anne bindoff CONSULTANCY

Reg no: 2014/011805/07

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

for

ILLOVO SOUTH AFRICA (PTY) Ltd
SEZELA SUGAR MILL & DOWNSTREAM PRODUCTION PLANT

by

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Professional Affiliations: RPMASA, 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.
  - **RPMASA:** 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, Gledhow mills.

- Motivation in support of the removal of various waste streams from Umfolozi Sugar Mill.

- **ILLOVO SUGAR MILL:**
  - Motivation in support of the removal of various waste streams from Illovo Sezela Sugar Mill:

1. INTRODUCTION

Sezela is a small town on the mouth of iSezela River in KwaZulu-Natal, South Africa. The town is 78.7 km south of Durban. It is notable for its large sugar mill. In 1915, the Reynolds Brothers opened a sugar mill at Sezela. In 1974 the Furfural plant was built. This was later purchased by C. G. Smith, then by Illovo Sugar Ltd in 1994, and finally by Associated British Foods. (Reference: https://en.wikipedia.org/wiki/Sezela#:~:text=following%20a%20trail.-,History,finally%20by%20Associated%20British%20Foods, and correspondence from Sezela Mill.)

The Illovo Sezela Sugar Mill (ISSM) is located in the Sezela Village, which was built around the mill to house the employees. The Sezela Village is located in the Umdoni local municipality within the Ugu District municipality Kwazulu Natal province. (Reference: https://www.cogta.gov.za/cgta_2016/wp-content/uploads/2021/02/Umdonii-Municipality-20202021-IDP-1-2.pdf.). Sezela is classed as a Natal Coastal cane growing area.

The total population of Umdoni as of 2017 was recorded at 154 427. This constitutes 22% of the total population of the Ugu district. The population in Umdoni grew significantly after 2009 due to in-migration driven by perceived employment opportunities. The Park Rynie industrial development attracted people from surrounding municipalities who sought employment due to the development. The majority of people who are of working age in Umdoni are not economically active. This means that 54% are neither employed nor unemployed. The Municipality is dominated by young people, who are the main driving force behind economic activity in terms of the labour force composition. 11,5% of the economic sector are from agriculture, forestry and fishing activities. 16% constitutes manufacturing of which ISSM forms a big component. (Reference: https://www.cogta.gov.za/cgta_2016/wp-content/uploads/2021/02/Umdonii-Municipality-20202021-IDP-1-2.pdf.).

Figure 1: Google Earth photo of the Illovo Sezela Sugar Mill in Umdoni local municipality within the Ugu District Municipality: KZN; shows the location of the mill and the surrounding areas. The mill is surrounded by:

- The Sezela River Estuary,
- Small village of Sezela,
- Sugar cane.

The mill lies within the Maputaland-Pondoland-Albany Hotspot Region an area described by Conservation International as “Biodiversity Hotspot. The hotspot’s vegetation is comprised mainly of forests, thickets, bushveld and grasslands. It is for this reason that any activities within this area be careful assessed for possible risks and be appropriately managed.

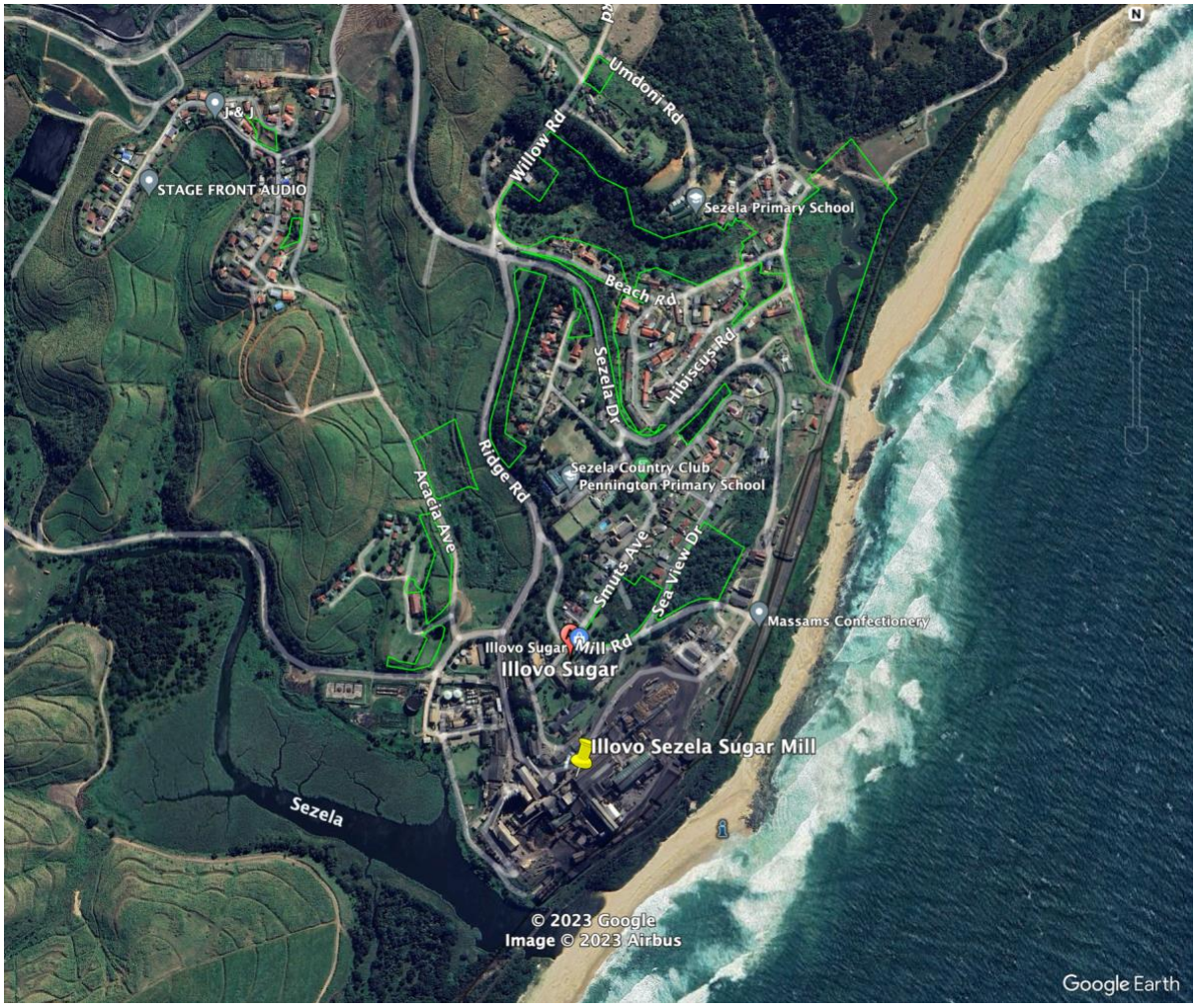

Figure 1: Google Earth photo of the Illovo Sezela Sugar Mill in Umdoni local municipality within the Ugu District Municipality: KZN.

