromite (0% flux).

The three (3) slag samples were submitted to an accredited laboratory for analysis.

Slag samples tested as part of this assessment are considered to be a good indication of what the actual slag will be.

### 3.2.2 BAGHOUSE DUST

A baghouse dust sample was obtained from Mogale Alloys (“Mogale”) during November 2015. The company on-site smelter is located in Krugersdorp on the West Rand.

The raw material/ore processed at Mogale is not specific to Siyanda, although is similar in that both Mogale and Siyanda's source of incoming chrome concentrate access ore from the BIC. The smelter process is fully representative of the Siyanda smelter. Therefore, the sample referred to in this report as "Mogale DC Baghouse" has been used as a proxy for Siyanda baghouse dust and is assumed to be indicative of the actual baghouse dust.

### 3.3 LABORATORY ANALYSIS

The three (3) slag samples and the Mogale DC Baghouse sample were submitted to Waterlab Laboratory, for analysis. Analysis was undertaken separately on each sample.

In terms of GN R 635, the total concentrations of chemical substances specified in Section 6 of the Norms and Standards that are *known to occur, likely to occur or can reasonably be expected to occur in the waste* must be determined. For the Siyanda samples, it was considered appropriate to test for metal ions and inorganic anions only. Organics and pesticides are unlikely to occur in this material.

Based on the above, the following laboratory analysis was undertaken:

- Aqua Regia Digestion to determine the "total concentration" (TC), i.e. total elements in sample material.
- Leach tests to determine the "leachable concentrations" (LC) in the sample material.

Section 5(2) of GN.R 635, indicates the type of leaching fluid that should be used in the leaching procedure. The type of leaching fluid depends on whether the waste being assessed will be disposed of with, or contains putrescible[1] wastes, or will be disposed of with non-putrescible waste, or will be disposed of with no other wastes. Reagent water was considered appropriate for the Siyanda samples.

[1] Solid waste that contains organic matter capable of being decomposed by microorganisms.

# 4 RESULTS

This section presents the results of the laboratory test work and the outcome of the waste assessment.

## 4.1 DETERMINING WASTE TYPE

The full results tables for the four (4) samples are presented in Appendix B. Laboratory certificates are presented in Appendix C.

The waste types for each sample, determined through the waste assessment as described in Section 2 are presented in Table 4-1 below.

**TABLE 4-1: WASTE TYPES DETERMINED FOR THE SIYANDA SAMPLES**

| Sample ID | Waste Type | Reason for Classification |
|---|---|---|
| SLAG Tap 42 | Type 3 | Total Concentrations: As, Ba, Ni, F |
| SLAG Tap 75 | Type 3 | Total Concentrations: Ba, Ni |
| SLAG Tap 82 | Type 3 | Total Concentrations: Ba, Ni |
| Mogale DC Baghouse | Type 1 | Total Concentrations: Zn |

## 4.2 DETERMINING LANDFILL CLASS (LINER REQUIREMENTS)

The three (3) slag samples have been classified as **Waste Type 3** and therefore require disposal to a facility with **Class C lining**. Figure 4-1 depicts the prescribed liner requirement associated with a Class C disposal facility.

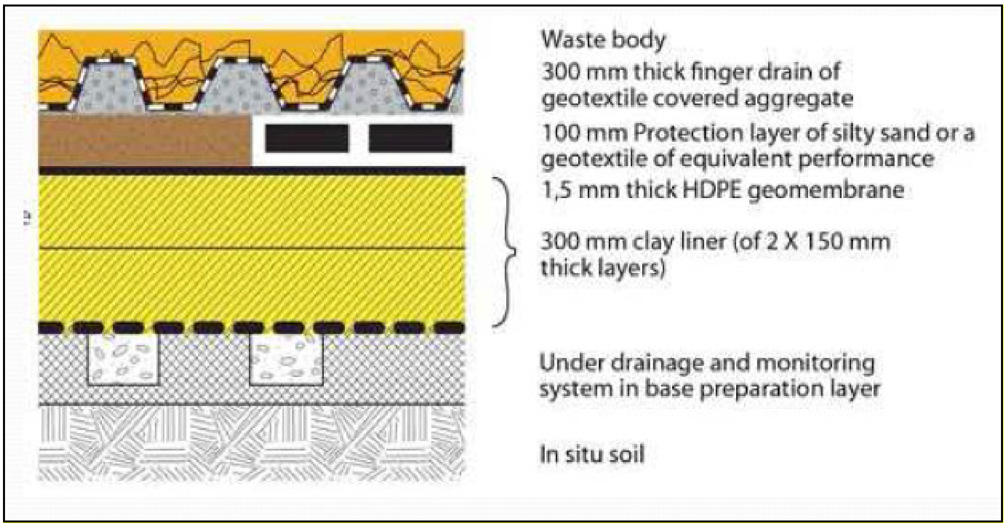



**FIGURE 4-1: CLASS C PRESCRIBED LINING REQUIREMENTS**

The Mogale DC Baghouse sample has been classified as **Waste Type 1** and therefore require disposal to a facility with **Class A lining**. Figure 4-2 depicts the prescribed liner requirement associated with a Class A disposal facility.

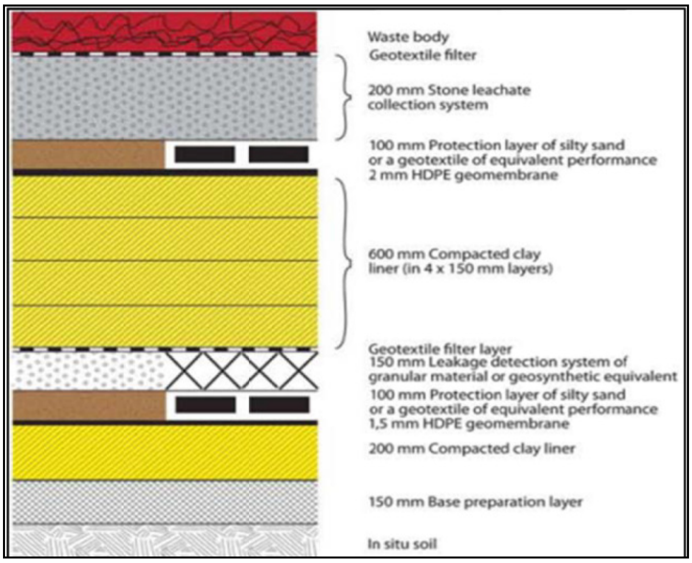



**FIGURE 4-2 CLASS A PRESCRIBED LINING REQUIREMENTS**

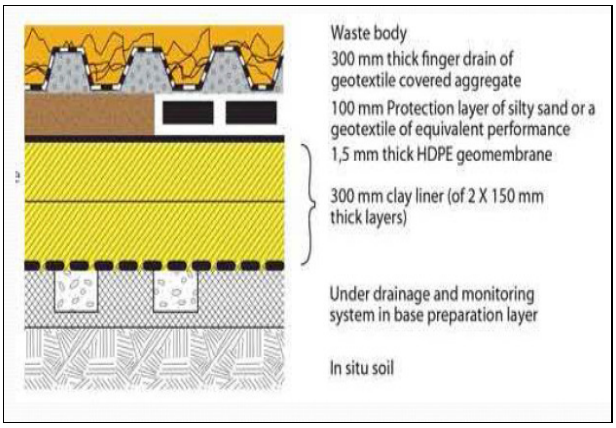
# 5 CONCLUSIONS

A waste type assessment has been undertaken in terms of the National Norms and Standards: for the assessment of waste for landfill disposal (GN R.635 of 2013) and for disposal of waste to landfill (GN R. 636 of 2013) in accordance with the WCMR made under the National Environmental Management: Waste Act, 2008 (Act 59 of 2008).

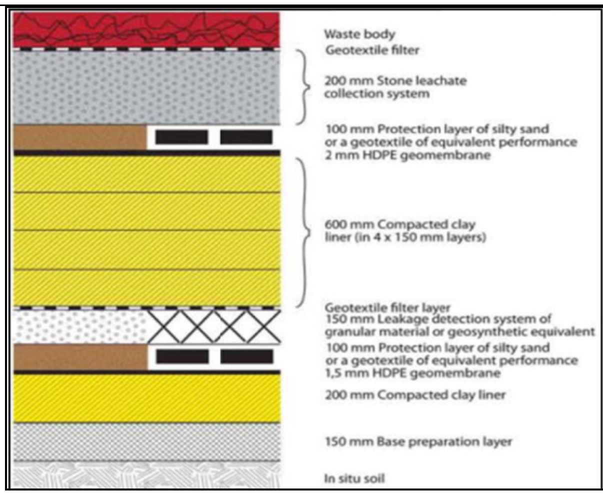
Three (3) slag samples were generated from a pilot plant. A separate baghouse dust sample was provided from a similar, operational smelter facility, referred to as Mogale DC Baghouse. All samples were submitted to an accredited laboratory for analysis of chemical substances likely to occur in the waste: metal ions and inorganic anions.

