



Reg no: 2014/011805/07

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

for

## **ILLOVO SUGAR (SOUTH AFRICA) (PTY) LTD - ESTON SUGAR MILL.**

by

**Anne Bindoff**

**Anne Bindoff Consultancy.**

**May 2023**

**Revision 2.**

**Address:** PO Box 1794,  
Umhlanga Rocks, 4320.

**Cell:** (083) 655-1132  
**Mail:** [annebc@cykelbin.co.za](mailto:annebc@cykelbin.co.za).  
**Web:** [www.etremkards.co.za](http://www.etremkards.co.za).

## TABLE OF CONTENTS

TABLE OF CONTENTS .....	- 2 -
LIST OF TABLES.....	- 4 -
LIST OF FIGURES.....	- 4 -
LIST OF ATTACHMENTS.....	- 4 -
Details of the specialist .....	- 5 -
1. INTRODUCTION.....	- 6 -
2. LEGISLATIVE FRAMEWORK .....	- 8 -
2.1. Acts: .....	- 8 -
2.2 National Norms and Standards. Listed Activities and other relevant documents .....	- 8 -
3. ESTON MILL SITE AND CONTACT DETAILS .....	- 9 -
4. ILOVO INTEGRATED MANAGEMENT SYSTEM .....	- 9 -
5. FACILITY WASTE GENERATING PROCESS .....	- 10 -
5.1. Brief overview .....	- 10 -
5.2. Waste stream - Filter cake .....	- 10 -
5.3. Process description to produce filter cake .....	- 10 -
6. CONSEQUENCES OF NOT RECYCLING OR REUSING THE FILTER CAKE .....	- 15 -
6.1 Benefits of reuse and recycling.....	- 15 -
7 METHODOLOGY USED TO ASSESS THE CHEMICAL/HAZARDOUS NATURE OF THE WASTE TO BE EXCLUDED. ....	- 17 -
7.1 Rationale .....	- 17 -
7.2 Characterisation of the waste .....	- 18 -
7.3. Results.....	- 18 -
7.3.4. GHS Classification and Hazard Management. ( <i>refer to the Safety Data Sheet SDS</i> ):-	19 -
7.4. Precautionary Measures.....	- 20 -
7.4.1. Prevention.....	- 20 -
7.4.2. Responses .....	- 20 -
7.4.3. First-aid measures.....	- 20 -
7.4.4. Fire Fighting .....	- 21 -
7.4.5. Accidental release measures: .....	- 21 -
7.4.6. Safe Handling and Storage.....	- 21 -
7.4.7. Engineered controls:.....	- 21 -
7.4.10. Stability and reactivity .....	- 21 -

7.4.11. Disposal.....	- 21 -
8. CHEMICAL AND TECHNICAL SPECIFICATIONS – PRE-BENEFICIATION .....	- 22 -
8.1. Introduction .....	- 22 -
8.2. Laboratory results .....	- 22 -
8.3. Total concentration and leachable concentration of components in filter cake as a characterisation of the hazard components. ....	- 24 -
8.4. Soil Screening Values as a basis for developing risk assessment and risk management plans. ....	- 24 -
8.5. Long term stability and functionality .....	- 26 -
8.6. Reactivity with environmental factors. ....	- 26 -
8.7. Interpretation of results in terms of GHS classification and SSV of contaminated soils....	- 26 -
9. CHEMICAL AND TECHNICAL SPECIFICATIONS – POST-BENEFICIATION .....	- 27 -
9.1. Intended users of the waste stream.....	- 27 -
9.2. Long term stability and functionality.....	- 27 -
9.3. Reactivity with environmental factors. ....	- 27 -
10. IDENTIFICATION OF POTENTIAL RISKS AND THE MANAGEMENT THEREOF .....	- 27 -
11. OVERVIEW.....	- 28 -
12. REFERENCES:.....	- 28 -
13. DECLARATION BY SPECIALIST – Anne Bindoff .....	- 29 -

## **LIST OF TABLES**

**Table 1:** Summary of filter cake hazard classification

**Table 2:** LC and TC laboratory results for the ESTON MILL filter cake

**Table 3:** Summary of soil screening values (SSV) for Contaminated Land and for the protection of water resources

## **LIST OF FIGURES**

**Figure 1:** Google Earth photo of the Eston Sugar Mill in Eston: KZN.

**Figure 2:** Eston Sugar Mill, Natal Midlands, KwaZulu-Natal

**Figure 3:** Eston Mill Process Flow Diagram Showing Detail

**Figure 4:** Eston Mill Factory Layout

**Figure 5:** Sugar production process flow chart showing filter cake generation

## **LIST OF ATTACHMENTS**

**Attachment 1:** Eston Mill Process Flow Diagram Showing Detail

**Attachment 2:** Eston Mill: Process flow chart showing the generation of waste streams

**Attachment 3:** Sugar Making Process at Eston Mill

**Attachment 4:** Waste Management Document

**Attachment 5:** Pollution Management Document.

**Attachment 6:** Illovo Group Code Of Conduct And Business Ethics

**Attachments 7a:** Filter cake Safety Data Sheet SDS

**Attachments 7b:** Certificate of Analysis

**Attachments 7c:** Waste Assessment and Classification

**Attachment 8:** Risks Assessment

**Attachment 9:** Risk Management Plan

## 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 SUMITOMO MILL waste ash 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 the 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 Illovo Sugar (South Africa) (Pty) Ltd - Eston Sugar Mill is the newest in the KwaZulu-Natal sugar industry, having been commissioned in 1995 to replace the old mill at Illovo. The mill is situated along Eston Road within the Midlands area of the Mkhambathini Municipality, KwaZulu Natal and can be located at the following GPS coordinates: 30° 31' 42.9924" E, 29° 52' 8.2812" S. As illustrated in Figure 1 below, the mill is surrounded by farms and agricultural activities.