ISSM GPS coordinates 30°24'42.85"S. 30°40'38.96"E.

There are around 72 commercial growers that supply about 721,000 tons of cane and around 3051 small scale growers which supply about 114 000 tons to the mill. The mill crushes approximately 2.05 million tons of sugar cane per annum to produce raw sugar. The Downstream Factory produces approximately 19 500 tons of Furfural and approximately 7000 tons of Furfural Alcohol and smaller quantities of other by-products (Diacetyl, 2.3 PD) dependent on orders. The sugar making process is typically a 38 week crushing season which allows for breakdowns, scheduled maintenance stops and weather interrupted cane supply. The factory is shut down for the rest of the off-season ("off-crop") for maintenance.

The following figure, Figure 2 shows the Google Maps image of the four point pin locations identifying the boundaries of the ISSM filter cake storage area.

Figure 2: Google Maps image of the four point pin locations identifying the boundaries of the ISSM filter cake storage area.

Table 1: GPS co-ordinates of the filter cake storage location in the ISSM site follows below:

Table 1: GPS co-ordinates of the filter cake storage location in the ISSM site.

GPS CO-ORDINATES AT CORNERS OF WASTE GENERATING FACILITY (i.e., filter cake storage area)	Pin Locations	LATITUDE			LONGITUDE		
	A	30°	24'	46,08"S	30°	40'	37.76"E
	B	30°	24'	46.22"S	30°	40'	37.92"E
	C	30°	24'	46.33"S	30°	40'	37.51"E
	D	30°	24'	46.45"S	30°	40'	37.71"E

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 compiled as the basis for the risk assessment and the risk management plan to beneficiate various waste streams. It focuses on managing the filter cake waste stream as a beneficiated product.

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. ILLOVO SEZELA SUGAR MILL CONTACT DETAILS

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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 1: Illovo Group Code of Conduct and Business Ethics).

4.1. Environmental management

Excerpts from the Illovo Group Environmental Management document are given as follows:

- 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.

Illovo has developed its own Integrated Risk Management System (IIRMS) to ensure that the standards to which the business conforms are unified under a single platform, guiding and measuring compliance.

IIRMS guidelines have been developed from best practices in the Illovo Group, and from best practice in their industry where necessary. IIRMS assists in the management of environmental risks at Illovo and ensures that these standards are implemented by the whole group.

Many of the Illovo Group sugar factories already operate to high environmental standards through a circular economy model where outputs such as molasses, vinasse, condensed molasses solids (CMS), bagasse, bagash/boiler ash, and filter cake are turned into co-products; such as energy feedstock, fertiliser, soil conditioning nematodes and bioethanol. This is aligned to the circular economy, meaning that, as much as possible, we eliminate waste, and re-use resources, putting them back into the process.

5. FACILITY WASTE GENERATING PROCESS

Refer to Figure 3: Sezela Process Flow. This illustrates the overall process flow diagram of the mill to produce sugar and the accompanying waste streams: bagasse, filter cake and ash. It must be noted that for the purpose of this report and the application for waste exclusion of filter cake from the definition of waste, a brief overview of the main processes that generate the waste streams have been discussed below.

5.1. Brief overview

The purpose of this section is to satisfy the legal requirement for the description of the components that make up the filter cake waste stream.

5.2. Waste stream - filter cake

The generation of the filter cake waste stream is described in greater detail in section 5.3: Process description to produce sugar, from which the various process streams that make up the filter cake waste stream are formed. The following is a very brief description of the filter cake formation (Refer to Figure 3: Sezela Process Flow):

- The bagacillo stream from the diffusers and the mud from the treated mixed sugar juice clarifier underflow are filtered at the Oliver filters.
- The liquid filtrate from the Oliver Filters is returned to the mixed juice tank. The solids called filter cake is then sent for storage for disposal or beneficiation.

Filter cake is the waste stream relevant to this waste exclusion application, as the proposal for beneficiating use is for soil enhancement/fertilizer for farmers and for nurseries.

5.3. Process description to produce sugar

Refer to Attachment 3: Sezela Mill Process Description.docx for a detailed description of the process.

The following section briefly describes the sugar milling processes to produce raw sugar. The purpose of this section is to given an overall viewpoint of the process to show the inputs into the process to show where and how the various waste streams are generated.

Refer to Figure 3: Sezela Process Flow. The following is the process description obtained from the Sezela Sugar Mill directly.

Note: The detail given in the following section is relevant to the understanding of the waste that makes up the filter cake waste. `some other detail is also given to illustrate the broader economic activity behind the sugar manufacturing process for the purposes of job creation.

5.3.1. Delivery

Sugar cane comes in from the growers by vehicle. The majority of the growers make use of contract haulers while some of the large commercial growers haul their own cane.

The vehicles cross into the mill over a weigh bridge where they are check weighed. The vehicles are weighed on the way out, after dropping off their cane and the difference in the in and out weights is the amount of cane delivered.

On entering the mill the vehicles may be off loaded by Hilo unloader cranes onto spiller tables.