The samples were assessed in terms of GN R. 635 to determine the waste type and in terms of GN R. 636 to establish the landfill class (liner requirements). Results of the assessment are presented in the table below.

| Sample ID | Waste Type | Reason for Classification | Landfill Class |
|---|---|---|---|
| SLAG Tap 42 | Type 3 | Total Concentrations: As, Ba, Ni, F | Class C |
| SLAG Tap 75 | Type 3 | Total Concentrations: Ba, Ni | Class C |
| SLAG Tap 82 | Type 3 | Total Concentrations: Ba, Ni | Class C |
| Mogale DC Baghouse | Type 1 | Total Concentrations: Zn | Class A |




**Class C: Slag**




**Class A: Baghouse Dust**

The results are considered acceptable for the purpose of this level of assessment and there is no reason not to proceed with the project provided that the waste facility design, as determined by this assessment and any impact mitigation measures, as determined by the water specialists, are implemented.

## 6 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations are applicable to this geochemical assessment:

- Baghouse dust sample (from similar smelter operation) tested as part of this assessment is considered to be a proxy sample which gives a good indication of the expected waste characteristics.
- Slag samples from the project specific pilot plant are assumed to represent the actual slag

## 7 DECLARATION OF INDEPENDENCE

I, *Jenny Ellerton* hereby declare that *SLR Consulting (Africa) (Pty) Limited*, an independent consulting firm, has no interest or personal gains in this project whatsoever, except receiving fair payment for rendering an independent professional service.

Consultant name: Jenny Ellerton

Signature:

Date: September 2016

| | | |
|---|---|---|
| **Jenny Ellerton** | **Caitlin Hird** | **Terry Harck** |
| **(Report Author)** | **(Project Manager)** | **(Project Reviewer)** |

**APPENDIX A: CURRICULUM VITAE OF PROJECT TEAM**

**Jenny Ellerton**
Senior Hydrogeologist / Geochemist

**Curriculum Vitae**

## Qualifications

| | | |
|---|---|---|
| MSc | 2005 | Hydrogeology – University of Birmingham |
| BSc (Hons) | 2002 | Geology and Physical Geography Dual Honours - Keele University (Upper Second) |
| FGS | Since 2006 | Fellow of the Geological Society |

## Key Areas of Expertise

Jenny has **10 years** of professional experience gained in both the UK and South Africa. Key areas of Jenny's expertise are summarised below

| | |
|---|---|
| Groundwater Assessments | Groundwater Assessments – to support environmental impact assessments, water use licence applications and engineering design. |
| Hydrogeological Site Investigation | Supervising drilling contractors for numerous types of site investigations and undertaking aquifer tests. |
| Environmental Monitoring | Groundwater, surface water, leachate & gas monitoring. |
| Development of Conceptual Site Models | Analysis & interpretation of geological and hydrogeological information. |
| Acid Rock Drainage Assessments | Geochemical assessment and remediation of mine related water pollution. |
| Project Management | Experience in management of field based hydrogeological studies and desk based projects. |

## Summary of Experience and Capability

Jenny is a Senior Hydrogeologist within SLR with 10 years of geological and hydrogeological experience gained through a master's degree and environmental consultancy both in the UK and South Africa.

Jenny has undertaken projects covering all aspects of hydrogeology and specialises in the following:

- Site investigation, including the installation of groundwater and gas monitoring boreholes and the detailed logging of soil and rock samples.
- Undertaking monitoring and sampling of surface water, groundwater, landfill gas and leachate and undertaking field permeability tests and data analysis.
- Qualitative and quantitative Hydrogeological Risk Assessments.
- Groundwater assessments for Environmental Statements in support of planning applications for mineral extraction operations, landfill developments, and other industrial and commercial developments.

- Geochemical and Acid Rock Drainage (ARD) assessments to characterise the expected waste rock material associated with the mineral extraction process of various types of mining operations in accordance with best practice.
- Waste classification in terms of the National Norms and Standards for the Assessment of Waste for Landfill Disposal (No. R. 635) and Disposal of Waste to Landfill (No. R 636).
- Soil contamination assessment to determine the level of soil contamination in terms of soil screening values as presented in National Norms and Standards for the Remediation of Contaminated land and Soil Quality.

**Recent Project Experience**

Key aspects of Jenny's recent project experience are summarised below.

| Project | Date | Jenny's Role |
|---|---|---|
| Siyanda Chrome Smelter Project (South Africa) | Current | Responsible for managing and co-ordinating the groundwater and geochemical studies. Work includes geophysical investigations, drilling and pump testing, collection of samples, development of a conceptual site model and source term and a numerical groundwater model to assess the potential impact of the site on surrounding water resources. |
| Kudumane Manganese Project (South Africa) | Current | Responsible for co-ordinated drilling to drill boreholes within the riverbed of the Ga-mogara River and to undertake an study to understand the groundwater / surface water interaction at the site in support of the Water Use License Application. |
| Manica Gold Project (Mozambique) | Current | Involved in both the groundwater and geochemical assessments for the project in support of the Environmental Impact Assessment for the Project. |
| Lofdal REE Project (Namibia) | Current | Responsible for the selection of representative waste samples for geochemical characterisation and undertaking an assessment of the potential for acid mine drainage (AMD) and metal leaching in support of an Environmental and Social Impact Assessment (ESIA). |
| Panda Hill Gold Project (Tanzania) | Current | Geochemical assessment to support engineering design work and assess potential impact on groundwater. Work included geochemical modelling and development of a salt balance. |
| Mokala Manganese Project (South Africa) | September 2015 | Waste assessment in terms of the National Norms and Standards to determine the waste type and the class of landfill (liner specification) required to dispose of mining waste. |
| Alfred Knight Due Diligence Project (South Africa) | August 2014 | Responsible for the selection of samples, sample analysis and interpretation of results in terms of the National Norms and Standards for the Remediation of Contaminated land and Soil Quality to determine 'baseline' condition of the soil. |
| Hinda Phosphate Project (Congo) | September 2013 | Responsible for co-ordination and undertaking the supervision of the drilling of boreholes and pumping tests. Interpretation of field data and reporting. |

**Publications**

None to date

Terry Harck
Solution[H+]
PO Box 39546, Moreleta Park 0044
+27 83 521 3711
terry.harck@solutionhplus.com www.solutionhplus.com

## PROFESSIONAL PROFILE

Environmental Geochemist. Mine drainage quality prediction. Acid Mine Drainage (AMD) assessment. Mine water management. Integration of geochemistry, groundwater and surface water studies.

## BIOGRAPHY

Terry advises Southern African and international clients on the management of acid rock drainage and contaminated seepage at mine sites. He has been practicing as a consultant for over 20 years. He was the manager and lead consultant of a team of 11 specialists before going solo as Solution[H+].

Terry is a member of the International Mine Water Association (IMWA), the Groundwater Division of the Geological Society of South Africa (GWD-GSSA), and the South African chapter of the International Association of Hydrogeologists (IAH-SA), for which he serves as Treasurer.

## PROFESSIONAL EXPERIENCE

Solution[H+], Pretoria, South Africa
Principal Consultant — February 2012 – present
Environmental Geochemist

Golder Associates Africa, Johannesburg, South Africa
Senior Geochemist and Divisional Leader — May 2004 – February 2012
Specialist impact prediction studies with special reference to the geochemistry and groundwater aspects of mining impacts. Integration of hydrogeological and geochemical aspects of contamination assessment projects for the mining and related industries.

Responsible for 10 professionals: internal coordination, marketing, developing proposals, project management, commissioning specialists, report development, client liaison and budget management.

Coffey Geosciences, Sydney, Australia
Senior Geoscientist — July 1997 – December 2003
Led a business unit comprising four employees. Project managed mine environmental specialist studies. Business development. Internal auditor for office Quality Management System

Wates, Meiring and Barnard, Johannesburg, South Africa
Contaminant Geohydrologist/Geochemist — July 1996 – June 1997
Specialist hydrogeological and geochemical studies for mining and industrial clients.

Steffen, Robertson and Kirsten, Johannesburg, South Africa
Contaminant Hydrogeologist/Geochemist — May 1995 – June 1996
Specialist hydrogeological and geochemical studies for mining and industrial clients.

E Martinelli and Associates, Johannesburg, South Africa
Geologist — January 1991 – December 1993
Geophysical surveys, contractor supervision, groundwater development work.

## EDUCATION

University of Cape Town, Cape Town, South Africa
M.Sc. in Environmental Geochemistry 1995
Thesis: "A Geochemical Investigation of the Aquatic Sediments, Groundwater and Surface water of the Verlorenvlei Coastal Lake, With Special Reference to Nitrate Transformations."

University of the Witwatersrand, Johannesburg, South Africa
M.Sc. in Geology 1994
Thesis: "Depositional Systems and Syndepositional Tectonics of the Basal Griqualand West Sequence, Northern Cape"

University of the Witwatersrand, Johannesburg, South Africa
B.Sc. Honours in Geology 1987

## PUBLICATIONS AND PAPERS

Pretorius JA, Harck T, and Gunther P "Brine Disposal / Storage of Brine in Underground Mining Compartments – A Case Study" Solution Mining Research Institute (SMRI) Fall 2011 Conference, 2-5 October 2011, York, UK.

