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MOTIVATION IN SUPPORT OF THE APPLICATION TO EXCLUDE FILTER CAKE WASTE FROM THE DEFINITION OF WASTE

for

ILLOVO SUGAR (SOUTH AFRICA) (PTY) LTD - NOODSBERG SUGAR MILL

by

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TABLE OF CONTENTS

LIST OF TABLES.....	- 4 -
LIST OF FIGURES.....	- 4 -
LIST OF ATTACHMENTS.....	- 4 -
DETAILS OF THE SPECIALIST.....	- 5 -
1. INTRODUCTION	- 6 -
2. LEGISLATIVE FRAMEWORK.....	- 7 -
2.1. Acts:.....	- 7 -
2.2. National Norms and Standards. Listed Activities and other relevant documents	- 7 -
3. NOODSBERG SUGAR MILL CONTACT DETAILS	- 8 -
3.1. Mill Physical Location and contact details.....	- 8 -
4. INTEGRATED MANAGEMENT SYSTEM	- 8 -
5. FACILITY WASTE GENERATING PROCESS	- 9 -
5.1. Brief overview	- 9 -
5.2. Waste stream.....	- 9 -
5.3. Facility process description to produce filter cake.....	- 9 -
5.4. Filter cake a brief description of the waste source	- 10 -
5.5. Beneficial use and recipients.	- 11 -
6. CONSEQUENCES OF NOT RECYCLING OR REUSING THE FILTER CAKE	- 11 -
6.1. Benefits of reuse and recycling.....	- 11 -
7. METHODOLOGY USED TO ASSESS THE CHEMICAL/HAZARDOUS NATURE OF THE WASTE... -	13 -
7.1. Rationale	- 13 -
7.2. Characterisation of the waste.....	- 13 -
7.3. Results.....	- 14 -
7.4. Precautionary Measures	- 15 -
7.4.1. Prevention.....	- 15 -
7.4.2. Responses	- 15 -
7.4.3. First-aid measures.....	- 16 -
7.4.3. Fire Fighting.....	- 16 -
7.4.4. Accidental release measures	- 16 -

7.4.5.	Safe Handling and Storage.....	- 16 -
7.4.6.	Exposure controls and Personal protection (PPE).....	- 17 -
7.4.7.	Stability and reactivity	- 17 -
7.4.8.	Disposal Considerations.....	- 17 -
7.4.9.	Transport Information.....	- 17 -
8.	CHEMICAL AND TECHNICAL SPECIFICATIONS – PRE-BENEFICIATION	- 17 -
8.1.	Introduction	- 17 -
8.2.	Laboratory results	- 18 -
8.3.	Total concentration and leachable concentration of components in filter cake as a characterisation of the hazard components	- 20 -
8.4.	Soil Screening Values as a basis for developing risk assessment and risk management plans	- 20 -
8.5.	Long term stability and functionality.....	- 23 -
8.6.	Reactivity with environmental factors.....	- 23 -
8.7.	Interpretation of results in terms of GHS classification and SSV of contaminated soils... ..	- 23 -
9.	CHEMICAL AND TECHNICAL SPECIFICATIONS – POST-BENEFICIATION	- 24 -
9.1.	Intended users of the waste stream.....	- 24 -
9.2.	Long term stability and functionality.....	- 24 -
9.3.	Reactivity with environmental factors.....	- 24 -
10.	IDENTIFICATION OF POTENTIAL RISKS AND THE MANAGEMENT THEREOF.....	- 25 -
11.	REFERENCES:	- 25 -
12.	DECLARATION BY SPECIALIST – Anne Bindoff	- 26 -

LIST OF TABLES

Table 1: Showing The GHS Classification Hazard/s

Table 2: LC And TC Laboratory Results For The Noodsberg Mil Filter Cake.

Table 3: Summary Of Soil Screening Values For Contaminated Land And For The Protection Of Water Resources.

LIST OF FIGURES

Figure 1: Google Earth Photo Of The Noodsberg Sugar Mill In Dalton: KZN. (Screen Shot from Google Earth).

Figure 2: Noodsberg Process Flow Schematic 2022

LIST OF ATTACHMENTS

Attachment 1: Noodsberg Process Flow 2022.

Attachment 2a: Certificate of Analysis,

Attachment 2b: Waste Assessment and Classification.

Attachment 2c: Filter cake Safety Data Sheet SDS,

Attachment 3: Risk Assessment Filter Cake Noodsberg Mill

Attachment 4: Risk Management Plan Filter Cake Noodsberg Mill.

Attachment 5: ILLOVO GROUP Code of Conduct and Business Ethics.

DETAILS OF THE SPECIALIST

Name of Company: Anne Bindoff Consultancy.

Name: Anne Bindoff: Director/Owner.

Qualifications: MSc (Eng – Enviro) UKZN, BSc (Chem and App Chem) UKZN, HED UNISA. RMPASA and Plant Science Consultants Association (PSCA) attendance for GHS training.

Professional Affiliations: RMPASA, IWMSA, PSCA.

Professional Registration: SACNASP: application pending

Company Specialities: Environmental Management, specialising in Waste Management, Hazardous Waste, Legal aspects, GHS: UN Standards Safety Data Sheet Compilations for Hazardous chemicals, Agri-Remedies (New standards) and fertilizers (New standards).