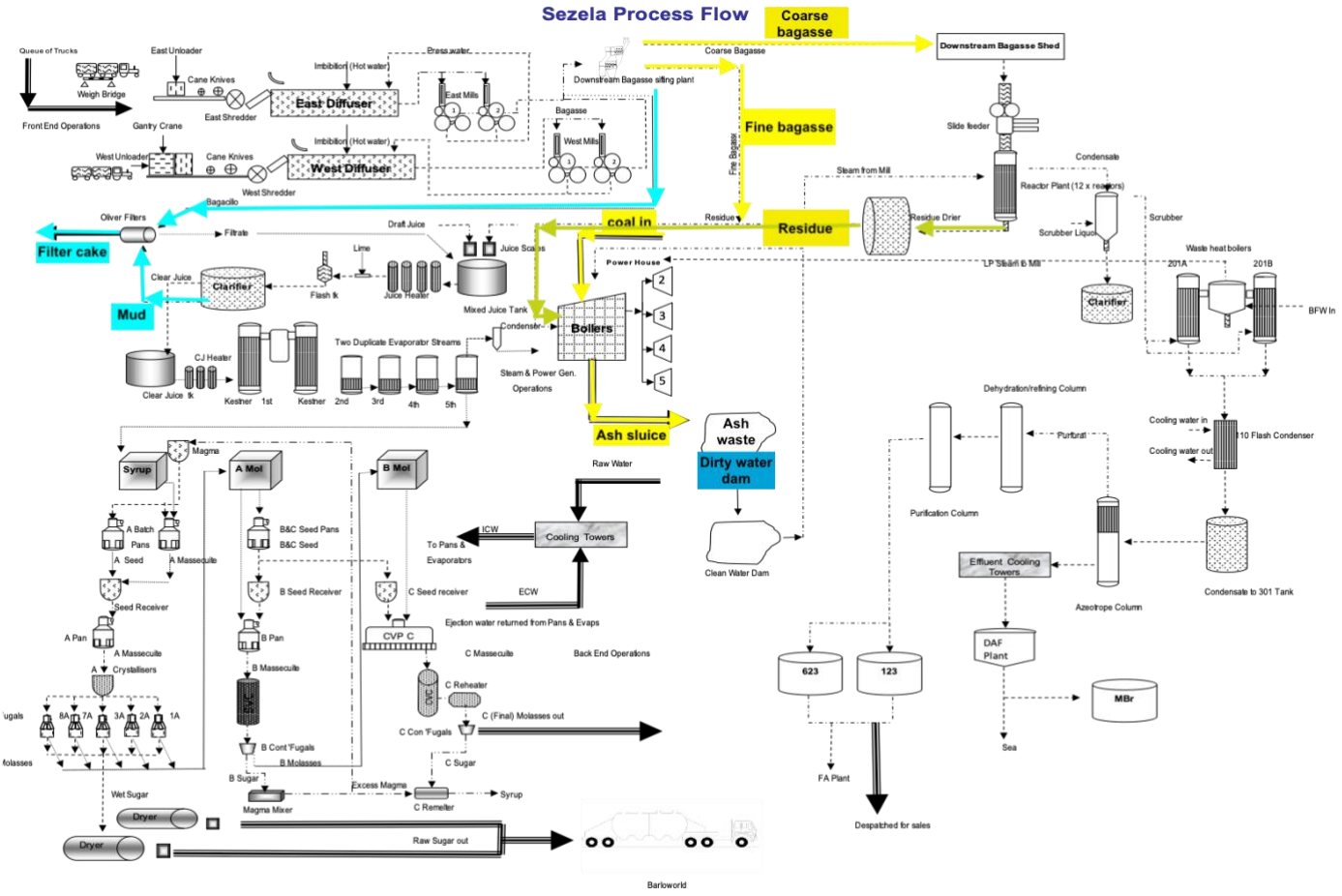

Figure 3: Sezela Process Flow.

5.3.2. Juice Extraction

There are 4 conveyors, between the "spiller table and the Diffuser. The third conveyor is a metal slat conveyor and conveys the cane from the "Cane preparation" section where the cane is among others:

- chopped up into manageable pieces,
- then shredded.
- hammers, which flatten the cane to expose the cells in the cane for the diffusion process.
- From the third carrier the cane drops down again onto the fourth carrier which feeds cane evenly across the diffuser inlet.

The diffuser is a long steel housing. The diffuser is like a:

- multi stage percolator with
- hot water passing through the prepared cane bed in each stage and
- extractes the sucrose from the cane fibre.

5.3.3. Raw Sugar Process

The juice exiting the diffusers which requires further processing is pumped to the mixed juice tank. From the mixed juice tank the juice passes through heaters and then clarifiers to remove the ash and mud from the mixed juice. Clarification is done by heating the juice, adding:

- heat,
- Milk-of-lime,
- Flocculant,

Allowing the resulting mud (Miala) to settle out in large decanting vessels called Clarifiers.

Refering to Figure 3: Sezela Process Flow, the mud is sent to the Oliver filters where the mud is seperated from the liquid. The filtered mud is called filter cake and the filtrate is sent back as draft juice to the mixed juice tank.

The clear juice, now free of mud is returned to the process.

- The thin, clear juice is then concentrated into a heavy syrup in evaporators.
- Sugar is made in Vacuum Pans.
- When the boiling cycle is complete, the resultant product, sugar crystals suspended in molasses.
- The Sugar Crystals are separated from the Molasses by centrifuging.
- The Molasses is processed further to recover sugar.

Sezela produces approximately:

- 85,000 tons of molasses per season and
- 225,000 tons of Raw Sugar per season.

5.4. Downstream products Process.

A portion of the bagasse leaving the cane sugar juice extraction process is used in the 'Downstream products process'. The remaining portion is sent for use as fuel in steam and power generation.

5.5. Steam and power generation

Bagasse, bagasse residue and coal are used as fuel sources in the steam generation plant which consists of four boilers:

- Boiler 1 is fuelled with bagasse only,
- boilers 2, 3, 4 use mixed fuel. :

Approximately:

- 640,000 tons of bagasse and
- 40000 tons of coal are burnt

per 38 week season (3-year average).

The steam exhausted from the turbo-alternators or TA's is used as a heating medium in the raw sugar processes. The condensate resulting from the heating processes is returned to the boilers to be converted to steam.

- Filter cake generation: approximately 2000 tons per month.

5.6. Downstream processing Furfural production

The Furfural Plant production season is directly linked to the Sezela Sugar Mill. refer to Figure 4: Furfural Plant process flow, to follow the waste streams used and generated from this process. The primary waste used from this plant is the treated waste water resulting from this downstream process.