T Harck "Mobilisation of salts from mine waste. A pinch or a pound?" Symposium of the International Mine Water Association. September 2010, Sydney, Nova Scotia

T Harck and M Peters "Reprocessing Kimberlite tailings: A square contaminant source in a big hole?" 11th International Mine Water Association Congress. October 2009, Pretoria, South Africa

T Harck et al "Impact prediction of the reactivation of an unused tailings dam," 11th International Mine Water Association Congress. October 2009, Pretoria, South Africa

Ochieng L, Harck T, and Peters M "Net Neutralisation Potential NNP) in Kimberley Diamond Tailings and Slimes Waste Materials" 11th International Mine Water Association Congress. October 2009, Pretoria, South Africa

T Harck "Managing the Groundwater Impact of Mine Water Treatment Waste", 10th International Mine Water Association Congress. June 2008, Karlovy Vary, Czech Republic.

T Harck "Are biodiversity offsets a licence to plunder natural resources?", IAIAsa Newsletter. August 2005, South Africa.

T Harck "Old mines yield history", Australian Geographic. July – September 2002, Australia

T Harck, Willis JP, and Fey MV "Denitrification of nitrate-rich ground water entering Verlorenvlei Lake on the west coast of South Africa" Proceedings of the 4th International symposium on Environmental Geochemistry, Oct. 5-10 1997, Vail, CO, United States

T Harck "Identification and Characterisation of a Source of Contaminated Seepage", Young Water, Environmental & Geotechnical Engineers Conference, July 1996, KwaZulu Natal, South Africa.

## PRESENTATIONS AND TEACHING

University of Pretoria, Pretoria, South Africa 2012-2014
Volunteer lecturer: "Environmental Geochemistry" GTX715

Principles of low temperature geochemistry, geochemistry and origin of acid mine water, acid-mineral reactions; industrial effluents, remediation methods, waste disposal, environmental sampling and data analysis, geochemical modelling.

North West University, Potchefstroom, South Africa 2012-2013
Extraordinary lecturer

Presented course "An introduction to Hydrogeochemistry". This included themes such as: Chemical equilibrium, Contents of Water, and Solids and water. Topics included: equilibrium constants, pH, pe, solubility, dissolved gases, alkalinity, speciation, redox reactions, ion exchange, colloids, sulphide mineral oxidation and introduction to the PHREEQC geochemical modelling code.
Supervised honours degree student during their honours project fieldwork and write-up

Golder Associates, Johannesburg, South Africa 2012-2014
Facilitator: "Understanding and Applying Best Practice Management of Acid Rock Drainage"

Developed syllabus and course structure, and coordinated the course

Golder Associates, Johannesburg, South Africa 2011
Facilitator: "Technical Writing"

Co-presented training material developed in-house

Department of Water Affairs and Forestry and Water Institute of South Africa – Mine Water Division 2008-2010
Presenter: "The value of impact prediction from case studies." Second Symposium on Best Practice Guidelines"

Three geochemical prediction studies from project experience

Geological Society of South Africa – Ground Water Division 11-12 February 2009
Presenter: "Re-evaluation of Cr(VI) Contamination After Remediation"

Case study not included in the conference proceedings

International Association for Impact Assessment – South African chapter (IAIAsa) October 2007
Presenter: "Does the new Mining Act further sustainability in the mining industry?"

Discussion paper not included in the conference proceedings

University of Cape Town, Cape Town, South Africa October 2005
Tutor

Teaching support for laboratory sessions

**APPENDIX B: TABLE OF RESULTS**

**Siyanda**
**Waste Classification**
**Lab Sample No** 73
**Sample No** SLAG Tap 42

| Element & Chemical Substances in Waste according to GNR. 635 | Total Concentration Threshold (TCT) Limits according to GNR. 635 | | | Leachable Concentration Threshold (TCT) Limits according to GNR. 635 | | | | Waste Types According to GNR. 635 | | | | | Sample Analysis Results | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TCT0 | TCT1 | TCT2 | LCT0 | LCT1 | LCT2 | LCT3 | Type 0 | Type 1 | Type 2 | Type 3 | Type 4 | Total Concentration (TC) | Leachable Concentration (LC) |
| | mg/kg | mg/kg | mg/kg | mg/l | mg/l | mg/l | mg/l | LC>LCT3 or TC>TCT2 | LCT2 <LC≤LCT3 or TCT1<TC≤TCT2 | LCT1<LC≤LCT2 and TC≤TCT1 | LCT0<LC≤LCT1 and TC≤TCT1 | LC≤LCT0 and TC≤TCT0 | mg/kg | mg/l |
| ***Metal Ions*** | | | | | | | | | | | | | | |
| As, Arsenic | 5.8 | 500 | 2 000 | 0.01 | 0.5 | 1 | 4 | - | - | - | Type 3 | - | **7.00** | 0.005 |
| B, Boron | 150 | 15 000 | 60 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 18.63 | 0.005 |
| Ba, Barium | 62.5 | 6 250 | 25 000 | 0.7 | 35 | 70 | 280 | - | - | - | Type 3 | - | **81.00** | 0.025 |
| Cd, Cadmium | 7.5 | 260 | 1 040 | 0.003 | 0.15 | 0.3 | 1.2 | - | - | - | Type 3 | - | 2.00 | **0.005** |
| Co, Cobalt | 50 | 5 000 | 20 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 12.00 | 0.005 |
| Cr Total, Chromium Total | 46 000 | 800 000 | N/A | 0.1 | 5 | 10 | 40 | - | - | - | - | Type 4 | 1134.87 | 0.005 |
| Cr (VI), Chromium (VI) | 6.5 | 500 | 2 000 | 0.05 | 2.5 | 5 | 20 | - | - | - | - | Type 4 | 2.50 | 0.005 |
| Cu, Copper | 16 | 19 500 | 78000 | 2 | 100 | 200 | 800 | - | - | - | - | Type 4 | 5.64 | 0.005 |
| Hg, Mercury | 0.93 | 160 | 640 | 0.006 | 0.3 | 0.6 | 2.4 | - | - | - | - | Type 4 | 0.00 | 0.0005 |
| Mn, Manganese | 1000 | 25 000 | 100 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 918.89 | 0.005 |
| Mo, Molybdenum | 40 | 1 000 | 4 000 | 0.07 | 3.5 | 7 | 28 | - | - | - | - | Type 4 | 2.00 | 0.005 |
| Ni, Nickel | 91 | 10 600 | 42 400 | 0.07 | 3.5 | 7 | 28 | - | - | - | Type 3 | - | **183.85** | 0.005 |
| Pb, Lead | 20 | 1 900 | 7600 | 0.01 | 0.5 | 1 | 4 | - | - | - | - | Type 4 | 2.00 | 0.005 |
| Sb, Antimony | 10 | 75 | 300 | 0.02 | 1 | 2 | 8 | - | - | - | - | Type 4 | 2.00 | 0.005 |
| Se, Selenium | 10 | 50 | 200 | 0.01 | 0.5 | 1 | 4 | - | - | - | - | Type 4 | 2.00 | 0.005 |
| V, Vanadium | 150 | 2 680 | 10 720 | 0.2 | 10 | 20 | 80 | - | - | - | - | Type 4 | 14.03 | 0.005 |
| Zn, Zinc | 240 | 160 000 | 640000 | 5 | 250 | 500 | 2 000 | - | - | - | - | Type 4 | 11.73 | 0.005 |
| ***Inorganic Anions*** | | | | | | | | | | | | | | |
| TDS | NA | NA | NA | 1 000 | 12 500 | 25 000 | 100 000 | - | - | - | - | Type 4 | NA | 26 |
| Chloride | NA | NA | NA | 300 | 15 000 | 30 000 | 120 000 | - | - | - | - | Type 4 | NA | 6 |
| Sulphate | NA | NA | NA | 250 | 12 500 | 25 000 | 100 000 | - | - | - | - | Type 4 | NA | 2.5 |
| NO3 as N, Nitrate-N | NA | NA | NA | 11 | 550 | 1 100 | 4 400 | - | - | - | - | Type 4 | NA | 0.1 |
| F, Fluoride | 100 | 10 000 | 40 000 | 1.5 | 75 | 150 | 600 | - | - | - | Type 3 | - | **104** | 0.1 |
| CN (Total), Cyanide Total | 14 | 10 500 | 42 000 | 0.07 | 3.5 | 7 | 28 | - | - | - | - | Type 4 | 0.005 | 0.005 |

Note: Values on Red were below the detection limit. A value equal to half that detection limit has been taken
Note: Values in bold indicate exceedance