Experience:

- **Regulatory DAEA/EDTEA:** Pollution and Waste Management: Acting Assistant Manager ILembe DM 2006 - 2009.
- **Corporate: SAPPI Mandeni:** 2009 – 2013: Environmental Specialist: SHEQ systems, landfill site management, waste management, legal compliance for permits licences, waste classifications, water permits, waste permits, etc.
- **Own Business: Anne Bindoff Consultancy: As above:**
 - Clients:**
 - **Sappi Mandeni,** Hazardous waste removal.
 - **INDIFLORA: Brookdale Assessment Centre** - Rehabilitation: Waste removal for legal compliance.
 - **Aquasol:** SDS and labels, HCA and DALRD new requirements.
 - **NCP Chlorchem:** Waste assessment.
 - **Intellichem:** Tremcards supply.
 - **IFF:** Tremcards supply.
 - **SAPREF:** Tremcards supply.
 - **Bowisolve:** Legal requirements for road transportation of waste/Hazardous waste.
 - **Andermatt Madumbi:** Agri-remedies SDS assessments and advisory.
 - **RMPASA:** GHS training for Safety Data Sheets.
 - **IWMSA:** Hazardous waste management training.
 - **ECOGUARD:** Agri-remedies SDS compilations – new requirements and advisory.
 - **Aquasolve:** Supply of Safety Data Sheets: Fertilizers, new agricultural standards as per Dept of Labour HCA requirements.
 - **Dow/Corteva** – SDS advisory and tremcards supply.
 - **BPL:** Tremcards Supply.
 - **WALLACE AND GREEN ENVIRONMENTAL SPECIALISTS:** Waste Specialist –
 - Motivation in support of the removal of Illovo Sumitomo Mill waste filter cake and rubber compound from definition of waste.
 - Motivation in support of the removal of various waste streams from Illovo mills: Eston, Noodsberg and Gledhow mills.
 - Motivation in support of the removal of various waste streams from Umfolozi Sugar Mill.

1. INTRODUCTION

Illovo Sugar (South Africa) (Pty) Ltd, is an invested, long-term contributor to South Africa's economy, committed to partnering for the continuing transformation of its agricultural and sugar production sectors. The Noodsberg mill is part of the Illovo Sugar South Africa Group. The Illovo Sugar (South Africa) (Pty) Ltd - Noodsberg Sugar Mill mill is located at Noodsberg (near Dalton) in the KwaZulu-Natal Midlands. The GPS coordinates of the site are 29°21'35.31" S, 30°41'12.85" E.



Figure 1: Google Earth photo of the Noodsberg Sugar Mill in Dalton: KZN. (Screen shot from GOOGLE EARTH)

The site of the mill is in a rural area with high unemployment. The presence of the mill supports the local communities through the employment it offers directly at the mill, the

farmers which supply the mill with the sugar cane and the local community members that supply services to the community: shops, doctors, contractors, schools, etc.

ILLOVO SUGAR (SOUTH AFRICA) (Pty) Ltd (Illovo SA) is a wholly-owned subsidiary of the Illovo Group, with its operations including the cultivation of sugar cane and production of raw, brown, and refined sugar, syrup, together with the downstream products of furfural and its derivatives, ethyl alcohol and lactulose.

The company annually produces more than 550 000 tons of raw and refined sugar from 4.8 million tons of sugar cane cultivated by independent growers, together with a small tonnage of cane produced by Illovo's own agricultural operations. Land holdings in South Africa have been strategically reduced from the mid-90's to make way for the growth and development of Black smallholder cane growers within Illovo's cane supply areas. This in turn produces large quantities of waste streams that require management to prevent human and environmental harm. One waste type of waste being filter cake, which is produced by the separation of the liquid fraction of the pure cane juice from the suspended matter and non sucrose related components. As part of the South African Waste Management Strategy, the filter cake is to be beneficiated in a legal and responsible way by moving it away from landfilling and redirecting it to be used as a soil enhancer.

This report serves as a basis for the application to remove the filter cake from the definition of waste as per the NEM:WA legal requirement. It is the basis for the risk assessment and the risk management plan. This is done to manage the filter cake waste stream as a beneficiated product as a soil enhancer. This report fulfils the requirements as set out in the legislative framework given in Section 2 below.

2. LEGISLATIVE FRAMEWORK

2.1. Acts:

- The Constitution of the Republic of South Africa, Act 108 of 1996.
- National Environmental Management Act (NEMA): Act No 107, 1998. 27 November 1998. (NEMA)
- National Environmental Management: Waste Act. (NEM:WA) No. 59 of 2008.
- The National Environmental Management: Waste Amendment Act (NEM:WAA), 2014 (Act No 26 of 2014).
- National Environmental Management: Waste Act (59/2008): National Waste Management Strategy, 2020 (NWMS)
- National Road Traffic Act (RTA), No. 93 of 1996.
- Occupational Health and Safety Act (**OHSA**) no: 85 of 1993.

2.2. National Norms and Standards. Listed Activities and other relevant documents

- **NEM:WA** Regulation 331 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality. 2013.

- The Framework for the Management of Contaminated Land, Department of Environmental Affairs (DEA), May 2010.
- National Norms and Standards for the Storage of Waste. 2013.
- NEM:WA (Act 59 of 2008) Government Notices (23 August 2013):
 - R.634 Waste classification and Management Regulations
 - R.635 National norms and standards for the assessment of waste for landfill disposal
 - R.636 National norms and standards for disposal of waste to landfill.
- National Environmental Management: Waste Act (59/2008): Regulations regarding the exclusion of a waste stream or a portion of a waste stream from the definition of waste (18 July 2018).
- **SANS 10234 (2019)(2nd ed)**: Globally Harmonized System (GHS) of Classification and Labelling of Chemicals .
- **GHS**: UN Standards Purple Book 9th ed.

3. NOODSBERG SUGAR MILL CONTACT DETAILS

3.1. Mill Physical Location and contact details

Name: Illovo Sugar Limited - Noodsberg Sugar Mill.

Physical address: 1 Oliver Pierce Avenue, Noodsberg, KwaZulu-Natal.

Postal address: Private Bag 501, Dalton, 3236

Contact person:

Name: Shaun Ramsunder

Portfolio: Country SHERQ Manager

General Mill Contact no: 033-5029500.

Mobile: 084 554 9664

email: SRamsunder@illovo.co.za.

4. INTEGRATED MANAGEMENT SYSTEM

As part of the mill operations, the Illovo Integrated Management System which include the SHERQ Management Systems are adopted for best practice in the industry. The Illovo group have a policy which is adhered to by all its sugar mills. In relation to environmental responsibility, the following is an extract from the Code Of Conduct And Business Ethics (refer to Attachment 5: ILLOVO GROUP Code of Conduct and Business Ethics).