FURFURAL PLANT FLOW DIAGRAM

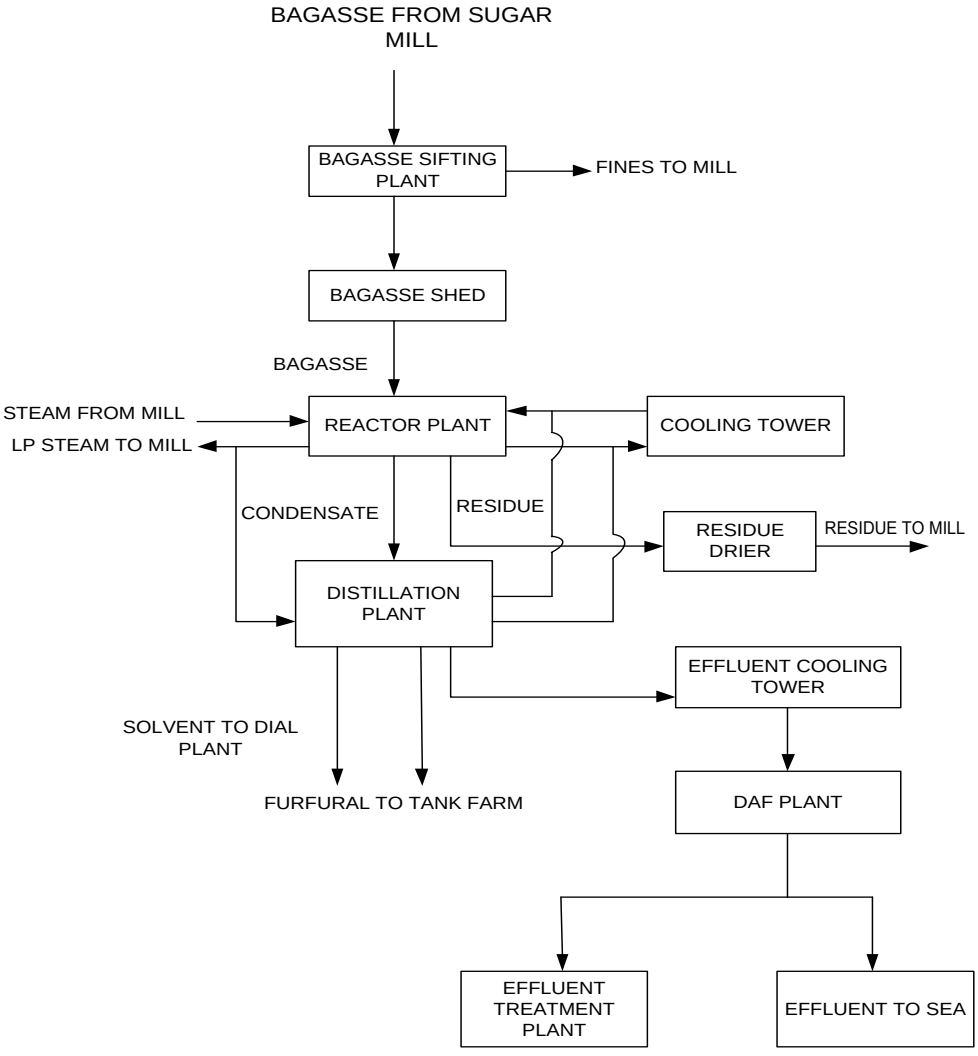

Figure 4: Furfural Plant process flow

Bagasse is received from the Sezela Sugar Mill. Rotary screens are used to separate the bagasse into two fractions referred to as:

- coarse bagasse which is conveyed to the Reactor Plant where the furfural manufacturing process begins.
- fine bagasse - which is returned to the Mill
- excess bagasse is conveyed from the reactors to the bagasse shed.

Bagasse is fed into the reactors through various feeders and processes. . The reactors are pressurised with steam, a chemical reaction takes place in the bagasse and furfural is produced. The spent bagasse is discharged from the base of the reactor as residue. The furfural leaves the reactors in a steam/vapour phase which then enters the scrubbers. The furfural rich vapour from the reactors carries over small particles of bagasse and waxes. These are removed in scrubbers as the vapour passes through the scrubber liquor. The scrubber liquor has three main sources;

- cooling tower blow down,
- raw water (used in emergency situations) and
- process recycle liquor.
    - This liquor is the cleaned effluent from the Dissolved Air Flotation (DAF) Plant.

The solids in a slurry are discharged from the bottom of the scrubbers to the clarifier. The furfural rich vapour is then partially condensed in the waste heat boilers.

The furfural rich vapour heat is transferred to the water in the steam drum to produce L.P. steam. The L.P. steam is used in the:

- distillation plant,
- the sugar mill and
- the residue drier.

The distillation plant receives furfural condensate from the reactor section.

- The effluent from the goes to the cooling towers and is then pumped to the DAF Plant before being pumped to the sea and or the Membrane Bio-Reactor (MBR).

5.7. Waste and Effluent streams

Each of these waste and effluent streams are interlinked primarily through the waste water recycling back into the system. Spills from the processes are also washed into the effluent treatment system with this water being fed back into the system.

5.7.1. Ash

Has been described in the previous sections 5.2 Waste stream - boiler ash, and section 5.5 Steam and power generation.

5.7.2. Filter cake

Solid waste from the cane juice clarifier is sent to the Oliver mud filters and the waste after the Oliver filters is called filter cake.

5.7.3. Liquid effluent

Refer to Figure 5a: Google Earth screen shot from the WULA showing the main features of the effluent treatment plant, and Figure 5b: Sezela Mill effluent treatment plant, show the details and location of the features for liquid treatment as given in the following sections.

.

Water from the factory is let down to dams via different processes depending on it's type and after filtration is used for cooling and "Scrubbing" of boiler flue gasses. Very little water is used as 70% of the cane is water.

The Sezela Waste Water Recovery Plant consists of two Waste Water Treatment Plants which are separate, the Effluent Treatment Plant (ETP) and a Membrane Bio-Reactor (MBR).

5.7.3.1. Effluent Treatment Plant (ETP)

The ETP is a conventional activated sludge Plant (CAS). It accepts effluent that emanates from site plant:

- wash downs,
- sewage and
- storm water.

The ETP receives waste water from six different sources around the Sezela Complex. These are the:

- North Outfall which is situated on the North side of the Sugar Mill's molasses tank, the
- Stores Sump which is located near the Main Stores on the North side of the East Diffuser,
- the Boilers Sump along the main factory road near Boiler 4,
- New East Drain situated at the bottom of an embankment below the Downstream Boilershop.
    - The East drain is a collection point for the Furfural plant:
        - washing,
        - filtration plant washing,
        - cooling tower,
        - the Boilers emergency dam and
        - storm water from all these areas.
- the 50 ton tank which collects effluent streams from the:
    - FA Plant and
    - Diketones Plant and finally
- sewage from the village.