**Siyanda Samples**
**Waste Classification**
**Lab Sample No** 74
**Sample No** Slag Tap 75

| Element & Chemical Substances in Waste according to GNR. 635 | Total Concentration Threshold (TCT) Limits according to GNR. 635 | | | Leachable Concentration Threshold (TCT) Limits according to GNR. 635 | | | | Waste Types According to GNR. 635 | | | | | Sample Analysis Results | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TCT0 | TCT1 | TCT2 | LCT0 | LCT1 | LCT2 | LCT3 | Type 0 | Type 1 | Type 2 | Type 3 | Type 4 | Total Concentration (TC) | Leachable Concentration (LC) |
| | mg/kg | mg/kg | mg/kg | mg/l | mg/l | mg/l | mg/l | LC>LCT3 or TC>TCT2 | LCT2 <LC≤LCT3 or TCT1<TC≤TCT2 | LCT1<LC≤LCT2 and TC≤TCT1 | LCT0<LC≤LCT1 and TC≤TCT1 | LC≤LCT0 and TC≤TCT0 | mg/kg | mg/l |
| ***Metal Ions*** | | | | | | | | | | | | | | |
| As, Arsenic | 5.8 | 500 | 2 000 | 0.01 | 0.5 | 1 | 4 | - | - | - | - | Type 4 | 4.00 | 0.005 |
| B, Boron | 150 | 15 000 | 60 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 8.83 | 0.005 |
| Ba, Barium | 62.5 | 6 250 | 25 000 | 0.7 | 35 | 70 | 280 | - | - | - | Type 3 | - | **117** | 0.005 |
| Cd, Cadmium | 7.5 | 260 | 1 040 | 0.003 | 0.15 | 0.3 | 1.2 | - | - | - | Type 3 | - | 2 | **0.005** |
| Co, Cobalt | 50 | 5 000 | 20 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 13 | 0.005 |
| Cr Total, Chromium Total | 46 000 | 800 000 | N/A | 0.1 | 5 | 10 | 40 | - | - | - | - | Type 4 | 5200 | 0.005 |
| Cr (VI), Chromium (VI) | 6.5 | 500 | 2 000 | 0.05 | 2.5 | 5 | 20 | - | - | - | - | Type 4 | 2.5 | 0.005 |
| Cu, Copper | 16 | 19 500 | 78000 | 2 | 100 | 200 | 800 | - | - | - | - | Type 4 | 11 | 0.005 |
| Hg, Mercury | 0.93 | 160 | 640 | 0.006 | 0.3 | 0.6 | 2.4 | - | - | - | - | Type 4 | 0.0005 | 0.0005 |
| Mn, Manganese | 1000 | 25 000 | 100 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 771 | 0.059 |
| Mo, Molybdenum | 40 | 1 000 | 4 000 | 0.07 | 3.5 | 7 | 28 | - | - | - | - | Type 4 | 2 | 0.005 |
| Ni, Nickel | 91 | 10 600 | 42 400 | 0.07 | 3.5 | 7 | 28 | - | - | - | Type 3 | - | **244** | 0.005 |
| Pb, Lead | 20 | 1 900 | 7600 | 0.01 | 0.5 | 1 | 4 | - | - | - | - | Type 4 | 2 | 0.005 |
| Sb, Antimony | 10 | 75 | 300 | 0.02 | 1 | 2 | 8 | - | - | - | - | Type 4 | 2 | 0.005 |
| Se, Selenium | 10 | 50 | 200 | 0.01 | 0.5 | 1 | 4 | - | - | - | - | Type 4 | 2 | 0.005 |
| V, Vanadium | 150 | 2 680 | 10 720 | 0.2 | 10 | 20 | 80 | - | - | - | - | Type 4 | 16 | 0.005 |
| Zn, Zinc | 240 | 160 000 | 640000 | 5 | 250 | 500 | 2 000 | - | - | - | - | Type 4 | 2 | 0.005 |
| ***Inorganic Anions*** | | | | | | | | | | | | | | |
| TDS | NA | NA | NA | 1 000 | 12 500 | 25 000 | 100 000 | - | - | - | - | Type 4 | NA | 5 |
| Chloride | NA | NA | NA | 300 | 15 000 | 30 000 | 120 000 | - | - | - | - | Type 4 | NA | 2.5 |
| Sulphate | NA | NA | NA | 250 | 12 500 | 25 000 | 100 000 | - | - | - | - | Type 4 | NA | 2.5 |
| NO3 as N, Nitrate-N | NA | NA | NA | 11 | 550 | 1 100 | 4 400 | - | - | - | - | Type 4 | NA | 0.1 |
| F, Fluoride | 100 | 10 000 | 40 000 | 1.5 | 75 | 150 | 600 | - | - | - | - | Type 4 | 95.6 | 0.1 |
| CN (Total), Cyanide Total | 14 | 10 500 | 42 000 | 0.07 | 3.5 | 7 | 28 | - | - | - | - | Type 4 | 0.01 | 0.01 |

Note: Values on Red were below the detection limit. A value equal to half that detection limit has been taken
Note: Values in bold indicate exceedance

**Siyanda Samples**
**Waste Classification**
**Lab Sample No** 75
**Sample No** Slag Tap 82

| Element & Chemical Substances in Waste according to GNR. 635 | Total Concentration Threshold (TCT) Limits according to GNR. 635 | | | Leachable Concentration Threshold (TCT) Limits according to GNR. 635 | | | | Waste Types According to GNR. 635 | | | | | Sample Analysis Results | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TCT0 | TCT1 | TCT2 | LCT0 | LCT1 | LCT2 | LCT3 | Type 0 | Type 1 | Type 2 | Type 3 | Type 4 | Total Concentration (TC) | Leachable Concentration (LC) |
| | mg/kg | mg/kg | mg/kg | mg/l | mg/l | mg/l | mg/l | LC>LCT3 or TC>TCT2 | LCT2 <LC≤LCT3 or TCT1<TC≤TCT2 | LCT1<LC≤LCT2 and TC≤TCT1 | LCT0<LC≤LCT1 and TC≤TCT1 | LC≤LCT0 and TC≤TCT0 | mg/kg | mg/l |
| ***Metal Ions*** | | | | | | | | | | | | | | |
| As, Arsenic | 5.8 | 500 | 2 000 | 0.01 | 0.5 | 1 | 4 | - | - | - | - | Type 4 | 2.00 | 0.005 |
| B, Boron | 150 | 15 000 | 60 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 5.53 | 0.005 |
| Ba, Barium | 62.5 | 6 250 | 25 000 | 0.7 | 35 | 70 | 280 | - | - | - | Type 3 | - | **72** | 0.005 |
| Cd, Cadmium | 7.5 | 260 | 1 040 | 0.003 | 0.15 | 0.3 | 1.2 | - | - | - | Type 3 | - | 2.00 | **0.005** |
| Co, Cobalt | 50 | 5 000 | 20 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 23 | 0.005 |
| Cr Total, Chromium Total | 46 000 | 800 000 | N/A | 0.1 | 5 | 10 | 40 | - | - | - | - | Type 4 | 7200 | 0.005 |
| Cr (VI), Chromium (VI) | 6.5 | 500 | 2 000 | 0.05 | 2.5 | 5 | 20 | - | - | - | - | Type 4 | 6.3 | 0.005 |
| Cu, Copper | 16 | 19 500 | 78000 | 2 | 100 | 200 | 800 | - | - | - | - | Type 4 | 7.8 | 0.005 |
| Hg, Mercury | 0.93 | 160 | 640 | 0.006 | 0.3 | 0.6 | 2.4 | - | - | - | - | Type 4 | 0.0005 | 0.0005 |
| Mn, Manganese | 1000 | 25 000 | 100 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 521 | 0.005 |
| Mo, Molybdenum | 40 | 1 000 | 4 000 | 0.07 | 3.5 | 7 | 28 | - | - | - | - | Type 4 | 2.00 | 0.005 |
| Ni, Nickel | 91 | 10 600 | 42 400 | 0.07 | 3.5 | 7 | 28 | - | - | - | Type 3 | - | **357** | 0.005 |
| Pb, Lead | 20 | 1 900 | 7600 | 0.01 | 0.5 | 1 | 4 | - | - | - | - | Type 4 | 2.00 | 0.005 |
| Sb, Antimony | 10 | 75 | 300 | 0.02 | 1 | 2 | 8 | - | - | - | - | Type 4 | 2.00 | 0.005 |
| Se, Selenium | 10 | 50 | 200 | 0.01 | 0.5 | 1 | 4 | - | - | - | - | Type 4 | 4.48 | 0.005 |
| V, Vanadium | 150 | 2 680 | 10 720 | 0.2 | 10 | 20 | 80 | - | - | - | - | Type 4 | 31 | 0.005 |
| Zn, Zinc | 240 | 160 000 | 640000 | 5 | 250 | 500 | 2 000 | - | - | - | - | Type 4 | 23 | 0.012 |
| ***Inorganic Anions*** | | | | | | | | | | | | | | |
| TDS | NA | NA | NA | 1 000 | 12 500 | 25 000 | 100 000 | - | - | - | - | Type 4 | NA | 5.0 |
| Chloride | NA | NA | NA | 300 | 15 000 | 30 000 | 120 000 | - | - | - | - | Type 4 | NA | 2.5 |
| Sulphate | NA | NA | NA | 250 | 12 500 | 25 000 | 100 000 | - | - | - | - | Type 4 | NA | 2.5 |
| NO3 as N, Nitrate-N | NA | NA | NA | 11 | 550 | 1 100 | 4 400 | - | - | - | - | Type 4 | NA | 0.1 |
| F, Fluoride | 100 | 10 000 | 40 000 | 1.5 | 75 | 150 | 600 | - | - | - | - | Type 4 | 99.5 | 0.1 |
| CN (Total), Cyanide Total | 14 | 10 500 | 42 000 | 0.07 | 3.5 | 7 | 28 | - | - | - | - | Type 4 | 0.01 | 0.005 |