**Figure 1:** Google Earth photo of the Eston Sugar Mill in Eston: KZN.



**Figure 2:** Eston Sugar Mill, Natal Midlands, KwaZulu-Natal  
(<https://showme.co.za/tourism/eston-sugar-mill-natal-midlands-kwazulu-natal/>)

The Mkhambathini Municipality in which the mill is located, is largely rural in nature and underdeveloped. The presence of the mill supports the local communities through the employment it offers directly at the mill, the sugar cane farmers and the local community members that supply services to the community such as shops, doctors, contractors, schools, etc. The mill also funds one of KwaZulu-Natal's major mountain bike events i.e. the Eston Illovo Mountain Bike Challenge, which attracts riders from all around the country on an annual basis.

The mill crushes about 1.26 million tons of cane and produces 125,000 tons of sugar per annum. This in turn produces large quantities of waste 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 the 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.
- Dept Of Water Affairs (DWA):
  - National Water Act (NWA): (Act 36 of 1998)
  - Water Quality Guidelines. 1996. Various.
  - Guidelines for the Utilisation and Disposal of Wastewater Sludge. Vol 1 - 5.
- 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)(2<sup>nd</sup> ed)**: Globally Harmonized System (GHS) of Classification and Labelling of Chemicals .
- **GHS**: UN Standards Purple Book 9<sup>th</sup> ed.
- **Dept of Labour**: Regulations For Hazardous Chemical Agents, 2021.
- **WHO**: Guidelines for Drinking-water Quality. FIRST ADDENDUM TO THIRD EDITION. Volume 1. Recommendations (3<sup>rd</sup> ed.)



### 3. ESTON MILL SITE AND CONTACT DETAILS

**Name:** Illovo Sugar (South Africa) (Pty) Ltd – Eston Sugar Mill.

**Physical location:** Eston Road, Eston, 3740, Camperdown Rural District, Eston, KZN Midlands, South Africa.

**Postal Address:** Private Bag X2, Eston, 3740

**Phone number:** 031 781 8300

**Contact person:**

**Name:** Shaun Ramsunder

**Portfolio:** Country SHERQ Manager

**General Mill Contact no:** 033-5029500

**Mobile:** 084 554 9664

**Email:** [SRamsunder@illovo.co.za](mailto:SRamsunder@illovo.co.za)

### 4. ILLOVO INTEGRATED MANAGEMENT SYSTEM

As part of the mill operations, the Illovo Integrated Management System which includes the SHERQ Management Systems has been adopted for best practice in the industry and is adhered to by all its sugar mills. In relation to environmental responsibility, the following is an extract from Illovo's Code of Conduct and Business Ethics (see Attachment 6).

#### 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**

Refer to Figures 3 and 4 below which illustrates the overall process flow diagram of the Eston Mill as well as to Attachment 3: Sugar Making Process. It must be noted that for the purpose of this report and application for waste exclusion, a brief overview of the main processes that generate the waste streams have been discussed below.

### **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**

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

### **5.3. Process description to produce filter cake**

Refer to the process flow chart: Figure 3/Attachment 1: Eston Mill Process Flow Diagram Showing Detail and Figure 4/Attachment 2: Eston Mill: Process flow chart showing the generation of waste streams.

The cane is delivered to the cane yard and is directed into mechanical chopping with cane knives where the cane is chopped into manageable pieces and then shredded with a series of hammers which flatten the cane to expose the cells in the cane for the next process. The diffuser has a conveyor inside which carries the shredded cane through the diffusion process. Hot sugar water known as "scolding juice" is poured onto the beginning to raise the temperature of the cane / water mixture in the diffuser and to help kill bacteria which will eat the sucrose and convert into undesirable invert sugars. The diffuser is a fairly simple looking machine with a complex operation. Water from the "de-watering mills" and fresh water are fed into the process and this water or "Imbibition" is fed back in stages toward the beginning of the diffuser so that the most concentrated juice is at the beginning and the weakest at the end.

The pulp leaving the diffuser is now known as "Bagasse". There is a last wash process to extract the last sucrose. which then feeds the first de-watering mill. Here water is added to try and extract the last of the sucrose. The mill presses the water out and it is collected and sent back to the diffuser. The first de-watering mill sends its bagass load to the second and last de-watering mill. Once again, water is added, more sucrose is extracted and the water sent back to the diffuser. The water from the mills, which is sent back to the diffuser, is known as "press water".

At this point the stream is split in two:

- The pressed cane is squeezed out to between 48 - 52% moisture then becomes bagasse. The bagasse is fed into the boilers as the main fuel source to the mill boilers to provide energy to drive the mill processes.
- This second stream is the juice stream, from the diffuser conveyor and the Oliver filters. Once fibre has been removed and sent to the bagasse stream, the juice goes through a few processes by adding additives such as:
  - Indion resins for the ion exchange process to decolourise the brown sugar (sugar melt) to white sugar.
  - Phosphoric acid added to the juice to optimize the natural phosphates in the juice.
  - This juice is then heated up, milk of lime is added to precipitate part of the colloids, colouring matter and non-sugars that the juice contains. The precipitate formed with lime is mainly Tricalcium Phosphate. ( $\text{Ca}_3(\text{PO}_4)_2$ ).
  - The mixed juice is then in the process of being clarified by flocculating out the non-sugars. It is then flashed to atmospheric pressure to release any air bubbles .
  - Flocculant is then added to allow completion of the flocculation process.