Near the inflows is situated a Bar Raked Screen which removes the bulk of the inflows solid waste such as bagasse and rags which is then deposited into drums. Nutrients such as phosphoric acid and urea are added before the rake into the incoming effluent after an incident of contamination to assist with normalising the plant.

Situated further along the channel are two grit settling chambers which serve to remove any remaining solids, such as ash and sand, in the effluent stream. After this the channel runs directly to the pre-treatment Aerated tank with the available diversion route to the Activated Sludge Reactor.

The Aerated tank is used to store the mixed liquor viz incoming waste water, dosing chemicals and recycle activated sludge.

The activated sludge reactor is a biological reactor that uses micro-organisms such as bacteria to consume biodegradable organ contaminants from waste water. The waste water is generally contaminated with bagasse, sugars and traces of organic chemicals that are manufactured at the Sezela complex.
The activated sludge mixed liquor suspended solids (MLSS) from the aerator pre-treatment tank is allowed to flow into the activated sludge tank.

The clarifier allows the activated sludge to settle out of the mixed liquor. Clear treated effluent water (final effluent) is recovered from the top of the clarifier. The final effluent is either discharged to the Maturation River or directly to the final effluent pump station which will transfer it to one or more of its destinations i.e. the Boilers for use in the scrubbers or to sea.

The sludge from the underflow is recycled back to the head of the works. During the crushing season the excess sludge is wasted via the sludge recycle pumps (5%) to the volute where it is:

- filtered in the de-waterer with the
    - recovered water draining into maturation and
    - It is then conveyed by the screw pump into the trailer for dumping.

- During the season the final effluent is pumped to the Sugar Mill Boilers to be used as scrubber water for the boiler stacks.
- During off-crop the final effluent is pumped to the sea.
    - When the final effluent is found to contain a solids content that is greater than 25 ppm and or a Chemical Oxygen Demand (COD) that is greater than 100 ppm, it is diverted to the Maturation River to allow further biological treatment and the excess solids to settle.

5.7.4. Membrane Bio-Reactor (MBR)

The MBR is a modern activated sludge plant capable of treating higher COD (Chemical Oxygen Demand) effluents. It is dedicated to the treatment of the:

- Furfural Plant Effluent from the Azeotrope column via Effluent Cooling Towers and
- the DAF Plant.

The MBR is a biological Activated Sludge Treatment Plant to treat Acid Water from the Furfural Plant Effluent which is currently being discharged to the sea under the licence issued from DEA — Oceans and Coast. The waste water has a COD of ± 18 000 ppm which is too high for treatment in the Conventional Activated Sludge Plant. The major liquid effluent stream form the furfural azeotrope distillation consists of mainly water with 1.5% acetic acid.

The Fine Bubble Air Blowers and a smaller Coarse Bubble Membrane Air Blowers pump air into the bottom of the reactor. The treated water (Permeate — PMT) is separated from the Activated Sludge

by a series of semipermeable membranes. The screens in the membranes catch the solids. The treated effluent is then pumped to sea during off-crop and in season joins final effluent to the mill.

Sezela has 2 raw water supply dams and a boiler scrubber water recovery dam system which catches the solids and passes the clear water on to the clear water dam. Clear water dam is a holding dam from where water is fed back to the factory for reuse in the boiler scrubber system.

The effluent plant discharge water is fed into the Boiler scrubber water recovery system. The Sezela effluent plant is one of the few effluent treatment plants in the country that reuses water rather than discharging into a natural water course. Figure 5a: Google Earth screen shot from the WULA showing the main features of the effluent treatment plant, and Figure 5b: Sezela Mill effluent treatment plant, show the details and location of the features for treatment as given above.

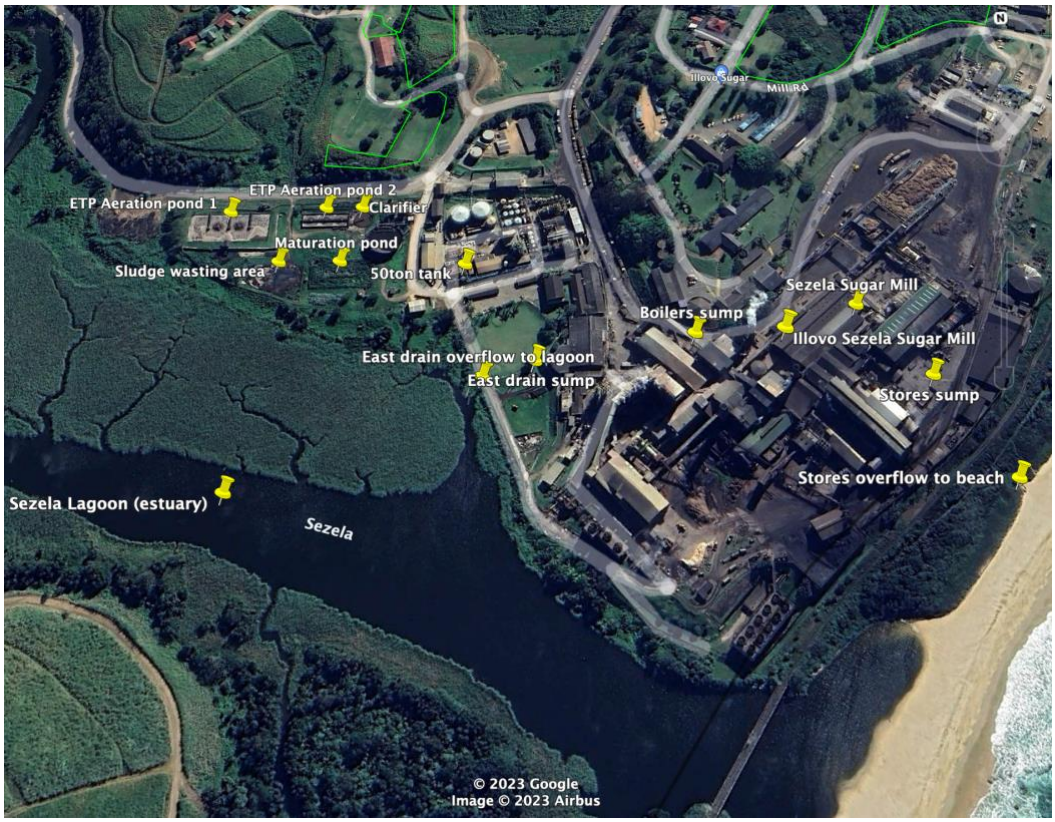

Figure 5a: Google Earth screen shot from the WULA showing the main features of the effluent treatment plant