Note: Values on Red were below the detection limit. A value equal to half that detection limit has been taken
Note: Values in bold indicate exceedance

**Siyanda Samples**
**Waste Classification**
**Lab Sample No** **21156**
**Sample No** **Mogale DC Baghouse**

| Element & Chemical Substances in Waste according to GNR. 635 | Total Concentration Threshold (TCT) Limits according to GNR. 635 | | | Leachable Concentration Threshold (TCT) Limits according to GNR. 635 | | | | Waste Types According to GNR. 635 | | | | | Sample Analysis Results | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TCT0 | TCT1 | TCT2 | LCT0 | LCT1 | LCT2 | LCT3 | Type 0 | Type 1 | Type 2 | Type 3 | Type 4 | Total Concentration (TC) | Leachable Concentration (LC) |
| | mg/kg | mg/kg | mg/kg | mg/l | mg/l | mg/l | mg/l | LC>LCT3 or TC>TCT2 | LCT2 <LC≤LCT3 or TCT1<TC≤TCT2 | LCT1<LC≤LCT2 and TC≤TCT1 | LCT0<LC≤LCT1 and TC≤TCT1 | LC≤LCT0 and TC≤TCT0 | mg/kg | mg/l |
| ***Metal Ions*** | | | | | | | | | | | | | | |
| As, Arsenic | 5.8 | 500 | 2 000 | 0.01 | 0.5 | 1 | 4 | - | - | - | Type 3 | - | **8.95** | 0.005 |
| B, Boron | 150 | 15 000 | 60 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 13 | 0.037 |
| Ba, Barium | 62.5 | 6 250 | 25 000 | 0.7 | 35 | 70 | 280 | - | - | - | - | Type 4 | 36 | 0.053 |
| Cd, Cadmium | 7.5 | 260 | 1 040 | 0.003 | 0.15 | 0.3 | 1.2 | - | - | - | Type 3 | - | **7.82** | 0.005 |
| Co, Cobalt | 50 | 5 000 | 20 000 | 0.5 | 25 | 50 | 200 | - | - | - | - | Type 4 | 21 | 0.005 |
| Cr Total, Chromium Total | 46 000 | 800 000 | N/A | 0.1 | 5 | 10 | 40 | - | - | - | - | Type 4 | 8800 | 0.005 |
| Cr (VI), Chromium (VI) | 6.5 | 500 | 2 000 | 0.05 | 2.5 | 5 | 20 | - | - | - | - | Type 4 | 5 | 0.005 |
| Cu, Copper | 16 | 19 500 | 78000 | 2 | 100 | 200 | 800 | - | - | - | Type 3 | - | **212** | 0.005 |
| Hg, Mercury | 0.93 | 160 | 640 | 0.006 | 0.3 | 0.6 | 2.4 | - | - | - | Type 3 | - | 4 | 0.005 |
| Mn, Manganese | 1000 | 25 000 | 100 000 | 0.5 | 25 | 50 | 200 | - | - | - | Type 3 | - | 679 | **0.886** |
| Mo, Molybdenum | 40 | 1 000 | 4 000 | 0.07 | 3.5 | 7 | 28 | - | - | - | - | Type 4 | 4.77 | 0.005 |
| Ni, Nickel | 91 | 10 600 | 42 400 | 0.07 | 3.5 | 7 | 28 | - | - | - | Type 3 | - | **232** | 0.013 |
| Pb, Lead | 20 | 1 900 | 7600 | 0.01 | 0.5 | 1 | 4 | - | - | - | Type 3 | - | **825** | 0.101 |
| Sb, Antimony | 10 | 75 | 300 | 0.02 | 1 | 2 | 8 | - | - | - | Type 3 | - | **11** | 0.005 |
| Se, Selenium | 10 | 50 | 200 | 0.01 | 0.5 | 1 | 4 | - | - | - | Type 3 | - | **20** | 0.016 |
| V, Vanadium | 150 | 2 680 | 10 720 | 0.2 | 10 | 20 | 80 | - | - | - | - | Type 4 | 126 | 0.005 |
| Zn, Zinc | 240 | 160 000 | 640000 | 5 | 250 | 500 | 2 000 | - | Type 1 | - | - | - | **163200** | 32 |
| ***Inorganic Anions*** | | | | | | | | | | | | | | |
| TDS | NA | NA | NA | 1 000 | 12 500 | 25 000 | 100 000 | - | - | - | Type 3 | - | NA | **1002** |
| Chloride | NA | NA | NA | 300 | 15 000 | 30 000 | 120 000 | - | - | - | - | Type 4 | NA | 219 |
| Sulphate | NA | NA | NA | 250 | 12 500 | 25 000 | 100 000 | - | - | - | Type 3 | - | NA | **389** |
| NO3 as N, Nitrate-N | NA | NA | NA | 11 | 550 | 1 100 | 4 400 | - | - | - | - | Type 4 | NA | 0.5 |
| F, Fluoride | 100 | 10 000 | 40 000 | 1.5 | 75 | 150 | 600 | - | - | - | Type 3 | - | **581** | 1.3 |
| CN (Total), Cyanide Total | 14 | 10 500 | 42 000 | 0.07 | 3.5 | 7 | 28 | - | - | - | - | Type 4 | 0.025 | 0.005 |

Note: Values on Red were below the detection limit. A value equal to half that detection limit has been taken
Note: Values in bold indicate exceedance

**APPENDIX C: LABORATORY CERTIFICATES**

# WATERLAB (PTY) LTD

## CERTIFICATE OF ANALYSES

## ICP-MS SCAN ANALYSIS

| | | | |
|---|---|---|---|
| **Date received:** | 2015/03/03 | **Date Completed:** | 2015/04/02 |
| **Project number:** | 139 | **Report number:** | 50768 |
| **Client name:** | SLR Consulting (South Africa) (Pty) Ltd | **Contact person:** | Jenny Ellerton |
| **Address:** | PO Box 40161, Fairy Glen, 0043 | **Email:** | jellerton@slrconsulting.com |

| Extract | Sample Mass (g) | Volume (ml) | Factor |
|---|---|---|---|
| Distilled Water | 50 | 1000 | 20 |

| Sample Id | Sample Number | Ag | Ag | Al | Al | As | As |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | 0.706 | 14 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | 0.143 | 2.86 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | 0.240 | 4.80 | <0.010 | <0.200 |

| Sample Id | Sample Number | Au | Au | B | B | Ba | Ba |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | 0.034 | 0.682 | <0.010 | <0.200 | 0.025 | 0.500 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | 0.050 | 0.991 | 0.046 | 0.914 |

| Sample Id | Sample Number | Be | Be | Bi | Bi | Ca | Ca |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | 8.80 | 176 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | 1.06 | 21 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | 0.010 | 0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | <0.010 | <0.200 | 153 | 3060 |

| Sample Id | Sample Number | Cd | Cd | Ce | Ce | Co | Co |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Cr | Cr | Cs | Cs | Cu | Cu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | 112 | 2240 | 0.283 | 5.66 | <0.010 | <0.200 |

| Sample Id | Sample Number | Dy | Dy | Er | Er | Eu | Eu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Fe | Fe | Ga | Ga | Gd | Gd |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | 0.024 | 0.472 | <0.010 | <0.200 |

| Sample Id | Sample Number | Ge | Ge | Hf | Hf | Ho | Ho |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | 0.014 | 0.275 | <0.010 | <0.200 |

| Sample Id | Sample Number | In | In | Ir | Ir | K | K |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | 0.033 | 0.660 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | <0.010 | <0.200 | 205 | 4100 |

| Sample Id | Sample Number | La | La | Li | Li | Lu | Lu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | 0.032 | 0.642 | <0.010 | <0.200 |

| Sample Id | Sample Number | Mg | Mg | Mn | Mn | Mo | Mo |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | 1.49 | 30 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | 0.788 | 16 | 0.059 | 1.18 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | 0.084 | 1.68 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | 2.07 | 41 | <0.010 | <0.200 | 0.039 | 0.787 |

| Sample Id | Sample Number | Na | Na | Nb | Nb | Nd | Nd |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | 330 | 6600 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Ni | Ni | Os | Os | P | P |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | 0.010 | 0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | <0.010 | <0.200 | 0.012 | 0.240 |

| Sample Id | Sample Number | Pb | Pb | Pd | Pd | Pt | Pt |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Rb | Rb | Rh | Rh | Ru | Ru |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | 1.01 | 20 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Sb | Sb | Sc | Sc | Se | Se |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | <0.010 | <0.200 | 0.083 | 1.66 |

| Sample Id | Sample Number | Si | Si | Sm | Sm | Sn | Sn |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | 2.4 | 48 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | 0.6 | 12.5 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | 0.1 | 1.9 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | 14.9 | 299 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Sr | Sr | Ta | Ta | Tb | Tb |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | 0.036 | 0.711 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | 0.872 | 17 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Te | Te | Th | Th | Ti | Ti |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | 0.017 | 0.338 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | <0.010 | <0.200 | 0.131 | 2.63 |

| Sample Id | Sample Number | Tl | Tl | Tm | Tm | U | U |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | V | V | W | W | Y | Y |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | 0.109 | 2.17 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Yb | Yb | Zn | Zn | Zr | Zr |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 42 | 73 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 75 | 74 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| SLAG Tap 82 | 75 | <0.010 | <0.200 | 0.012 | 0.240 | <0.010 | <0.200 |
| Baghouse Composite Sample | 76 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |

# WATERLAB (PTY) LTD

Building D, The Woods,
Persequor Techno Park,
Meiring Naudé Road, Pretoria
P.O. Box 283, 0020

Telephone: +2712 – 349 – 1066
Facsimile: +2712 – 349 – 2064
Email: accounts@waterlab.co.za


## CERTIFICATE OF ANALYSES

## TCLP / ACID RAIN / DISTILLED WATER EXTRACTIONS

**Date received:** 2015/03/03 **Date completed:** 2015/04/02

**Project number:** 139 **Report number:** 50768 **Order number:** 0169

**Client name:** SLR Consulting (South Africa) (Pty) Ltd **Contact person:** Jenny Ellerton

**Address:** PO Box 40161, Fairy Glen, 0043 **Email:** jellerton@slrconsulting.com

**Telephone:** 012 361 8118 **Cell:** 072 077 7463

| Analyses | SLAG Tap 42 | | SLAG Tap 75 | | SLAG Tap 82 | | Baghouse Composite Sample | |
|---|---|---|---|---|---|---|---|---|
| Sample Number | 73 | | 74 | | 75 | | 76 | |
| TCLP / Acid Rain / Distilled Water / $H_2O_2$ | Distilled Water | | Distilled Water | | Distilled Water | | Distilled Water | |
| **Dry Mass Used (g)** | 50 | | 50 | | 50 | | 50 | |
| **Volume Used (mℓ)** | 1000 | | 1000 | | 1000 | | 1000 | |
| pH Value at 25˚C | 7.6 | | 7.2 | | 6.3 | | 8.8 | |
| Electrical Conductivity in mS/m at 25℃ | 6.0 | | 1.4 | | 0.4 | | 284 | |
| ***Inorganic Anions*** | mg/ℓ | mg/kg | mg/ℓ | mg/kg | mg/ℓ | mg/kg | mg/ℓ | mg/kg |
| Total Dissolved Solids at 180 ˚C | 26 | 520 | <10 | <200 | <10 | <200 | 2116 | 42320 |
| Total Alkalinity as CaCO3 | 24 | 480 | 8 | 160 | <5 | <100 | 164 | 3280 |
| Chloride as Cl | 6 | 120 | <5 | <100 | <5 | <100 | 139 | 2780 |
| Sulphate as SO4 | <5 | <100 | <5 | <100 | <5 | <100 | 926 | 18520 |
| Nitrate as N | <0.2 | <4.0 | <0.2 | <4.0 | <0.2 | <4.0 | 0.2 | 4.0 |
| Fluoride as F | <0.2 | <4.0 | <0.2 | <4.0 | <0.2 | <4.0 | 4.1 | 82 |
| Total Cyanide as CN | <0.01 | <0.2 | 0.01 | 0.2 | <0.01 | <0.02 | 0.01 | 0.2 |
| Hexavalent Chromium as CrVI | <0.010 | <0.20 | <0.010 | <0.20 | <0.010 | <0.20 | 190 | 3800 |
| Mercury as Hg | <0.001 | <0.02 | <0.001 | <0.02 | <0.001 | <0.02 | <0.001 | <0.02 |
| ICP-MS Scan | See tab ICP MS DW | | See tab ICP MS DW | | See tab ICP MS DW | | See tab ICP MS DW | |
| Acid Base Accounting | See attached report 50768 ABA | | | | | | | |
| X-ray Diffraction [s] | See attached report 50768 XRD | | | | | | | |

[s]=subcontracted

E. Botha
Geochemistry Project Manager

# WATERLAB (PTY) LTD

Building D, The Woods,
Persequor Techno Park,
Meiring Naudé Road, Pretoria
P.O. Box 283, 0020

Telephone: +2712 – 349 – 1066
Facsimile: +2712 – 349 – 2064
Email: accounts@waterlab.co.za

## CERTIFICATE OF ANALYSES

**Digestion**

| | | | | | |
|---|---|---|---|---|---|
| **Date received:** | 2015/03/03 | | | **Date completed:** | 2015/04/02 |
| **Project number:** | 139 | **Report number:** | 50768 | **Order number:** | 0169 |

| | | | |
|---|---|---|---|
| **Client name:** | SLR Consulting (South Africa) (Pty) Ltd | **Contact person:** | Jenny Ellerton |
| **Address:** | PO Box 40161, Fairy Glen, 0043 | **Email:** | jellerton@slrconsulting.com |
| **Telephone:** | 012 361 8118 | **Cell:** | 072 077 7463 |

| Analyses | SLAG Tap 42 | | SLAG Tap 75 | | SLAG Tap 82 | | Baghouse Composite Sample | |
|---|---|---|---|---|---|---|---|---|
| Sample Number | 73 | | 74 | | 75 | | 76 | |
| TCLP / Acid Rain / Distilled Water / $H_2O_2$ | Aqua Regia | | Aqua Regia | | Aqua Regia | | Aqua Regia | |
| Dry Mass Used (g) | 0.25 | | 0.25 | | 0.25 | | 0.25 | |
| Volume Used (mℓ) | 100 | | 100 | | 100 | | 100 | |
| Units | mg/ℓ | mg/kg | mg/ℓ | mg/kg | mg/ℓ | mg/kg | mg/ℓ | mg/kg |
| Mercury as Hg | --- | <0.001 | --- | <0.001 | --- | <0.001 | --- | <0.001 |
| ICP-MS Scan | See tab ICP AQR | | See tab ICP AQR | | See tab ICP AQR | | See tab ICP AQR | |
| Total Cyanide as CN | --- | <0.01 | --- | 0.01 | --- | 0.01 | --- | 0.01 |
| Total Fluoride [s] | --- | 104 | --- | 95.6 | --- | 99.5 | --- | 315 |
| Total Hexavalent Chromium as $Cr^{6+}$ [s] | --- | <5 | --- | <5 | --- | 6.3 | --- | 1005 |

[s]=subcontracted

E. Botha
Geochemistry Project Manager

# WATERLAB (PTY) LTD

## CERTIFICATE OF ANALYSES

### ICP-MS SCAN ANALYSIS

| | | | |
|---|---|---|---|
| **Date received:** | 2015/03/03 | **Date Completed:** | 2015/04/02 |
| **Project number:** | 139 | **Report number:** | 50768 |



| | | | |
|---|---|---|---|
| **Client name:** | SLR Consulting (South Africa) (Pty) Ltd | **Contact person:** | Jenny Ellerton |
| **Address:** | PO Box 40161, Fairy Glen, 0043 | **Email:** | jellerton@slrconsulting.com |



| Extract | Sample Mass (g) | Volume (ml) | Factor |
|---|---|---|---|
| Aqua Regia | 0.25 | 100 | 400 |

| Sample Id | Sample Number | Ag | Ag | Al | Al | As | As |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | 0.136 | 54 | 67 | 26800 | 0.017 | 7.00 |
| SLAG Tap 75 | 74 | 0.013 | 5.27 | 113 | 45200 | 0.010 | 4.00 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | 98 | 39200 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | <0.010 | <4.00 | 41 | 16400 | 0.024 | 10 |

| Sample Id | Sample Number | Au | Au | B | B | Ba | Ba |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | 0.047 | 19 | 0.203 | 81 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | 0.022 | 8.83 | 0.293 | 117 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | 0.014 | 5.53 | 0.179 | 72 |
| Baghouse Composite Sample | 76 | <0.010 | <4.00 | 0.035 | 14 | 0.095 | 38 |

| Sample Id | Sample Number | Be | Be | Bi | Bi | Ca | Ca |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | <0.010 | <4.00 | 194 | 77600 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | <0.010 | <4.00 | 160 | 64000 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | <0.010 | <4.00 | 65 | 26000 |
| Baghouse Composite Sample | 76 | <0.010 | <4.00 | 0.028 | 11.31 | 44 | 17600 |

| Sample Id | Sample Number | Cd | Cd | Ce | Ce | Co | Co |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | 0.035 | 14 | 0.030 | 12 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | 0.054 | 21 | 0.033 | 13 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | 0.050 | 20 | 0.057 | 23 |
| Baghouse Composite Sample | 76 | <0.010 | <4.00 | 0.012 | 4.95 | 1.18 | 471 |