ENVIRONMENTAL MANAGEMENT

- Illovo supports and encourages operating, manufacturing, farming and agricultural practices and production systems that are sustainable.
- As an environmentally sensitive business, Illovo supports a precautionary approach to environmental challenges and is committed to promoting environmental responsibility and encouraging the development and diffusion of environmentally friendly technologies in our operations.

- Suppliers should adopt a precautionary approach to environmental challenges and continually strive towards improving the efficiency and sustainability of their operations, including water conservation programmes, initiatives to promote greater environmental responsibility and encourage the development and diffusion of environmentally friendly technologies.
- The following aspects of environmental management will be included in the assessments of Suppliers:-
 - they should be aware of, and be able to demonstrate compliance with all current environmental legislation that may affect their activities;
 - they should conduct an environmental review of all aspects of their products and services.
- Any enforcement, improvement or prohibition notices served on a Supplier within the last three years by any competent authority must be disclosed and will be reviewed.

5. FACILITY WASTE GENERATING PROCESS

5.1. Brief overview

The following is a brief overview of the main processes that generate the waste streams. The purpose of this is to give an indication of the inputs which generate the filter cake to satisfy the legal requirement for the description of the components. Laboratory testing does not necessarily cover all the possible elements and organic components which may be in the filter cake, It is thus important to understand the principle of the processes.

5.2. Waste stream

Filter cake is the waste stream relevant to this application for exclusion from the waste stream. It is to be used as a fertilizer for sugar cane farms.

5.3. Facility process description to produce filter cake.

Refer to Attachment 1: Noodsberg Process Flow 2022 For The Mill Process Schematic. and to Figure 2: Noodsberg Process Flow Schematic 2022

This schematic shows the different process streams as well as the waste generated off these streams.

The filter cake is the waste product from the following processes:

- i. Cane Milling: Cane is shredded/chopped.
- ii. Juice Extraction: The shredded cane is taken through the diffuser where water is used to “wash” out or extract the juice containing the sucrose..
- iii. Clarification: various chemicals (lime and phosphates), flocculants and aids (second source of filter cake waste) are added to the juice to remove the suspended matter and organic matter to clarify the juice.
- iv. Filtration: This is allowed to settle as a sludge and is sent through a vacuum filter where the moisture is removed from the sludge. This sludge is the filtercake.

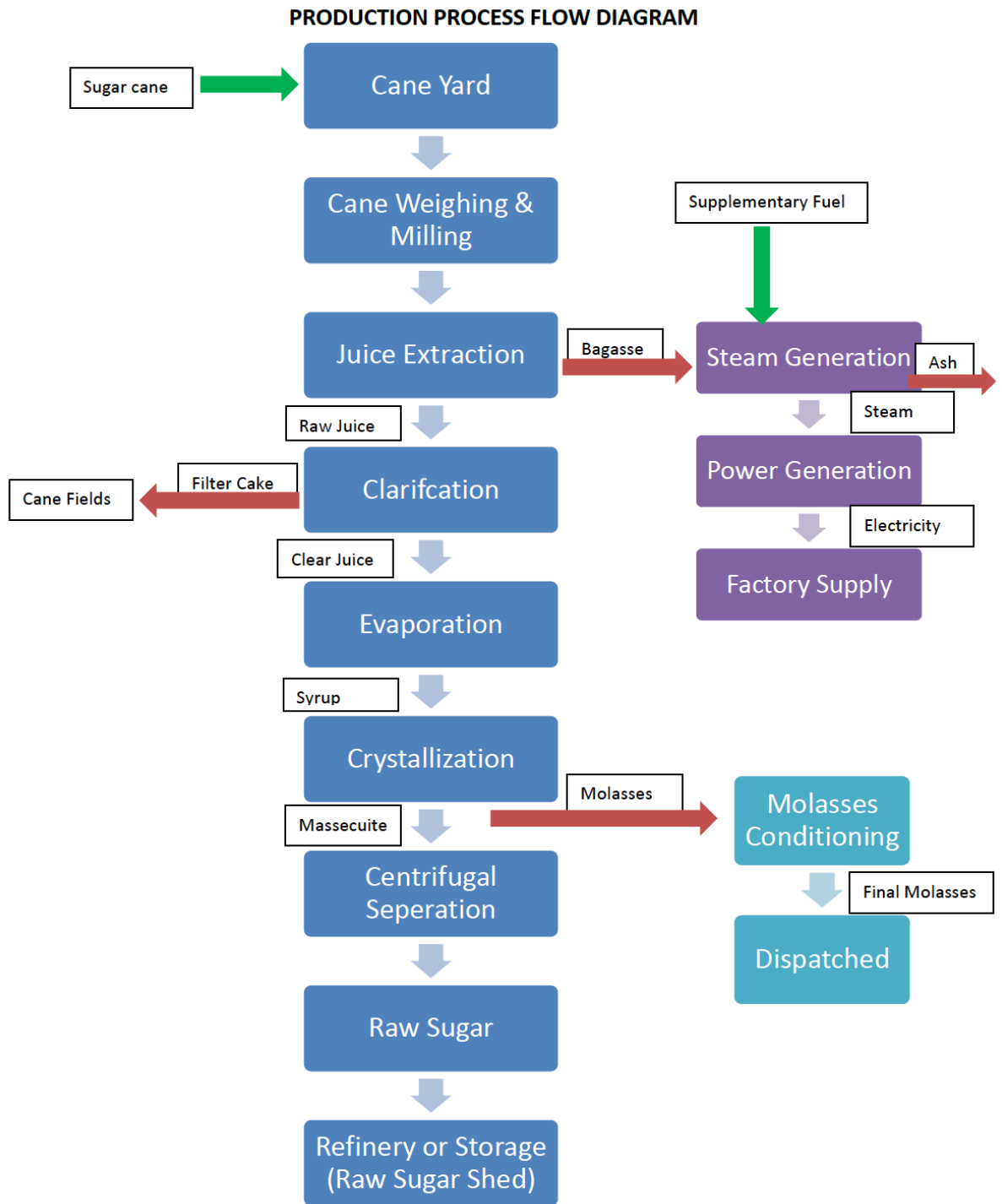


Figure 2: Noodsberg Process Flow Schematic 2022

5.4. Filter cake a brief description of the waste source

The filter cake is a nutrient rich sludge that is a collection. of solids (cellulosic fibres insoluble organics like waxes, etc.) and liquid components. Chemically the filter cake consists of mainly: Calcium, Potassium, Sodium, Magnesium, with the metallic minor micronutrients present as well which are described in the filter cake chemical analysis in Attachment 2a: Certificate of Analysis,

. Other anionic components are: Phosphate, Sulphur, Nitrogen and Carbon among several others but these constitute the major anionic components. The total dissolved solids (TDS) is made up of the soluble nutrient components. There is the organic component which is made up of wax, lipids, and resin, cellulosic fibres, protein and sugars, amongst others.