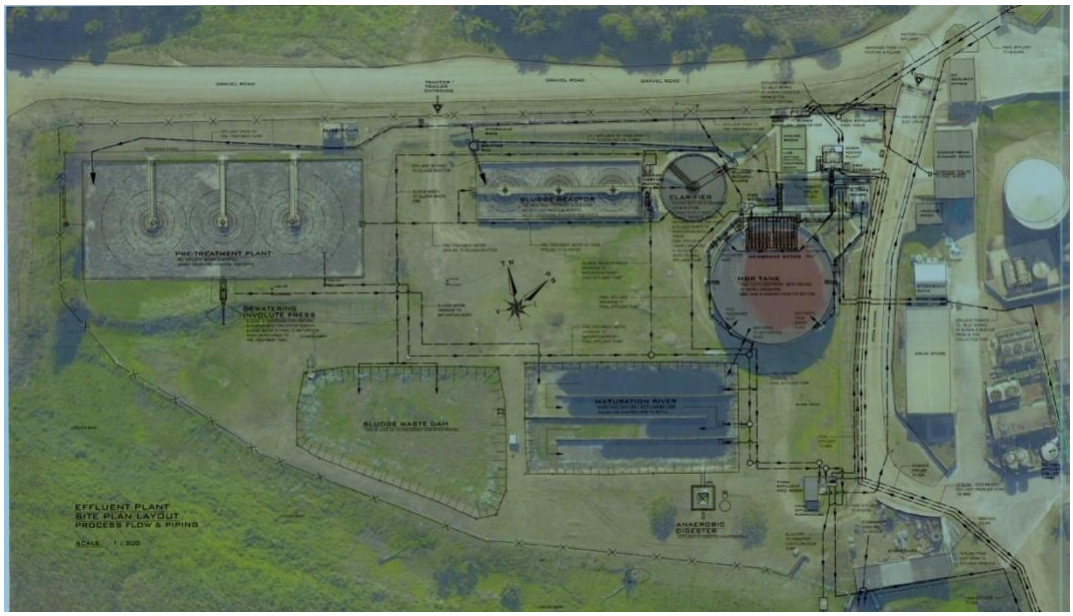

Figure 5b: Sezela Mill effluent treatment plant showing the different processing plants.

6. WASTE STREAM - FILTER CAKE.

6.1. Filter cake uses

The following gives a brief summary of research paper conclusions which is a reflection of filter cake uses:

- **As a feedstock:** (Abera, A.A., et. Al., (August 27th 2020),
- **Fertilizer and a soil conditioner** on sugar cane fields and for other crops.: Rabelo, S.C., Rossel, C.E.V., Sugarcane, (2015), and South African Sugarcane Research Institute (SASRI): (June 2003 from which the following citation is given: "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."

6.2. Waste recipients

- Poor socio economically, historically disadvantaged individuals, particularly the low income and no income groups,
- Farmers and nurseries for soil beneficiation.

6.3. Waste generated

Ash: +- 100 000kg per day (should be more than this – based on 1 day sample)
Filter cake: 2000 tons per month
Sludge:

- Clean water dam: 45tons/day (15000tons per annum – desludging is done annually) from sludge dam.
- ETP: 4tons/day.

6.4. Waste Removed

Ash: The intention is to use all waste generated to divert from landfill.
Filter Cake: +- 25 tons per day during season
Sludges: The intention is to use all waste generated to divert from landfill.

7. CONSEQUENCES OF NOT RECYCLING OR REUSING THE FILTER CAKE PRODUCED

The only recourse for the filter cake if it is not reused or recycled is to send for disposal to landfill. Landfilling is the option chosen by many to dispose of waste as the most convenient option. Unfortunately landfilling as a waste management practice contributes to high airspace use. This leads to very costly sourcing and development requirement for more landfill space. 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 as a resource in a safe and responsible manner.

Should the filter cake not be permitted to be used for its soil enhancer or fertilizer:

- Opportunities to feed themselves and even earn an income from a vegetable garden for those with no or low income:
  - youth,
  - women and
  - entrepreneurs in general.

- The requirement of Sezela Sugar Mill to dispose of the filter cake to a permitted and properly managed landfill site costs the company in terms of:
  - Landfilling fees; unless there is no charge for potential cover material,
  - Fuel which is changing and generally increasing monthly in 2023,
  - Driver salaries,
  - Truck fees and maintenance.
  - Possible greater distances to be covered due to the need to dispose to a properly managed and licenced landfill site.

8. BENEFITS OF REUSE AND RECYCLING

8.1. Intended use of filter cake

The filter cake use considered is for use in farm lands and nursaries as a soil enhancer and fertilizer.

8.2. 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 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, 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.

The re-use of the filter cake benefits:

- Sezela Sugar Mill by the cost savings of diverting these waste streams from landfilling.
- It promotes independence within the disadvantaged community by being able to:
  - feed themselves,
  - to sell their produce and,
  - also enabling them to potentially employ people within the community.
- Business creation and thus job creation because of the benefits derived from greater economic activity in the area.
- Growth and development potential within the Umvoti area realised.
- Supporting businesses would then be supported and thrive,
- increased income base for the municipality to develop infrastructure and services within the area.

To be able to benefit from this opportunity, the filter cake will need to be characterised to understand the chemical and physical nature of the waste stream. It is then assessed for landfilling using the standard criteria and classified by Globally Harmonised Standards (GHS) aligned to the United Nations standard for health and environmental risk. understanding these characteristics of the filter cake will help to minimise the risk for use for the purpose of fertilizer use. The following section describes this process and the results describe the nature of the waste.

9. METHODOLOGY USED TO ASSESS THE CHEMICAL/HAZARDOUS NATURE OF THE WASTE TO BE EXCLUDED.

9.1. Rationale

Research work has been done for the use of the filter cakes from various mills. There are promising results that this may be successful as a fertilizer. Proper understanding of the chemical makeup of the

filter cake is needed to identify the potential hazards and risks on health and the environment these pose in its proposed application. A risk assessment and a risk management plan are to be formulated to minimise any harm to people and the environment.