| Sample Id | Sample Number | Cr | Cr | Cs | Cs | Cu | Cu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | 2.84 | 1135 | <0.010 | <4.00 | 0.014 | 5.6 |
| SLAG Tap 75 | 74 | 13 | 5200 | <0.010 | <4.00 | 0.028 | 11 |
| SLAG Tap 82 | 75 | 18 | 7200 | <0.010 | <4.00 | 0.019 | 7.8 |
| Baghouse Composite Sample | 76 | 49 | 19600 | 0.029 | 12 | 3.36 | 1343 |

| Sample Id | Sample Number | Dy | Dy | Er | Er | Eu | Eu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | Fe | Fe | Ga | Ga | Gd | Gd |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | 34 | 13600 | 0.041 | 16 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | 50 | 20000 | 0.059 | 24 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | 67 | 26800 | 0.044 | 18 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | 306 | 122400 | 0.468 | 187 | <0.010 | <4.00 |

| Sample Id | Sample Number | Ge | Ge | Hf | Hf | Ho | Ho |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |

| Baghouse Composite Sample | 76 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
|---|---|---|---|---|---|---|---|

| Sample Id | Sample Number | In | In | Ir | Ir | K | K |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | 0.021 | 8.47 | 0.5 | 192 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | <0.010 | <4.00 | 0.3 | 112 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | <0.010 | <4.00 | 0.4 | 158 |
| Baghouse Composite Sample | 76 | <0.010 | <4.00 | <0.010 | <4.00 | 17.6 | 7059 |

| Sample Id | Sample Number | La | La | Li | Li | Lu | Lu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | 0.019 | 7.62 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | 0.028 | 11 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | 0.024 | 10 | <0.010 | <4.00 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | <0.010 | <4.00 | 0.016 | 6.33 | <0.010 | <4.00 |

| Sample Id | Sample Number | Mg | Mg | Mn | Mn | Mo | Mo |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | 199 | 79600 | 2.30 | 919 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | 266 | 106400 | 1.93 | 771 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | 281 | 112400 | 1.30 | 521 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | 320 | 128000 | 7.56 | 3024 | <0.010 | <4.00 |

| Sample Id | Sample Number | Na | Na | Nb | Nb | Nd | Nd |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | 31 | 12400 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | Ni | Ni | Os | Os | P | P |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | 0.460 | 184 | <0.010 | <4.00 | 0.091 | 36 |
| SLAG Tap 75 | 74 | 0.609 | 244 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | 0.892 | 357 | <0.010 | <4.00 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | 15 | 6000 | <0.010 | <4.00 | 0.075 | 30 |

| Sample Id | Sample Number | Pb | Pb | Pd | Pd | Pt | Pt |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | 7.50 | 2998 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | Rb | Rb | Rh | Rh | Ru | Ru |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | 0.091 | 36 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | Sb | Sb | Sc | Sc | Se | Se |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | 0.032 | 13 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | 0.067 | 27 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | 0.064 | 26 | 0.011 | 4.48 |
| Baghouse Composite Sample | 76 | 0.014 | 5.50 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | Si | Si | Sm | Sm | Sn | Sn |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | 4.0 | 1619 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | 1.9 | 749 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | 4.9 | 1965 | <0.010 | <4.00 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | 0.5 | 212 | <0.010 | <4.00 | 0.038 | 15 |

| Sample Id | Sample Number | Sr | Sr | Ta | Ta | Tb | Tb |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | 0.333 | 133 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | 0.422 | 169 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | 0.403 | 161 | <0.010 | <4.00 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | 0.184 | 74 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | Te | Te | Th | Th | Ti | Ti |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | 0.076 | 30 | 8.14 | 3256 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | 0.012 | 4.74 | 8.13 | 3251 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | <0.010 | <4.00 | 5.10 | 2041 |
| Baghouse Composite Sample | 76 | <0.010 | <4.00 | <0.010 | <4.00 | 1.36 | 544 |

| Sample Id | Sample Number | Tl | Tl | Tm | Tm | U | U |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Baghouse Composite Sample | 76 | 0.019 | 7.80 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | V | V | W | W | Y | Y |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | 0.035 | 14 | <0.010 | <4.00 | 0.022 | 8.68 |
| SLAG Tap 75 | 74 | 0.039 | 16 | <0.010 | <4.00 | 0.035 | 14 |
| SLAG Tap 82 | 75 | 0.078 | 31 | <0.010 | <4.00 | 0.036 | 14 |
| Baghouse Composite Sample | 76 | 0.405 | 162 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | Yb | Yb | Zn | Zn | Zr | Zr |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| SLAG Tap 42 | 73 | <0.010 | <4.00 | 0.029 | 12 | 0.019 | 7.53 |
| SLAG Tap 75 | 74 | <0.010 | <4.00 | <0.010 | <4.00 | 0.036 | 15 |
| SLAG Tap 82 | 75 | <0.010 | <4.00 | 0.056 | 23 | 0.025 | 10 |
| Baghouse Composite Sample | 76 | <0.010 | <4.00 | 21 | 8400 | 0.014 | 5.56 |

**WATERLAB (PTY) LTD**

23B De Havilland Crescent
Persequor Techno Park,
Meiring Naudé Road,
Pretoria

Telephone: +2712 – 349 – 1066
Facsimile: +2712 – 349 – 2064
Email: accounts@waterlab.co.za

**CERTIFICATE OF ANALYSES**
**EXTRACTIONS AS 4439.3**

| | | | | |
|---|---|---|---|---|
| **Date received:** | 2015/11/11 | | **Date completed:** | 2015/12/14 |
| **Project number:** | 139 | 55841 | **Order number:** | 0283 |
| **Client name:** | SLR Consulting (South Africa) (Pty) Ltd | | **Contact person:** | Jenny Ellerton (P/O) |
| **Address:** | PO Box 40161, Fairy Glen, 0043 | | **Email:** | jellerton@slrconsulting.com |
| **Telephone:** | 011 467 0945 | | **Cell:** | 0720777463 |

| Analyses | Mogale DC Baghouse |
|---|---|
| Sample Number | 21146 |
| TCLP / Borax / Distilled Water | Distilled Water |
| Ratio* | 1:20 |
| *Inorganic Anions* | mg/ℓ |
| Total Dissolved Solids at 180˚C | 1002 |
| Total Alkalinity as CaCO3 | <5 |
| Chloride as Cl | 219 |
| Sulphate as SO4 | 389 |
| Nitrate as N | 0.5 |
| Fluoride as F | 1.3 |
| Total Cyanide as CN | <0.010 |
| Hexavalent Chromium as Cr6+ | <0.010 |
| pH | 6.5 |
| Electrical Conductivity in mS/m at 25˚C | 161 |
| ICP-MS Scan | See tab ICP DW |
| Acid Base Accounting | See attached report 55841 ABA |
| X-ray Diffraction [s] | See attached report 55841 XRD |

[s]=subcontracted

E. Botha
Geochemistry Project Manager

# WATERLAB (PTY) LTD

## CERTIFICATE OF ANALYSES

## ICP-MS SCAN ANALYSIS

| | | | |
|---|---|---|---|
| **Date received:** | 2015/11/11 | **Date Completed:** | 2015/12/14 |
| **Project number:** | 139 | **Report number:** | 55841 |

| | | | |
|---|---|---|---|
| **Client name:** | SLR Consulting (South Africa) (Pty) Ltd | **Contact person:** | Jenny Ellerton (P/O) |
| **Address:** | PO Box 40161, Fairy Glen, 0043 | **Email:** | jellerton@slrconsulting.com |
| **Telephone:** | 011 467 0945 | **Email:** | accountsza@slrconsulting.com |

| Extract | Sample Mass (g) | Volume (ml) | Factor |
|---|---|---|---|
| Distilled Water | 50 | 1000 | 20 |

| Sample Id | Sample Number | Ag | Ag | Al | Al | As | As |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.100 | <2.00 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | <0.100 | <2.00 | <0.010 | <0.200 |

| Sample Id | Sample Number | Au | Au | B | B | Ba | Ba |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | 0.019 | 0.390 | 0.037 | 0.733 | 0.053 | 1.07 |

| Sample Id | Sample Number | Be | Be | Bi | Bi | Ca | Ca |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <1 | <20 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | <0.010 | <0.200 | 38 | 760 |

| Sample Id | Sample Number | Cd | Cd | Ce | Ce | Co | Co |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Cr | Cr | Cs | Cs | Cu | Cu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | 0.149 | 2.98 | <0.010 | <0.200 |

| Sample Id | Sample Number | Dy | Dy | Er | Er | Eu | Eu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Fe | Fe | Ga | Ga | Gd | Gd |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.025 | <0.500 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.025 | <0.500 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Ge | Ge | Hf | Hf | Ho | Ho |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | In | In | Ir | Ir | K | K |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.5 | <10.0 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | <0.010 | <0.200 | 114 | 2280 |

| Sample Id | Sample Number | La | La | Li | Li | Lu | Lu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | 0.013 | 0.262 | <0.010 | <0.200 |

| Sample Id | Sample Number | Mg | Mg | Mn | Mn | Mo | Mo |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <1 | <20 | 0.025 | <0.500 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | 36 | 720 | 0.886 | 18 | <0.010 | <0.200 |