The juice is then sent to the clarifier which is then separated out as clear juice as the overflow and mud in the underflow. The mud is sent to the Oliver Filters where any remaining sugar is separated from the mud by the addition of steam and hot water. The filtrate is returned to the sugar juice stream and the solid fraction is now known as filter cake. The filter cake is thus a rich mix of a variety of natural sugar cane based organic chemicals and inorganic chemicals.

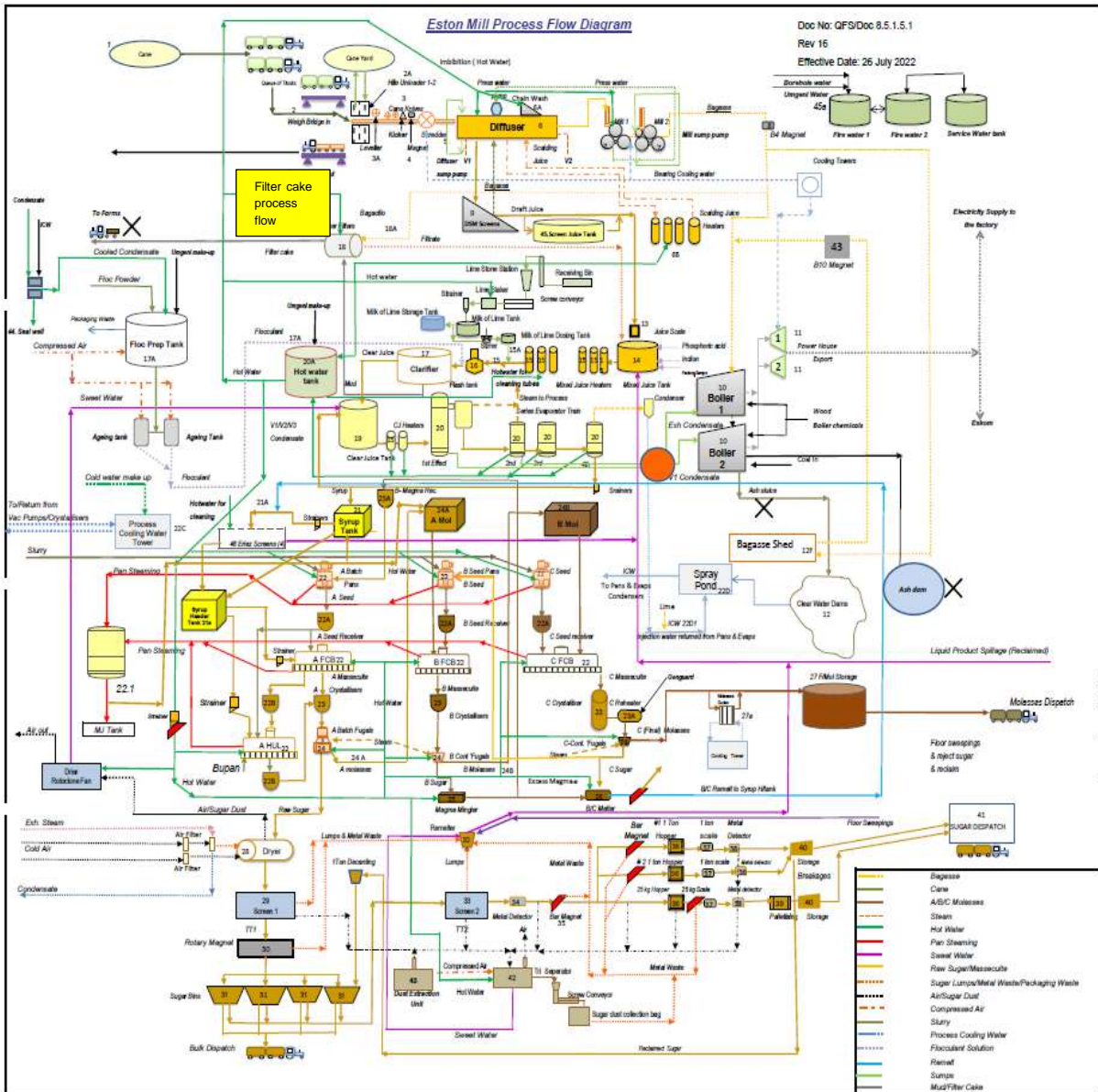


Figure 3: Eston Mill Process Flow Diagram Showing Detail

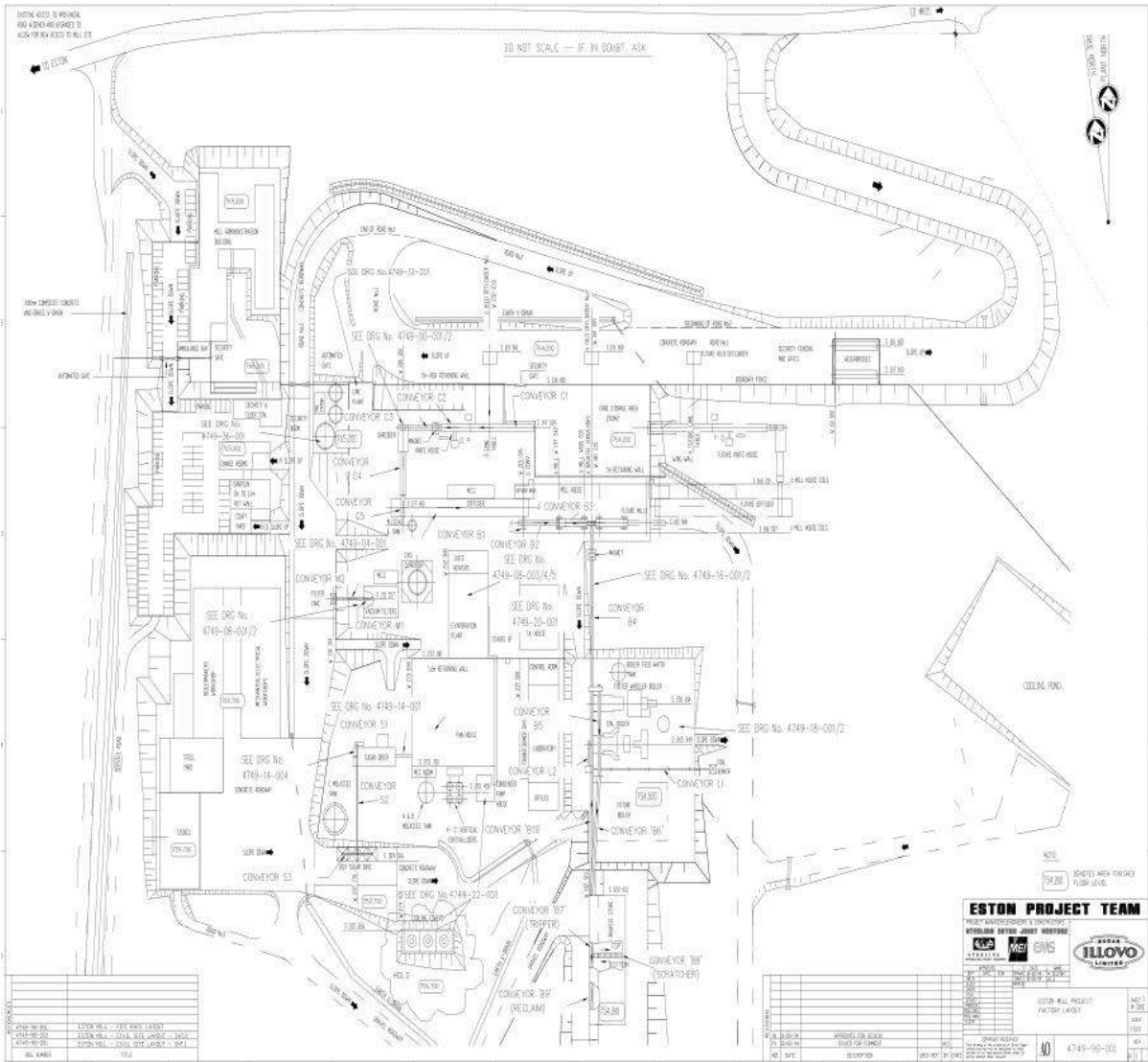


Figure 4: Eston Mill Factory Layout

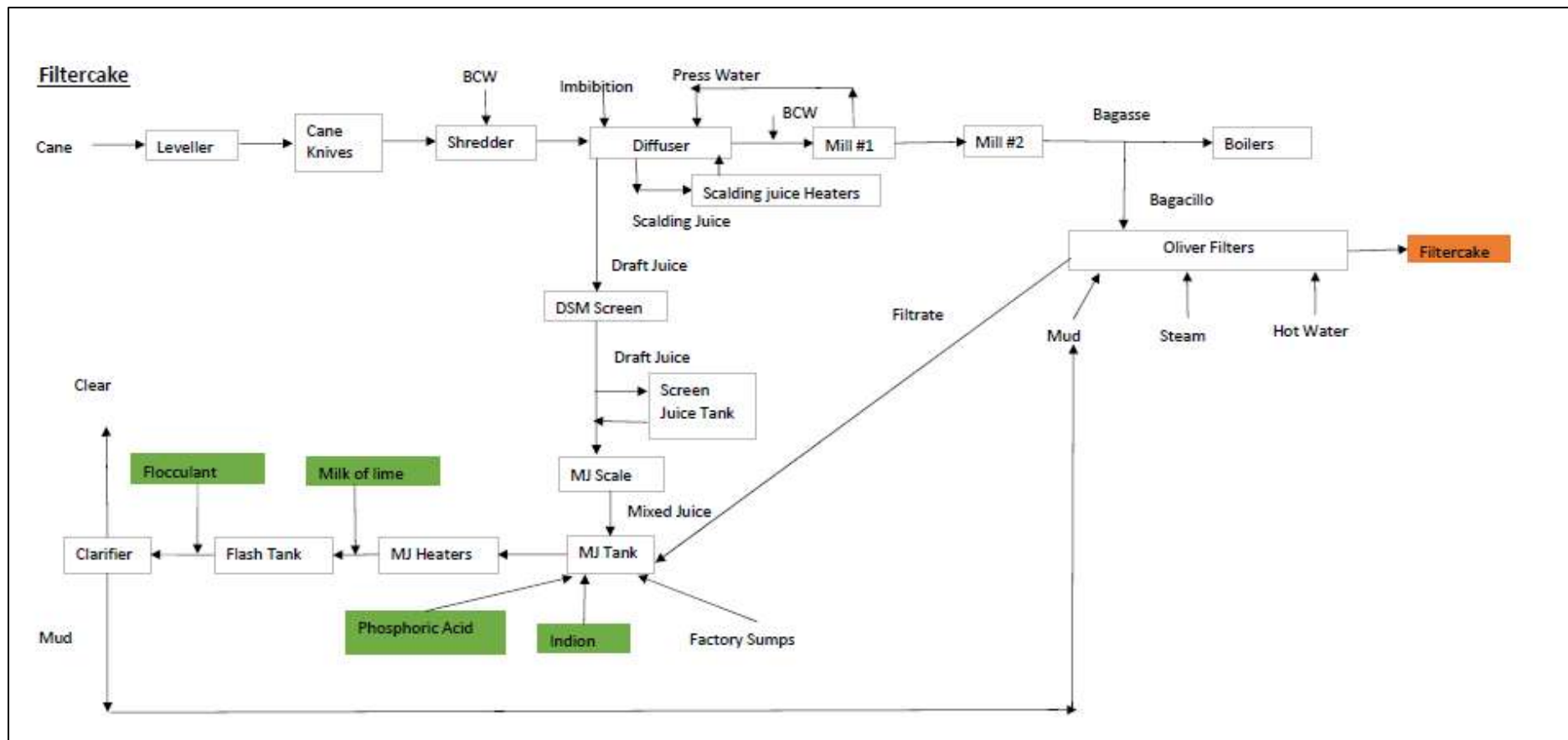


Figure 5: Eston Mill: Process flow chart showing the generation of waste streams

## 6. CONSEQUENCES OF NOT RECYCLING OR REUSING THE FILTER CAKE

The filter cake is a waste product. The only recourse for the filter cake if not recycled or reused is disposal to landfill. Landfilling is the option chosen by many to dispose of waste as the easiest option. Unfortunately landfilling is a waste management process that uses up airspace. 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 benefitiate the waste in a responsible manner i.e. to benefitiate the waste as a resource for soil enhancement for sugar cane farms.

Should farmers not get access to this free resource, then there is a cost incurred to them to buy commercial fertilizer. Fertilizers globally are increasing in cost significantly, hence more of the farmers budget would be spent on this cost. This is a cost that would be needed elsewhere to develop the farm and hence employ more people.

The requirement of Eston Mill to dispose of the ash to a permitted and properly managed landfill site costs the company in terms of:

- Landfilling fees
- Fuel which is changing and generally increasing monthly
- Driver salaries
- Truck wear and tear and maintenance
- Travelling distance
- This waste stream is prohibited/restricted from disposal to a landfill site based on the NEM:WA Regulation 636: National Norms and Standards for disposal of waste to landfill, hence needs to either be treated or benefitiated. See details on prohibition below:  
**GN R636 S.5: Current Prohibition/Restriction** from Disposal:  
**(1)(b)**, Waste with a pH value: < 6 or >12. Making it a hazardous waste.  
**(1)(q)(ii)**. Waste with a moisture content >40% (filter cake moisture = 71%).  
**GN R636 S.5: Future Prohibition/Restriction** from Disposal:  
**(1)(r)(iv)**: Hazardous waste with a calorific value of: > 6% TOC.

### 6.1 Benefits of reuse and recycling

The benefits of reusing and recycling the filter cake aligns with the objectives of the South African National Waste Management Strategy (NWMS) - 2020 and are also aligned with the Sustainable Development Goals (SDG) 2030. Examples of the relevant SDG's:

- **SDG 3**: To avoid/minimize waste related environmental factors that prevent ill-health and disease.
- **SDG 6**: Clean water and sanitation through:
  - Minimising discharge of wastewater from. Human activities into rivers/oceans/dams.
  - Supporting sustainable management of water to better manage food production.
- **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 National Waste Management Strategy (NWMS 2020) provides government policy and strategic interventions for the waste sector and is aligned and responsive to the Sustainable Development Goals (SDGs) of Agenda 2030 adopted by all United Nations (UN) member states. It is also aligned and responsive to South Africa's National Development Plan (NDP): Vision 2030 which is our country's specific response to, and integration of the SDGs into our overall socio-economic development plans.”

“Most importantly the 2020 strategy has the concept of the "**circular economy**" at its centre. The circular economy is an approach to minimising the environmental impact of economic activity by reusing and recycling processed materials to minimise: (a) the need to extract raw materials from the environment; and (b) the need to dispose of waste. “the historical development of waste management on South Africa. This gives a clearer understanding of the development towards a resource-based economy which will create more opportunities in the waste sector in South Africa)

The NWMS 2020 strategy is directing South Africa to a future with zero waste in landfills. This will be achieved through eight strategic goals, two 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.

Hence from these legislative and internationally aligned development goals; the re-use of the filter cake benefits Eston Mill by the cost savings of diverting from landfilling and promotes job creation by employment of people within the agricultural sector and the communities within the area. The cost savings will also be realised by the farmer by not having to buy commercial fertilizer. By correct management of the waste, the potentially hazardous components will not be an environmental hazard.

Research work papers on the use of the filter cake is summarised below:

- “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 which 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)).