9.2. Characterisation of the filter cake

The waste sample taken at the ISSM on 17/10/2022, was received at Talbot and Talbot accredited laboratories on 20/10/2022, and testing commenced on the same day. It was tested using the **NEM:WA Norms and standards Regulations** for assessment and classification of waste. See:

- Attachment 2a: Certificate of Analysis,
- Attachment 2b: Waste Assessment and Classification, and
- Attachment 2c: Safety Data Sheet - SDS.

This gives:

- the chemical composition from a prescribed list,
- the assessment of the waste for
  - waste type
  - the landfill class
- the GHS classification for any hazards from
  - the physical nature of the waste with any risks associated with it,
  - any risk to health, and
  - any risk to the environment.

The second approach is to determine the hazard thresholds of the chemicals in soils and hence the effect on the environment and the health of the community. The following was used:

- **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 from the identified risks.

9.3. Results

Note: refer to:

- Attachment 2a: Certificate of Analysis,
- Attachment 2b: Waste Assessment and Classification, and
- Attachment 2c: Safety Data Sheet - SDS.

for the full details of the analyses and assessments and hazard management requirements.

9.3.1. Waste assessment to landfill

- GN 636: Current Prohibition/Restriction from Disposal:
  - (1)(b): Type 0, Prohibited Waste per GN R636 (5)(1)(b) Waste with a pH value of <6 or >12. Analytical value of: 5.3 pH.
  - (1)(c): Flammable waste with a closed cup flashpoint <61 °C. Analytical value of: 60 - Flash°C.

- S5:(1)(q)(ii): Waste with a moisture content >40% or that liberates moisture under pressure in landfill conditions, and which has not been stabilised by treatment. Analytical value of: 75 %.

- GN R636 S5: Future Prohibition/Restriction from Disposal:
  - (1)(r)(iv): >6% Total Organic Carbon (TOC). Hazardous waste. Analytical value of: 69 %. (Prohibited from: Aug 2028).
- GN R634: Overall Waste Disposal to Landfill: Type 0 Waste Prohibited Waste (per GN R636 (5) above)
- GN R635 S7, Waste Type (Chemistry only):
  - the waste is chemically assessed as a Type 3 waste, which is Low risk. Class C Landfill (GLB+).

Table 2: Preliminary and chemical assessment for prohibitions and restrictions, waste type and landfill class.

GN R634 A1.2(a)	Listed General Waste	None identified
GN R634 A1.2(b)	Listed Hazardous Waste	None identified
GN R636 (5)	Disposal Prohibitions, Restrictions	(1)(b): Type 0, Prohibited Waste per GN R636 (5)(1)(b) Waste with a pH value of <6 or >12. Analytical value of: 5.3 pH
		(1)(c): Flammable waste with a closed cup flashpoint <61 °C. Analytical value of: 60 - Flash°C.
		(1)(q)(ii) Waste with a moisture content >40% or that liberates moisture under pressure in landfill conditions, and which has not been stabilised by treatment. Analytical value of: 75 %.
GN R636 (5)	Future Prohibitions, Restrictions	(1)(r)(iv): >6% Total Organic Carbon (TOC). Hazardous waste. Analytical value of: 69 %. (Prohibited from: Aug 2028)
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. (75% moisture content as-received analysis)
GN R636 (4)(1)	Landfill Class (Chemistry only)	Class C Landfill (GLB+)

9.4. Globally harmonised system (GHS) classification

9.4.1. Relevant use/s of the mixture and restriction on use.

Identified use/s: WASTE - intended for transport by road or rail, and disposal.
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.

9.4.2. Hazards identification.

- **Refer to SDS A** Attachment 2c: Safety Data Sheet - SDS. for **GHS hazard label elements**

Table 3: Summary of filter cake GHS hazard classification

Classification in accordance with SANS 10234:2019				
Hazard	**Code**	**Category**	**Class**	**Statement**
Physical	Hazardous: H226,	Cat 3	Flammable Liquid	Flammable liquid and vapour
	Hazardous: H251,	Cat 1:	Self-Heating	Self-heating; may catch fire
Environment	-	-		-
Health	-	-		-
Conclusion	**Hazardous - by way of above properties and/or effects.**			

NOTE: from the SDS (refer to Section 8.3 below):

- **Physical Hazards: Hazardous:**
  - Flammable Liquid: Flammable liquid and vapour.
  - Self-Heating: Self-heating; may catch fire.
- **Health Hazards:** No applicable waste constituent, characteristic, property, or hazard was identified.
- **Environmental Hazards:** No applicable waste constituent, characteristic, property, or hazard was identified.

9.4.3. Hazards not otherwise classified:

No data available.

9.4.4. Composition or information on ingredients in filter cake

Table 4: Composition of filter cake.

Ingredient(s)	[C/I/SA] %	GHS Classification (Regulation)
Mixture	100%	H226 H251

Notes to above table: [C] Constituent component; [I] Impurity; [SA] Stabilising Additive; [NS] Not Specified; [O]

9.4.5. Precautionary measures

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.
- Keep cool and protect from sunlight.

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 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 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.

Storage:

- Maintain air gap between stacks/pallets.
- Store away from other materials.
- Store in a well-ventilated place and keep cool.

Disposal

- Dispose of contents/container to an approved facility in accordance with all applicable regulations and landfill requirements per the safety data sheet's Section 13.

9.4.6. 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. Keep cool and protect from sunlight.

- **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.

Protection of first-aiders and notes for attending physicians

- **Physician notes:** Get medical advice / attention if you feel unwell.

9.4.7. Fire Fighting

- **Extinguishing media and methods:** 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.

9.4.8. Accidental release measures

- **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:** Take precautionary measures against static discharge. Keep cool and protect from sunlight.

9.4.9. 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. Maintain air gap between stacks/pallets.
- Safe storage: Keep cool and protect from sunlight. Store away from other materials. Store in a well-ventilated place and keep cool.
- **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.

9.4.10. Exposure controls and personal protection

- **Engineering controls:** No data available
- **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.

9.4.11. Stability and reactivity

- **Conditions to avoided:** heat.