| Sample Id | Sample Number | Na | Na | Nb | Nb | Nd | Nd |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <1 | <20 | <0.010 | <0.200 | <0.010 | <0.200 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mogale DC Baghouse | 21146 | 96 | 1920 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Ni | Ni | Os | Os | P | P |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | 0.013 | 0.268 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Pb | Pb | Pd | Pd | Pt | Pt |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | 0.101 | 2.03 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Rb | Rb | Rh | Rh | Ru | Ru |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | 0.937 | 19 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | S | S | Sb | Sb | Sc | Sc |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | 153 | 3060 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Se | Se | Si | Si | Sm | Sm |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.2 | <4.00 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | 0.016 | 0.324 | <0.2 | <4.00 | <0.010 | <0.200 |

| Sample Id | Sample Number | Sn | Sn | Sr | Sr | Ta | Ta |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | 0.522 | 10 | <0.010 | <0.200 |

| Sample Id | Sample Number | Tb | Tb | Te | Te | Th | Th |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Ti | Ti | Tl | Tl | Tm | Tm |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | 0.075 | 1.49 | 0.212 | 4.23 | <0.010 | <0.200 |

| Sample Id | Sample Number | U | U | V | V | W | W |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |

| Sample Id | Sample Number | Y | Y | Yb | Yb | Zn | Zn |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 | <0.010 | <0.200 | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 | <0.010 | <0.200 | 32 | 640 |

| Sample Id | Sample Number | Zr | Zr |
|---|---|---|---|
| | | mg/l | mg/kg |
| Det Limit | | <0.010 | <0.200 |
| Mogale DC Baghouse | 21146 | <0.010 | <0.200 |

# WATERLAB (PTY) LTD

23B De Havilland Crescent
Persequor Techno Park,
Meiring Naudé Road, Pretoria
P.O. Box 283, 0020

Telephone: +2712 – 349 – 1066
Facsimile: +2712 – 349 – 2064
Email: accounts@waterlab.co.za

## CERTIFICATE OF ANALYSES

**Digestion AS 4439.3**

| | | | | | |
|---|---|---|---|---|---|
| **Date received:** | **2015/11/11** | | | **Date completed:** | |
| **Project number:** | **139** | **Report number:** | **55841** | **Order number:** | **0283** |

| | | | |
|---|---|---|---|
| **Client name:** | **SLR Consulting (South Africa) (Pty) Ltd** | **Contact person:** | **Jenny Ellerton (P/O)** |
| **Address:** | **PO Box 40161, Fairy Glen, 0043** | **Email:** | **jellerton@slrconsulting.com** |
| **Telephone:** | **011 467 0945** | **Cell:** | **0720777463** |

| Analyses | Mogale DC Baghouse | | |
|---|---|---|---|
| **Sample Number** | **21146** | | **TCT0 mg/kg** |
| **Digestion** | **Aqua Regia** | | |
| **Dry Mass Used (g)** | **0.25** | | |
| **Volume Used (mℓ)** | **100** | | |
| **ICP-MS scan** | See tab ICP AQR | | |
| ***Inorganic Anions*** | **mg/ℓ** | **mg/kg** | |
| Cr(VI), Chromium (VI) Total [s] | --- | <5 | 6.5 |
| Total Fluoride [s] mg/kg | --- | 581 | 100 |
| Total Cyanide as CN mg/kg | --- | <0.05 | 14 |

[s] = subcontracted

UTD = Unable to determine

E. Botha__________________

Geochemistry Project Manager

# WATERLAB (PTY) LTD

## CERTIFICATE OF ANALYSES

### ICP-MS SCAN ANALYSIS

| | | | |
|---|---|---|---|
| **Date received:** | 2015/11/11 | **Date Completed:** | 2016/01/14 |
| **Project number:** | 139 | **Report number:** | 55841 |

| | | | |
|---|---|---|---|
| **Client name:** | SLR Consulting (South Africa) (Pty) Ltd | **Contact person:** | Jenny Ellerton (P/O) |
| **Address:** | PO Box 40161, Fairy Glen, 0043 | **Email:** | jellerton@slrconsulting.com |

| Extract | Sample Mass (g) | Volume (ml) | Factor |
|---|---|---|---|
| Aqua Regia | 0.25 | 100 | 400 |

| Sample Id | Sample Number | Ag | Ag | Al | Al | As | As |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.100 | <40 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | 31 | 12400 | 0.022 | 8.95 |

| Sample Id | Sample Number | Au | Au | B | B | Ba | Ba |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | 0.032 | 13 | 0.089 | 36 |

| Sample Id | Sample Number | Be | Be | Bi | Bi | Ca | Ca |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <1 | <400 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | 0.027 | 11 | 8 | 3200 |

| Sample Id | Sample Number | Cd | Cd | Ce | Ce | Co | Co |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 0.020 | 7.82 | 0.026 | 10 | 0.052 | 21 |

| Sample Id | Sample Number | Cr | Cr | Cs | Cs | Cu | Cu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 22 | 8800 | 0.022 | 8.70 | 0.530 | 212 |

| Sample Id | Sample Number | Dy | Dy | Er | Er | Eu | Eu |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | Fe | Fe | Ga | Ga | Gd | Gd |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.025 | <10 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 69 | 27600 | 0.405 | 162 | <0.010 | <4.00 |

| Sample Id | Sample Number | Ge | Ge | Hf | Hf | Hg | Hg |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 0.066 | 27 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | Ho | Ho | In | In | Ir | Ir |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | 0.010 | 4.10 | <0.010 | <4.00 |

| Sample Id | Sample Number | K | K | La | La | Li | Li |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.5 | <200 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 15.1 | 6051 | 0.014 | 5.45 | <0.010 | <4.00 |

| Sample Id | Sample Number | Lu | Lu | Mg | Mg | Mn | Mn |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <1 | <400 | <0.025 | <10 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | 97 | 38800 | 1.70 | 679 |

| Sample Id | Sample Number | Mo | Mo | Na | Na | Nb | Nb |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <1 | <400 | <0.010 | <4.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mogale DC Baghouse | 21146 | 0.012 | 4.77 | 16 | 6400 | <0.010 | <4.00 |

| Sample Id | Sample Number | Nd | Nd | Ni | Ni | Os | Os |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | 0.580 | 232 | <0.010 | <4.00 |

| Sample Id | Sample Number | P | P | Pb | Pb | Pd | Pd |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 0.277 | 111 | 2.06 | 825 | <0.010 | <4.00 |

| Sample Id | Sample Number | Pt | Pt | Rb | Rb | Rh | Rh |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | 0.110 | 44 | <0.010 | <4.00 |

| Sample Id | Sample Number | Ru | Ru | Sb | Sb | Sc | Sc |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | 0.027 | 11 | <0.010 | <4.00 |

| Sample Id | Sample Number | Se | Se | Si | Si | Sm | Sm |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.2 | <80 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 0.049 | 20 | 34 | 13600 | <0.010 | <4.00 |

| Sample Id | Sample Number | Sn | Sn | Sr | Sr | Ta | Ta |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 0.125 | 50 | 0.084 | 34 | <0.010 | <4.00 |

| Sample Id | Sample Number | Tb | Tb | Te | Te | Th | Th |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |

| Sample Id | Sample Number | Ti | Ti | Tl | Tl | Tm | Tm |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 1.19 | 474 | 0.026 | 10 | <0.010 | <4.00 |

| Sample Id | Sample Number | U | U | V | V | W | W |
|---|---|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | <0.010 | <4.00 | 0.315 | 126 | <0.010 | <4.00 |

| Sample Id | Sample Number | Y | Y | Yb | Yb |
|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 0.010 | 4.14 | <0.010 | <4.00 |

| Sample Id | Sample Number | Zn | Zn | Zr | Zr |
|---|---|---|---|---|---|
| | | mg/l | mg/kg | mg/l | mg/kg |
| Det Limit | | <0.010 | <4.00 | <0.010 | <4.00 |
| Mogale DC Baghouse | 21146 | 408 | 163200 | 0.013 | 5.13 |

SLR Consulting (Africa) (Pty) Limited

## RECORD OF REPORT DISTRIBUTION

| | |
|---|---|
| **SLR Reference:** | 710.19057.00010 |
| **Title:** | Waste Assessment |
| **Site name:** | Siyanda Ferrochrome Project |
| **Report Number:** | 01 |
| **Client:** | Siyanda Chrome Smelting Company (Pty) Ltd |

| Name | Entity | No. of copes | Date issued | Issuer |
|---|---|---|---|---|
| Caitlin Hird | SLR Consulting | 1 | September 2016 | J. Ellerton |
| Library | SLR Consulting | 1 | September 2016 | J. Ellerton |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

global environmental solutions


**JOHANNESBURG**

**Fourways Office**
P O Box 1596, Cramerview, 2060,
SOUTH AFRICA

Unit 7, Fourways Manor Office Park,
1 Macbeth Ave (On the corner with Roos Street), Fourways, Johannesburg,
SOUTH AFRICA

**T: +27 (0)11 467 0945**