- “...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 crop residues and the sugar industry by product (filter cake) as the raw sources of livestock feeds”. (Abera, A.A., et.al., (August 27<sup>th</sup> 2020)).
- “In saline/sodic soil conditions the incorporation of filter cake 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 filter cake lasts considerably longer than filter cake incorporated into the soil surface. “
- “Other characteristics have been described in this paper for the positive benefits of application of filter cake to soils for the sugarcane crop including: yield responses in specific soil groups showing the best results. Effect on sucrose when adding filter cake and how to manage the consequences, the effects of parasitic pests are also described. The effect of flyash to the filter cake is described. (de Mello Prado, et. al. (Published 30 Jul 2013)).

There is sufficient evidence for the benefit of this using filter cake on the sugar cane fields. However, the advantage of this waste stream in its diverse uses does give an indication of the benefit to the broader community within the Illovo Eston area. The filter cake could be used for community development in terms of:

- Alternative agricultural crops
- For livestock feed
- For the community to be able to have self-supporting gardens to grow their own vegetable crops.

To be able to benefit from this opportunity, the filter cake will need to be characterised for its chemical and physical character to manage it to prevent human and environmental harm. The following section describes this process and hence the nature of the waste.

## **7 METHODOLOGY USED TO ASSESS THE CHEMICAL/HAZARDOUS NATURE OF THE WASTE TO BE EXCLUDED.**

### **7.1 Rationale**

Research work has been done for the use of filter cakes on agricultural crops. This has been described in the previous sections. There are promising results that this may be successful with proper understanding of the chemical makeup of the filter cake. To understand the potential implications on the environment, this section focuses on the chemical makeup of the filter cake and the potential hazards and risks these pose in its proposed application.

The filter cake waste is to be used as a fertilizer as a mixture with waste boiler ash obtained from the boiler waste stream in the milling process.

The chemical composition of the filter cake needs to be qualified and quantified. Using the guidelines, the risk assessment and a risk management plan can be formulated to minimise any harm to people and the environment.

## 7.2 Characterisation of the waste

The waste has been sampled on 1<sup>st</sup> September 2022, sent to an 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, and
- For assessment for waste type and landfill class using the **NEM:WA Norms and Standards Regulations** for assessment and classification of waste.

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 of assessment are found in:

- Attachments 7a: Filter cake Safety Data Sheet SDS
- Attachments 7b: Certificate of Analysis
- Attachments 7c: Waste Assessment and Classification

The second approach is to determine the hazard thresholds of the chemicals on the 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 analytical results are then examined to determine what, if any, risks there are to people and to the environment, and what the hazards are if any. The filter cake is then managed appropriately using the mitigation/management provided in the SDS 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

NOTE: for the complete results, refer to: attachments:

- Attachment 7a: Boiler Ash Safety Data Sheet.
- Attachment 7b: Certificate of Analysis,
- Attachment 7c: Waste Assessment and Classification.

The following sections describes briefly the results of the chemical analyses and the conclusions from the assessments.

#### 7.3.1. Waste description:

- The filter cake is a combination of mud solids and filter aids from mud filtration of sugarcane clear juice.
- Sample description: Grey to black solid with visible mould.
- Additional information: Fermented odour.
- pH (Aqueous Leach) @ 25°C: 5.6.
- Moisture (% m/m): 71.
- Calorific Value (MJ/kg): No CV.
- Total Organic Carbon (TOC) (% g/g): 70

**7.3.2. Waste assessment to landfill:** Based on GN R635 (7)(2), the overall waste is assessed as a Type 0 waste, which is Very high risk.

**7.3.3. It is chemically assessed as TYPE 3 waste which is low risk.**

#### Notes:

- 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: Based on GN R635 (7)(2), the waste is:
  - Chemically assessed as a Type 3 waste; which is low risk waste, however
  - waste is classed Type 0 per prohibited characteristics GNR 636 (5)(1)(b) and (5)(1)(q)(ii) - refer to section 1.2 of the classification report.
- 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: 70 %. (Prohibited from: Aug 2028).

#### 7.3.4. GHS Classification and Hazard Management. (refer to the Safety Data Sheet SDS):

- Classification in accordance with SANS 10234:2019 concluded that:
  - Physical: none
  - Health: none
  - Environmental: none
  - Hazards were identified due to the exclusion or non-identification of hazardous properties or effects assessed. Non-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.

**Table 1:** Summary of filter cake hazard classification

<b>Classification in accordance with SANS 10234:2019:</b>	
Physical	Not classified
Health:	Not classified
Environment	Not classified
<b>Overall classification:</b>	Not Hazardous.
<b>Non GHS hazard/s</b>	Not specified due to classification; apply reasonable care

#### **7.4. Precautionary Measures**

Refer to the Safety Data Sheet (SDS) for the full management methodology.

##### **7.4.1. Prevention**

- Keep away from clothing.
- 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.

##### **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 exposed or concerned: call a poison centre or doctor/physician.