The constitution of filter cake makes it a valuable source of soil nutrients and is used as such in many countries successfully. .

The following sections will describe the legal requirements for the use of filter cake specifically on sugarcane fields and to minimise any human health and environmental impacts.

5.5. Beneficial use and recipients.

The filter cake will be put onto the farmers' soils as a fertilizer with the guidance of an agronomist.

6. CONSEQUENCES OF NOT RECYCLING OR REUSING THE FILTER CAKE

The filter cake is a waste product. The only recourse for the disposal of any waste legally is to landfill if not recycled or reused. There are landfills on site at Noodsberg, but these have almost reached their full airspace capacity with ash storage. However, another impediment to landfilling is the filter cake itself; it is prohibited from being landfilled unless treated to remove the prohibition conditions: pH = 4.3, (should be >6) and the moisture content 66% (should be <40%). There is a future prohibition due to the TOC 41%. (should be <6%). So, in line with the NEM:WA: National Waste Management Strategy (NWMS - 2020); the focus is on amongst others to divert waste from landfilling and to implement the circular economy principles to beneficiate the waste in a responsible manner: - to beneficiate the waste as a resource stream for other operations. This resource is very clearly favoured as a soil fertilizer/enhancer.

In summary if the filter cake is not beneficiated, Illovo Noodsberg Sugar Mill will not be able to supply those downstream users who would benefit from the properties of the waste. The main stakeholders are: the mill and the farmers and the local community in their enterprise. The cost savings also will be lost by the farmer by having to buy commercial fertilizer. By correct management of the waste, the potentially hazardous components will not be an environmental hazard.

6.1. Benefits of reuse and recycling

The objectives of the NWMS - 2020, are aligned with the Sustainable Development Goals:

SDG 3: to avoid/minimize waste related environmental factors that prevent ill-health and disease.

SDG 8: Promoting the waste management sector as a key contributor to overall economic growth and development.

SDG 9: use of natural resources to improve people's standard of living without damaging the environment.

SDG 12: Through: ensuring production patterns, implementing initiative that reduce waste, promote re-cycling, re-use.

The NWMS 2020 strategy is directing South Africa to a future with zero waste in landfills. This will be achieved through eight strategic goals, three of which are relevant for this report namely:

Goal 1: Promote waste minimisation, re-use, recycling and recovery of waste.

Focuses on implementing the waste management hierarchy, and with the ultimate aim of diverting waste from landfill.

Goal 8: Establish effective compliance with and enforcement of the Waste Act.

Ensures that everyone adheres to the regulatory requirements for waste management, and builds a culture of compliance.

The re-use of the filter cake and filter cake benefits Noodsberg Mill by the cost savings of diverting these waste streams from landfilling and the costs involved and promotes the job creation by employment of people within the agricultural economy. The cost savings also will be realised by the farmer by not having to buy commercial fertilizer entirely. By correct management of the waste, the potentially hazardous components will not be an environmental hazard.

The use of the filter cake from research work investigated is summarised as follows:

- “In most of the mills, filter cake is used as fertilizer in sugarcane fields. This is the most widely disseminated use of this by-product, especially because of the significant amount of nitrogen, phosphorus, calcium and organic matter available.
- “There are several other crops that benefit from this waste stream: this use has become very popular among farmers and results have been satisfactory for the production of banana, eucalyptus, guava, and vegetable seedlings.” (Rabelo, S.C., Rossel, C.E.V., (2015)). (Note: this would benefit the local community significantly to produce their own crops for own use or for production for local markets or for larger scale production.)
- “...*There are too many areas in developing countries where ruminant livestock starves due to lack of feed. So this study shows that the direction of searching and compensating the availability of such important croup residues and the sugar industry by product (filter cake) as the raw sources of livestock feeds.*” (Abera, A.A., et.al., (August 27th 2020)). (Note: this would benefit the local community significantly for their own livestock.)
- “In saline/sodic soil conditions the incorporation of filtercake at a rate of 350 tons/ha to a depth of 300 mm has been used successfully to leach out excessive levels of harmful sodium salt from both the topsoil and the subsoil. Buried filtercake lasts considerably longer than filtercake incorporated into the soil surface. “ (Note: this would benefit the local community significantly to use less water on their crops.)

- The advantage of this waste stream in its diverse uses does give an indication of the benefit to the broader community within the Illovo Noodsberg Sugar Mill area for community development regarding agricultural crop development for the alternative crops, for livestock feed, and for the community to be able to have self-supporting gardens to grow their own vegetable crops. Regarding the use on the sugar cane fields there is enough evidence for the benefit of this waste stream.

To be able to benefit from this opportunity safely, the filter cake will need to be characterised for minimum risk use of the micro nutrients to be available for the crops and not to not an environmental hazard. The following section describes this process and the results of the nature of the waste.

7. METHODOLOGY USED TO ASSESS THE CHEMICAL/HAZARDOUS NATURE OF THE WASTE

7.1. Rationale

To understand the potential implications on human health, the environment and potential safety hazards, this section focuses on the chemical makeup of the filter cake and the potential hazards and risks these pose for its proposed application.

Using the legal processes and guidelines, the risk assessment and a risk management plan can be formulated to minimise any potential harm to people and the environment.

7.2. Characterisation of the waste

The waste sample was received on 20th December 2022, the accredited laboratory (Talbot and Talbot) and:

- tested for its chemical composition and quantitative make-up of the elements,
- classification of the waste for any hazards using the SANS 10234 GHS system, and
- assessment for waste type and landfill class.

The following regulations were used:

Using NEM:WA (Act 59 of 2008) Government Notices (23 August 2013):

- R.634 Waste classification and Management Regulations
- R.635 National norms and standards for the assessment of waste for landfill disposal
- R.636 National norms and standards for disposal of waste to landfill.

Results are given in:

- Attachment 2a: (Certificate of Analysis),
- Attachment 2b: (Waste Assessment and Classification),
- Attachment 2c (SDS).

The second approach is to determine the hazard thresholds of the chemicals in contaminated soils and hence what would the effect on the environment and the health of the community would be. The Framework for Contaminated Land Rehabilitation (DEA- May

2010) guideline was used, and compared with the Total Concentration values (TC) obtained as well as the Leachable Concentration (LC) results from the laboratory analyses obtained.

The filter cake is then managed appropriately using the mitigation/management provided with the identified risks. The engagement of an agronomist is key to the correct management of the filter cake application onto the soils to ensure the soil ecosystem is well looked after to avoid salinity build up, pH imbalances, leaching of toxic components and other potential problems.

7.3. Results

The notes in this section are from the reports obtained from:

- Attachment 2a: (Certificate of Analysis),
- Attachment 2b: (Waste Assessment and Classification),
- Attachment 2c (SDS).

The following are the highlighted results.

i. Waste description.

- Sample description: Dark brown sludge
- Additional information: Yeast-like odour.
- **pH** (Aqueous Leach) @ 25°C: **4.3**.
- **Moisture** (% m/m): **66**.
- Calorific Value (MJ/kg): No CV.
- **Total Organic Carbon (TOC)** (% g/g): **41**

- Confirmatory analysis is required for Type 0 and Type 1 wastes treated in order to achieve a lower final Waste Type and Landfill Class. Where applicable, this Waste Assessment and Classification report and associated Safety Data Sheet will be updated.
- Prohibited or restricted under GN R636 (5) Waste Disposal Restrictions, but assessed as a different waste type under GN R635 (7). Subject to waste treatment and re-assessment per GN R634, the prohibition or restriction may be excluded.
 - Type 0 Waste
 - chemically assessed as a Type 3 waste; which is low risk waste. however
 - waste is classed Type 0 per prohibited characteristics GNR 636 (1)(b), (1)(c), (1)(q)(ii)
- Waste listed in GN R636 Section 5 (1) and (2), with future prohibition from or restriction to disposal: Future Prohibited Waste per GN R636 (5)(1)(r)(iv) >6% Total Organic Carbon (TOC). Non-hazardous waste with analytical value of: 41 %. (Prohibited from: Aug 2028).

ii. GHS Classification and Hazard Management. (refer to the Safety Data Sheet SDS Attachment 2c):

- Classification in accordance with SANS 10234:2019 concluded that:
 - **Physical: Flammable liquid and vapour: H226 Cat 3. Flashes at 60°C**

- Health NONE
 - Environmental NONE.
 - Conclusion: **Hazardous.**
 - **Uses advised against:** KEEP AWAY FROM clothing. DO NOT eat, drink or smoke when using this product. AVOID release to the environment. Collect spillage.
- iii. **SANS 10228:2012 Classification for Transport**
- **Class 4.1. UN Number 3175:** SOLIDS CONTAINING FLAMMABLE LIQUID, N.O.S Packing Groups I, II or III. Not applicable for Class 4.1.

Table 1: Showing the GHS classification hazard/s

Hazard	Code	Hazard effect	Class/Statement
Physical:	H226 Cat 3.	Flashes at 60°C	Flammable Liquid.. Flammable Liquid and vapour.
Health	-	None Identified	-
Environment	-	None Identified	-
Conclusion	Hazardous - by way of above properties and/or effects.		

iv. **Uses advised against:**

- WASTE - if a commercial product residue, not intended for original use.
- KEEP AWAY FROM clothing.
- Take precautionary measures against static discharge.
- DO NOT eat, drink or smoke when using this product.
- AVOID release to the environment. Collect spillage.

7.4. Precautionary Measures

(refer to SDS for full description of hazards and risks)

7.4.1. Prevention

- KEEP AWAY FROM clothing.
- Keep container tightly closed.
- Ground/bond container and receiving equipment.
- Take precautionary measures against static discharge.
- AVOID breathing dust, fume, gas, mist, vapours, spray.
- DO NOT get in eyes, on skin, or on clothing.
- DO NOT eat, drink or smoke when using this product.
- AVOID release to the environment.
- Wear protective gloves, protective clothing, eye protection, face protection

7.4.2. Responses

- Get medical advice / attention if you feel unwell.
- Fight fire with normal precautions from a reasonable distance.
- Collect spillage.

- IF SWALLOWED: Call a POISON CENTRE or doctor/physician if you feel unwell.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- IF ON SKIN (or hair): IMMEDIATELY remove/take off all contaminated clothing. IMMEDIATELY rinse skin with water/shower.
- IF INHALED: Call a POISON CENTRE or doctor/physician if you feel unwell
- If exposed or concerned: Call a POISON CENTRE or doctor/physician.

7.4.3. First-aid measures

Immediate actions: IF ON SKIN (or hair): IMMEDIATELY remove/take off all contaminated clothing. IMMEDIATELY rinse skin with water/shower. If exposed or concerned: Call a POISON CENTRE or doctor/physician..

Actions to be avoided: DO NOT eat, drink or smoke when using this product. AVOID release to the environment.

Inhalation: AVOID breathing dust, fume, gas, mist, vapours, spray. IF INHALED: Call a POISON CENTRE or doctor/physician if you feel unwell.

Skin Contact: Keep away from clothing. DO NOT get in eyes, on skin, or on clothing. Wear protective gloves, protective clothing, eye protection, face protection.