##### **7.4.3. First-aid measures**

**Immediate actions:** 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.

**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.

##### **Anticipated effects and symptoms summaries**

**Acute effects:** Not specified due to classification; apply reasonable care.

**Delayed effects:** Not specified due to classification; apply reasonable care.

**Symptoms/Effects:** Not specified due to classification; apply reasonable care.

#### 7.4.4. Fire Fighting

**Use extinguishing media suitable to the surrounding fire.**

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

#### 7.4.5. Accidental release measures:

**Responders, personal precautions, PPE:** keep away from clothing.

**Environmental precautions:** avoid release to the environment. Collect spillage.

**Methods and materials for containment and for clean-up:** not specified due to classification; apply reasonable care.

#### 7.4.6. Safe Handling and Storage

**Safe handling:** 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.

**Safe storage:** not specified due to classification; apply reasonable care.

**Technical measures:** not specified due to classification; apply reasonable care.

**Incompatible materials:** not specified due to classification; apply reasonable care.

**Packaging:** not specified due to classification; apply reasonable care.

**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.

#### 7.4.7. Engineered controls:

**PPE:** Not specified due to classification; apply reasonable care.

**Respiratory:** Not specified due to classification; apply reasonable care.

**Hand/Arm:** Not specified due to classification; apply reasonable care.

**Eye/Face:** Not specified due to classification; apply reasonable care.

**Skin/Body:** Not specified due to classification; apply reasonable care.

**Hygiene:** Not specified due to classification; apply reasonable care.

**Special conditions posing a hazard:** KEEP AWAY from clothing.

#### 7.4.10. Stability and reactivity

No issues noted only for the instruction: Not specified due to classification; apply reasonable care.

#### 7.4.11. Disposal

- Dispose of contents/container to an approved facility in accordance with all applicable regulations and landfill requirements per the waste's safety data sheet's Section 13.
- Refer to the current and future disposal restrictions/prohibitions for legal disposal as given in the waste assessment to landfill results.
- Additional information: Do not fly tip. Do not dispose into sewer, stormwater, or environment. Do not burn unless by means of compliant incineration practices.

## 8. CHEMICAL AND TECHNICAL SPECIFICATIONS – PRE-BENEFICIATION

### 8.1. Introduction

The filter cake prior to being beneficiated is represented in the laboratory analyses data (TC and LC). The basis of the leachability tests on the filter cake was in anticipation of the environment of the landfill site with putrescible waste and hence to low pH conditions. The leachability test was done with leaching liquid at pH 5. The leachate pH of the filter cake is 5.6, hence it is low.

(Refer to Attachment 7b– Certificate of Analysis and Attachment 7c Waste Assessment and Classification Report)

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 data obtained represent the hazard risk to all stakeholders when exposed directly to the filter cake. These exposures have been given toxicity values. The GHS classification for the hazard of filter cake is presented in Table 1. Based on this, the filter cake was given a **non-hazard** classification for people's health and the environment.

The results for the Total Concentration (TC) and the Leachability Concentration (LC) are presented in Table 2. These were used for the Framework for the Management of Contaminated Land database of the Guideline 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 mill has the intention of applying the filter cake 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

Table 2 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 in the Norms and Standards threshold Specifications.

**Table 2:** LC and TC laboratory results for the Eston Mill filter cake.

Chemical	LC (mgX/l)	TC (mgX/kg)
Antimony	<b>&lt;0,05</b>	<5
Arsenic	<b>&lt;0,08</b>	<8
Barium	0,21	20
Boron	<b>0,98</b>	27
Cadmium	<0,17	<17
Chromium Cr <sup>+3</sup>	<0,16	<16
Hexavalent Chromium	<0,0031	<0,031
Cobalt	<0,17	<17
Copper	<0,17	<17
Lead	<0,08	<8
Manganese	<b>16</b>	379
Mercury	<b>0,01</b>	<b>1,3</b>
Molybdenum	<0,31	<31
Nickel	<0,18	<18
Selenium	<0,63	<63
Vanadium	<0,02	<2
Zinc	0,27	26

Chloride	49	-
Cyanide (Total)	<0,01	<10
Fluoride	<0,06	<0,6
Nitrate	<0,25	-
Sulphate	<2,5	-
TDS	<b>7472</b>	-

Note:

- 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.
- Bold analytical results exceed at least the lowest applicable concentration threshold. Refer to:
  - **Attachment 7a:** Filter cake Safety Data Sheet SDS
  - **Attachment 7b:** Certificate of Analysis
  - **Attachment 7c:** Waste Assessment and Classification Report

### **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 anions. 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

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. 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 below 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)
<b>Metals and metalloids</b>						
Antimony	-	-	-	-	-	-
Arsenic	<b>5,8</b>	23	48	150	<b>5,8</b>	580
Barium	-	-	-	-	-	-
Boron	-	-	-	-	-	-
Cadmium	<b>7,5</b>	<b>15</b>	32	260	<b>7,5</b>	37
Chromium Cr <sup>+3</sup>	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	<b>16</b>	1100	2300	19000	200	<b>16</b>
Lead	20	110	230	1900	20	100
Manganese	740	740	1500	12000	10000	36000
Mercury	<b>0.93</b>	<b>0,93</b>	<b>1</b>	4,5	<b>1</b>	4,1
Molybdenum	-	-	-	-	-	-
Nickel	91	620	1200	10000	91	1400
Selenium	-	-	-	-	-	-
Vanadium	150	150	320	2600	2000	-
Zinc	240	9200	19000	150000	3700	240
<b>Anions</b>	<b>SSL (mg/kg)</b>					
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 purpose of the SSV1 and SSV2 values was to provide a guideline for the presence of the contaminants in the soils to exposure within areas given in table 3. Hence, the total concentration values for Arsenic (As), Cadmium (Cd) and Mercury (Hg) were exceeded for SSV1, 2 and for the protection of human health for drinking water. No leachable components were exceeded.