Eye Contact: DO NOT get in eyes, on skin, or on clothing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Ingestion: DO NOT get in eyes, on skin, or on clothing. IF SWALLOWED: Call a POISON CENTRE or doctor /physician if you feel unwell.

7.4.3. Fire Fighting

Use extinguishing media suitable to the surrounding fire.

Protection of fire-fighters: KEEP AWAY FROM clothing. Take precautionary measures against static discharge. AVOID breathing dust, fume, gas, mist, vapours, spray. Fight fire with normal precautions from a reasonable distance.

7.4.4. Accidental release measures

Responders, personal precautions, PPE: KEEP AWAY FROM clothing. Wear protective gloves, protective clothing, eye protection, face protection.

Environmental precautions: AVOID release to the environment. Collect spillage.

Methods and materials for containment and for clean-up: Take precautionary measures against static discharge.

7.4.5. Safe Handling and Storage

Safe handling: Keep container tightly closed. Ground/bond container and receiving equipment. Take precautionary measures against static discharge. DO NOT get in eyes, on skin, or on clothing. DO NOT eat, drink or smoke when using this product. AVOID release to the environment. Wear protective gloves, protective clothing, eye protection, face protection.

Safe storage: Store in a well-ventilated place and keep cool.

Technical measures: No data available

Incompatible materials: No data available

Packaging: No data available.

Additional information: Eating, drinking and smoking in work areas is prohibited. Remove contaminated clothing and protective equipment, and wash hands after use and before entering eating areas.

7.4.6. Exposure controls and Personal protection (PPE)

PPE:

Respiratory: Use respiratory protection approved under appropriate government standards

Hand/Arm: Handle with gloves approved under appropriate government standards.

Eye/Face: Use equipment for eye protection tested and approved under appropriate government standards.

Skin/Body: Wear protective clothing

Hygiene: Handle in accordance with good hygiene and safety practice. Wash hands before and after handling.

Special conditions posing a hazard: KEEP AWAY FROM clothing. Ground/bond container and receiving equipment.

7.4.7. Stability and reactivity

Conditions to avoid: Heat

7.4.8. Disposal Considerations.

As given above in section 7.3 on waste descriptions.

Safe, environmentally preferred disposal: Dispose of contents/container to an approved facility in accordance with all applicable regulations and landfill requirements

Additional information: Do not fly tip. Do not dispose into sewer, stormwater, or environment. Do not burn unless by means of compliant incineration practices.

7.4.9. Transport Information.

Refer to SDS.

8. CHEMICAL AND TECHNICAL SPECIFICATIONS – PRE-BENEFICIATION

8.1. Introduction

The basis of the leachability of the filter cake was in anticipation of the environment of the landfill site with putrescible waste and hence to low pH leaching conditions. The leachate pH of the filter cake is 5.6, hence it is low. The leachability test was done with leaching liquid at pH 5.

- Total concentrations for the filter cake were determined as per NEM:WA - National norms and standards for the assessment of waste for landfill disposal. The quantitative results present the hazard risk to all stakeholders as well as the landfill site containment when exposed directly to the filter cake. The GHS classification for the hazard of filter cake is presented in Section 7.3. (ii). The filter cake was given a

hazardous classification for the physical aspect of the waste. **Physical: Flammable liquid and vapour: H226 Cat 3. Flashes at 60°C**

The results for the Total Concentration (TC) and the Leachability Concentration (LC) are presented in Table 2: LC And TC Laboratory Results For The Noodsberg Mil Filter Cake. These were used for the Framework for the Management of Contaminated Land database of the Soil Screening values. The Soil Screening Values (SSV) are the soil quality values, expressed as mass of contaminant per mass of soil, that are:

For SSV1: protective of **both human health and ecotoxicological risk for multi-exposure pathways, inclusive of contaminant migration to the water resource.** Soil Screening Values 1 are applicable to all land-uses, and thus represent an ‘acceptable-risk’ situation, with no adverse effects on human health and the aquatic environment.

For SSV2: that are **protective of risk to human health in the absence of a water resource.** Soil Screening Values 2 are land-use specific and have been calculated for three key land-uses namely, standard residential, informal residential settlements and commercial/industrial land-uses.

This approach was followed because Noodsberg Mill has the intention of giving the filter cake to farmers to apply it to agricultural land as a fertilizer. Hence this provides a valuable tool to assess the risks and the management of the activity and material to the land.

8.2. Laboratory results

The Table 2: LC And TC Laboratory Results For The Noodsberg Mil Filter Cake.

shows the results of the metal and anionic components of the filter cake. No organic components are shown as they are not shown to be above any of the thresholds given from the Norms and Standards Threshold Specifications. For the full results refer to attachments:

- Attachment 2a: (Certificate of Analysis),
- Attachment 2b: (Waste Assessment and Classification),
- Attachment 2c (SDS).

Table 2: LC and TC Laboratory Results For The Noodsberg Mil Filter Cake.

CHEMICAL	LC	TC
	(mgX/l)	(mgX/kg)
Antimony	<0,05	<5
Arsenic	<0,08	<8
Barium	<0,08	20
Boron	0,46	<16
Cadmium	<0,17	<17
Chromium Cr ⁺³	<0,16	<16
Hexavalent Chromium	<0,0031	<0,031
Cobalt	<0,17	<17

CHEMICAL	LC	TC
	(mgX/l)	(mgX/kg)
Copper	<0,17	<17
Lead	<0,08	<8
Manganese	17,3	179
Mercury	<0,0031	<0,31
Molybdenum	<0,31	<31
Nickel	<0,18	<18
Selenium	<0,63	<63
Vanadium	0,04	9,6
Zinc	2,59	22

Chloride	79	-
Cyanide (Total)	0,02	<10
Fluoride	<0,06	<0,6
Nitrate	<0,25	-
Sulphate	<2,5	-
TDS	3839	-

CV	No CV	
Flashpoint at 22 C	No Flash	
FP at 60 C	Flash	
FP at 93 C	Flash	
pH (Aq Leach)@25	4,3	
Moisture	66 %m/m	
TOC	41 % g/g	
Sample description	Dark brown sludge	
Odour	Yeast-like odour	
GN R636 (5)	Disposal Prohibitions, Restrictions	(1)(b), (1)(c), (1)(q)(ii)
	Future Prohibitions, Restrictions	(1)(r)(iv)
GN R634	Overall Waste Disposal to Landfill	Type 0 Waste Prohibited Waste (per GN R636 (5) above)
GN R635 (7)	Waste Type (Chemistry only)	Type 3 Waste (66% moisture content as-received analysis)
GN R636 (4)(1)	Landfill Class (Chemistry)	Class C Landfill

CHEMICAL	LC	TC
	(mgX/l)	(mgX/kg)
	only)	(GLB+)
SANS 10234:2019. GHS Classification	Hazardous: H226. Cat 3	Flammable liquid and vapour
SANS 10228:2012	Dangerous Goods (Road & Rail)	Regulated: UN No. 3175, Class 4.1, PG II

Note:

- i. figures reported as < have a concentration below the detection limit of the laboratory equipment. Hence the figure is given as the very upper limit of the instrument detection limit. The implication of this is that the real figure is most likely much lower than the reported concentration.
- ii. Bold analytical results exceed at least the lowest applicable concentration threshold. Refer to Table 3: Summary Of Soil Screening Values For Contaminated Land And For The Protection Of Water Resources..

8.3. Total concentration and leachable concentration of components in filter cake as a characterisation of the hazard components

The TC and LC concentrations are representative of the components in the filter cake as metallic components and anionic components. The organic component will not be considered as there were no organic components assessed as hazardous from the analytical results. Sugar cane is also a natural material hence there would not be any organic components to be concerned about. Only the inorganic components will be considered.

The filter cake is proposed to be used as a fertilizer on farm fields. There is thus a need to be aware of the effect of these components in the filter cake on the receiving environment; the soil, natural water bodies, the aquatic environment, livestock which may encounter these components.

These are the sources of information for the possible effects that will be used to obtain information to assess the risk of these components:

- Department of Environmental Affairs: Framework For the Management of Contaminated Land. May 2010.
- Department of Environmental Affairs, Government Notices.
 - R. 634: National Environmental Management: Waste Act (59/2008): Waste Classification and Management Regulations.
 - R. 635: National norms and standards for the assessment of waste for landfill disposal.
 - R. 636: National norms and standards for disposal of waste to landfill.

8.4. Soil Screening Values as a basis for developing risk assessment and risk management plans

GHS classification has given the hazard for the filter cake for **human health and the environment** as non-hazardous.

The remediation of contaminated land is being used as a base from which to determine the effects on the environment and related stakeholders due to the possible effects through this medium as a route for exposure of the various components in the filter cake. The water use guidelines also presents a route for the exposure of other stakeholders when exposed..

This work is used to show the values used to assess the risk to the affected areas when the filter cake is applied to the fields.

“Soil Screening Value (SSV)1: soil quality values, expressed as mass of contaminant per mass of soil, that are protective of both human health and ecotoxicological risk for multi-exposure pathways, inclusive of contaminant migration to the water resource.

SSV 1 are applicable to all land-uses, and thus represent an ‘acceptable-risk’ situation, with no adverse effects on human health and the aquatic environment.

SSV 2: soil quality values, expressed as mass of contaminant per mass of soil, that are protective of risk to human health in the absence of a water resource. **SSV 2** are land-use specific and have been calculated for three key land-uses namely;

- standard residential,
- informal residential settlements and
- commercial/industrial land-uses.

(DEA, May 2010)

This approach will be a useful tool to manage the application of the filter cake to the soil, together with the expertise of the agronomist who would know the local soil conditions.

Table 3: Summary Of Soil Screening Values For Contaminated Land And For The Protection Of Water Resources shows the soil screening values for contaminated land and for DWA Water Quality Guidelines levels for aquatic ecosystems protection and domestic water use. (Framework for the Management of Contaminated Land. 2010. p 33)

Table 3: Summary Of Soil Screening Values For Contaminated Land And For The Protection Of Water Resources. (Note, the highlighted numbers from these thresholds represent exceedances of the components in their total concentration. No leachable components were exceeded)

Parameter	SSV1 All Land-Uses Protective of the Water Resource (mg/kg)	SSV2 Informal Residential (mg/kg)	SSV2 Standard Residential (mg/kg)	SSV2 Commercial/ Industrial (mg/kg)	Protection of Human Health (Drinking water usage) (mg/kg)	Protection of Ecosystem Health (mg/kg)
Metals and metalloids						
Antimony	-	-	-	-		-
Arsenic	5,8	23	48	150	5,8	580

Parameter	SSV1 All Land-Uses Protective of the Water Resource (mg/kg)	SSV2 Informal Residential (mg/kg)	SSV2 Standard Residential (mg/kg)	SSV2 Commercial/ Industrial (mg/kg)	Protection of Human Health (Drinking water usage) (mg/kg)	Protection of Ecosystem Health (mg/kg)
Barium	-	-	-	-	-	-
Boron	-	-	-	-	-	-
Cadmium	7,5	15	32	260	7,5	37
Chromium Cr ⁺³	46000	46000	96000	790000	N/A	N/A
Hexavalent Chromium	6,5	6,5	13	40	19	260
Cobalt	300	300	630	5000	-	22000
Copper	16	1100	2300	19000	200	16
Lead	20	110	230	1900	20	100
Manganese	740	740	1500	12000	10000	36000
Mercury	0.93	0,93	1	4,5	1	4,1
Molybdenum	-	-	-	-	-	-
Nickel	91	620	1200	10000	91	1400
Selenium	-	-	-	-	-	-
Vanadium	150	150	320	2600	2000	-
Zinc	240	9200	19000	150000	3700	240
Anions	SSL (mg/kg)					
Chlorides	12 000					
Fluorides	30					
Nitrate/Nitrite	120					
Sulphates	4000					

Two tiers of Soil Screening Value have been defined as follows:

- Soil Screening Value (SSV) 1 represents the lowest value calculated for each parameter from both the Human Health and Water Resource Protection pathways calculations as detailed under the preceding sections. SSV1 values are not land-use specific.
- Soil Screening Value (SSV) 2 represents the land-use specific soil value calculated following the methods as detailed under the preceding sections. SSV2 values are land-use specific and are appropriate for screening level site assessment in cases where protection of water resource is not an applicable pathway for consideration.