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

The soil screening values for anions given in Table 3 below 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 .**

Reference to section 10 (stability and reactivity ) in the SDS gives the filter cake no specific conditions for concern in the following areas:

- Conditions to avoid,
- Incompatible materials,
- Hazardous decomposition,

The interpretation of this means that the product has long term stability and functionality. The functionality refers to its function that is anticipated in the field as a fertilizer. The functionality of the filter cake will remain good as a fertilizer pre-beneficiation.

#### **8.6. Reactivity with environmental factors.**

There was no toxicological data available from the safety data sheet in Section 11 in terms of human effect on health and on the environment.

The purpose of the waste filter cake is to be reactive to the environment as a fertilizer. It will be applied to the soil on sugar cane farms.

The waste in terms of environmental damage is not a property that is wanted, hence the need to assess the chemical analyses against the guidelines in the contaminated soil rehabilitation.

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

The results from the GHS classification of the filter cake waste as being non- hazardous for any physical, health and environmental impacts. However, the pH is 5,6 which classifies this as a hazardous waste type 0 high risk waste for disposal, and it must be treated before

disposal. The recommendation is to adjust the pH using either ash from the boiler waste stream and/or lime. Note: these recommendations are for the filter cake to be disposed of to a landfill site. There are no environmental hazards nor human health hazards noted.

The results of the SSV tests gave exceedances of some components for SSV1, 2 and for human health for drinking water and natural water source. This requires caution when spreading onto the fields that there be no exposure of the filter cake to natural water sources. The informal settlements and standard residences must also be avoided.

## **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 to be a low risk waste stream to be used in agricultural fields. The application onto the fields must be done under the supervision of an agronomist.

### **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 as well as the miller come planter (MCP) business unit. The fields would be far away from any human locations and the correct management would be in place to prevent any 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.**

Described under pre-beneficiation

### **9.3. Reactivity with environmental factors.**

Described under pre-beneficiation.

## **10. IDENTIFICATION OF POTENTIAL RISKS AND THE MANAGEMENT THEREOF**

The identification of the risks will be based on the:

- Physical, and chemical nature of the filter cake.
- Classification for direct contact through potential exposure routes.
- Comparison with the SSV data, to assess risk to land which may presents health risk and water contamination risk from exposure to the soils.
- Looking at guidelines from the Department of Water Affairs (DWA) and the World Health Organisation (WHO) for specific risks when exposed to the filtercake waste through the water sources.
- Safety, environmental, economic, legal, social, community, operations, impacts.

- Hazards identified in the existing operations:
  - Transportation and
  - The Handling
  - The Treatment During Beneficiation
  - Training
  - Systems gaps

### 10.1. Risk assessment and Risk Management Plan

The Risk Assessment and Risk Management Plan has been compiled in accordance with Departments requirements and templates. Refer to attachments 8 and 9.

## 11. OVERVIEW

This waste stream is generally a low hazard with correct management in place. However for landfill disposal, there are current restriction which prohibit disposal to landfill and there will be future restrictions for the disposal onto landfill.

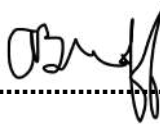
## 12. REFERENCES:

1. <https://www.illovosugarafrica.com/about-us/south-africa>.
2. <https://showme.co.za/tourism/eston-sugar-mill-natal-midlands-kwazulu-natal/>
3. (Abera, A.A., Duraisamy, R.D., Seda, T.B., *Characterization of Sugar Industry Waste (Filter Cake) and Agro-waste Crop Residue as Potential Source of Livestock Feed Raw Materials*. (August 27<sup>th</sup> 2020). Arba Minch University. (<https://orcid.org/0000-0001-8779-8550> ). (<https://doi.org/10.21203/rs.3.rs-36941/v1>).
4. Rabelo, S.C., Rossel, C.E.V., *Industrial Waste Recovery*. Science Direct. Sugarcane, (2015)
5. South African Sugarcane Research Institute (SASRI): June 2003 [https://sasri.org.za/wp-content/uploads/Information\\_Sheets/IS\\_7.4-Filtercake.pdf](https://sasri.org.za/wp-content/uploads/Information_Sheets/IS_7.4-Filtercake.pdf). )
6. de Mello Prado, R., Caione, G. and Silva Campos, C.N., (Published 30 Jul 2013). Department of Soils and Fertilizers, Universidade Estadual Paulista “Júlio de Mesquita Filho”, Via de Acesso Paulo Donato Castellane s/n, 14884-900 Jaboticabal, SP, Brazil. Academic Editor: Philip J. White. *Soil Management for Sustainable Agriculture 2013*. Volume 2013 | Article ID 581984 | <https://doi.org/10.1155/2013/581984>
7. South Africa State of Waste. Final draft report. Department of Environmental Affairs (First published in 2018). ISBN 978-0-621-46843-4. ([https://soer.environment.gov.za/soer/UploadLibraryImages/UploadDocuments/141119143510\\_state%20of%20Waste%20Report%202018.pdf](https://soer.environment.gov.za/soer/UploadLibraryImages/UploadDocuments/141119143510_state%20of%20Waste%20Report%202018.pdf). )
8. DEA. (May 2010). *Framework for the Management of Contaminated Land*. Pretoria: Department of Environmental Affairs.

### 13. DECLARATION BY SPECIALIST – Anne Bindoff

All information and instructions provided in this report in respect of the Risk Assessment and Risk Mitigations/Management Plan substance 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 Eston 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:** 17th May 2023 .....