Interpretation: The total concentration (TC) values for Arsenic (As), Cadmium (Cd) and Copper (Cu) were exceeded for SSV1, 2 as given in the Table 3: Summary Of Soil Screening Values For Contaminated Land And For The Protection Of Water Resources. above . No leachable components were exceeded.

Hence caution needs to be exercised in exposure to the material to people in the informal and standard residential areas and to be protective of the water resource for human.

The soil screening values for anions given in Table 3: Summary Of Soil Screening Values For Contaminated Land And For The Protection Of Water Resources.

above provides a site specific risk assessment for leaching/migration and transport of the contaminant/s during seasonal variations and the carrying capacity of the water resource.

8.5. Long term stability and functionality

Defining the term “stability” will be understood to mean to retain its physical and chemical character.

Filter cake being a mixture of organic and inorganic components: In terms of stability:

- **Physical stability**, it will remain stable, as there are no hazardous components. HOWEVER, it has a closed cup flash of 60°C. Hence heat, sparks and open flames are triggers for possible fire accidents. The high TOC content also implies that the heat generated from the biological processes within the filtercake pure or filter cake + ash mixture may trigger combustion if the filtercake/mixture is stockpiled in fields and not distributed onto the soils and immediately ploughed in. This includes the ash and filtercake mixture.
- **Chemical stability:**
 - The organic components have constituents that are conducive to microbial and other biological flora and fauna to develop in - hence the use of it as a fertilizer. The organic components will change.
 - Inorganic components: have long term stability and hence their functionality will remain stable.

The functionality of the filter cake will remain good as a fertilizer pre-beneficiation.

8.6. Reactivity with environmental factors

The SDS only cautioned against heat for stability and reactivity.

8.7. Interpretation of results in terms of GHS classification and SSV of contaminated soils.

The results from the GHS classification (refer to Table 1: Showing The GHS Classification Hazard/s) of the filter cake waste shows: hazardous physical hazard, with no health and environmental impacts. The assumption is made that the testing was done with a closed cup flash testing methodology. This requires management with transportation if the filter cake will be transported in a closed container. Thus the gases above the sample ignited with a spark or heat source at 60°C.. There are strict requirements legally for the transportation of the filter cake which must be adhered to. However, the filter cake must be transported in an open to air environment, kept in the open. The filter cake is a rich organic material full of sugars. These will ferment easily and quickly, hence the pH of 4.3. The fermentation process produces gases and flammable liquids. Thus on the farm, this cannot be stored in piles in the fields for any length of time. This will be conducive to elevated temperatures within the body of the filter cake, which can easily exceed 60°C and burn steadily within the body of the filter cake, producing a hazard in the field. There have been incidents

with smouldering filter cake in sugar cane fields where people can fall into the caverns formed by the burnt fibrous filter cake. and get seriously hurt. It is strongly advised to spread the filter cake onto the fields immediately and plough it into the soil without delay.

The agronomist can guide the chemical mix in terms of pH and mineral mix ratios.

The results of the SSV tests gave exceedances of some components for SSV1, 2 and for human health for drinking water and protection of ecosystem health. The runoff water must not be allowed to enter any natural water source. The waste must be managed to not allow run-off near any human habitation viz informal residences.

9. CHEMICAL AND TECHNICAL SPECIFICATIONS – POST-BENEFICIATION

The pre-beneficiation chemical and physical qualities of the filter cake have been described above. Once the filter cake has been applied to the soil, it is anticipated that it will be assimilated into the soil through natural biological processes to produce good sugar cane crop. The effect on the environment will be minimised as well as managed to not impact human health.

The filter cake is a low risk waste stream to be used in agricultural fields with correct physical management.

9.1. Intended users of the waste stream.

The intended use of the waste filter cake is solely for the purpose of soil enrichment. The recipients of these waste streams are primarily large and medium scale private growers. The fields would be far away from any human locations and the correct management would be in place to prevent uncontrolled run-off into natural water courses. The users would be utilising the services of a qualified agronomist

There is no formal training of the intended recipients of the waste, as the application of fertilizer is practiced the same as with commercial fertilizer application.

9.2. Long term stability and functionality.

The filter cake waste stream has been well researched for the intended purpose of soil enhancement in the field of agriculture. All fertilizers, whether from suitable waste streams or manufactured commercial fertilizers are to be utilized by end users under the supervision of agronomists to protect soils and the crops. The filter cake itself is an organic mixture. Hence the filter cake used remains. The functionality of this as a fertilizer requires management and monitoring over time as soil husbandry requires. However, as described above in section 8.7, the filter cake must be managed correctly by ploughing it into the soil immediately upon spreading to prevent any exposure to heat through sparks from say train wheels causing sparks on the railways, or motorists throwing live cigarettes out of the windows.

9.3. Reactivity with environmental factors

Described under pre-beneficiation.

10. IDENTIFICATION OF POTENTIAL RISKS AND THE MANAGEMENT THEREOF.

Refer to

Attachment 3: Risk Assessment Filter Cake Noodsberg Mill

Attachment 4: Risk Management Plan Filter Cake Noodsberg Mill

11. REFERENCES:

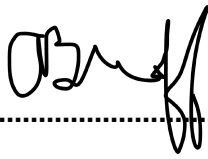
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12. DECLARATION BY SPECIALIST – Anne Bindoff

All information and instructions provided in this report in respect of the Risk Assessment and Risk Mitigations/Management Plan is given in terms of the provisions of the National Environmental Management: Waste Act (59/2008): Regulations regarding the exclusion of a waste stream or a portion of a waste stream from the definition of waste.

Information and data is based on available information given by Illovo Noodsberg Mill and is the best information available through general research based on this information as at the date of this report. It is presented in good faith, to be correct.

Name: Anne Bindoff

Signature:


Date: 5th June 2023