9.4.12. Disposal

- Refer to section 9.3.1
- **Safe, environmentally preferred disposal:** Dispose of contents/container to an approved facility in accordance with all applicable regulations and landfill requirements per this safety data sheet's Section 13.
- **Additional information:** Do not fly tip. Do not dispose into sewer, stormwater, or environment. Do not burn unless by means of compliant incineration practices.

9.4.13. Transport information.

Proper Shipping Name (PSN) for: Road & Rail (SANS 10228) | Air (IATA) | Sea Freight (IMO/IMDG)

- Road & Rail PSN: SELF-HEATING SOLID, ORGANIC, N.O.S

- IATA PSN: SELF-HEATING SOLID, ORGANIC, N.O.S

- IMO/IMDG PSN: SELF-HEATING SOLID, ORGANIC, N.O.S

Dangerous Goods Transportation: Road & Rail Requirements (SANS 10228:2012)

- UN number: 3088.
- Dangerous goods class (& Subsidiary): 4.2.
- Packing group: PG II.
- Special provisions: 274.
- Packaging codes: 0 | E2 | P410 | IBC06 | B2 | T3 | TP33

10. CHEMICAL AND TECHNICAL SPECIFICATIONS – PRE-BENEFICIATION

10.1. Introduction

Prior to being used in the proposed activities, the filter cake chemical composition, risks and the hazards these present are to be understood from the laboratory analyses results.

The basis of the leachability test of the filter cake was in anticipation of the environment within a landfill body containing putrescible waste and hence be subjected to low pH conditions (pH of 5). Low pH conditions are conducive to easier leaching out of metallic components of the salts. The filter cake is composed of a stable mixture of inorganic salts and an organic component (COD). It is a moist mixture and needs to remain so to prevent any easy dust formation. There are salts which do leach out under the leachate testing conditions which do not reflect the conditions in which it will be used. The filter cake will be used as a soil enhancer, so, the components of the filter cake will be: ploughed into soils, thus diluting the impacts on the environment, and be subjected to drier conditions. Should it rain, the rain pH is generally measured at 5,6, hence the leachability will be different in the soils. The chemistry of the filter cake within the soils is also different to the laboratory based leachate testing. However, as a conservative approach, the laboratory results will be used as a guide to manage the filter cake application on the soils.

The storage of the filter cake on site may affect the environment to some degree should it spill out of the storage area, be blown about by the wind or be stored over some time period. Management of the filter cake will be required, due to potential for exposure to humans and the environment., as well as the potential for the filter cake to catch fire and risk the crops around the area being destroyed. The chemical and hazardous nature of the filter cake is given in the analyses conducted on the filter cake. Refer to:

- Attachment 2a: Certificate of Analysis,
- Attachment 2b: Waste Assessment and Classification and
- Attachment 2c: Safety Data Sheet - SDS.

Total concentrations for the elements within 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 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 3: Summary of filter cake GHS hazard classification.

The results for the Total Concentration (TC) and the Leachability Concentration (LC) are presented in Table 5: LC and TC laboratory results for the ISSM filter cake. These values were used in 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 ISSM has the intention of beneficiating the filter cake waste stream as described above.
The filter cake will be:

- stored and prepared for loading
- loaded at the mill site,
- transported to the users' site,
- offloaded,
- stored, and
- ploughed into the land,,

so, information is needed on the potential risks to the people and to the environment to manage this material for safety at each step.

10.2. Laboratory results

Table 5: LC and TC laboratory results for the ISSM filter cake for classification and waste assessment.

SEZELA FILTER CAKE		
DATE SAMPLED 17/10/2022	**Date received and testing commenced by T n T 20/10/2022**	
Chemical	**LC. (mgX/l)**	**TC. (mgX/kg)**
Antimony	<0,05	<5
Arsenic	<0,08	<8
Barium	0,28	36
Boron	<0,16	<16
Cadmium	<0,17	<17
Chromium Cr^{+3}	<0,16	<16
Hexavalent Chromium	<0,0031	<0,031
Cobalt	<0,17	<17
Copper	<0,17	<17
Lead	0,27	<8
Manganese	15,9	545
Mercury	<0,0031	0,85

Molybdenum	<0,31	<31
Nickel	<0,18	<18
Selenium	<0,63	<63
Vanadium	<0,02	<2
Zinc	0,08	35

Chloride	95	-
Cyanide (Total)	0,02	<10
Flouride	<0,06	<0,6
Nitrate	<0,25	-
Sulphate	<2,5	-
TDS	9087	-

CV	No CV	
Flashpoint at 22 C	No Flash	
FP at 60 C	Flash	
FP at 93 C	Flash	
pH (Aq Leach)@25	5.3	
Moisture %	75	
TOC	69	
Sample description	Brown/black damp solid	
Odour	Sugar cane odour	

Note: Bold highlighted analytical results exceed at least the lowest applicable concentration threshold per Appendix 1 of the T and T analytical report. for the assessment of waste to landfill.

10.3. Total concentration and leachable concentration of components in filter cake to characterise the hazard nature of the filter cake.

The GHS classification for the hazards that the filter cake would pose in terms of its physical nature, health and environmental hazards were made based on information given by the mill and by standard testing. The filter cake was determined to be hazardous due to the physical hazards: The physical hazards presented were:

- Flammable Liquid, by means of tested physical properties.
- Self-Heating may catch fire, means of Existing hazard classification + Based on client provided information

There was no risk to health nor to the environment as assessed by the GHS method. These physical hazards are mitigated using the management measures as outlined in the Safety Data Sheet. Refer to Section 9.3.1 for the complete classification.

The waste is CHEMICALLY assessed as low risk (Type 3 waste) when assessed for landfill. However, overall it is Type 0 Waste Prohibited Waste. Refer to Section 9.3.1 for the complete assessment

There is thus a need to be aware of the effect of the filter cake in use at every stage of the beneficiation. The following are the sources of information for the possible effects that may be encountered 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.

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

The remediation of contaminated land is being used as a base from which to determine the effects on the environment and related stakeholders.

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 use of the filter cake in the environment of the intended end users.

TABLE 6: Summary of the TC and LC values when compared to the soil screening values for protection of water resources. Metals only; shows the soil screening values required to achieve DWA Water Quality Guidelines levels for aquatic ecosystems protection and domestic water use. (Framework for the Management of Contaminated Land. 2010. p 33).

Table 6: Summary of the TC and LC values when compared to the soil screening values for protection of water resources. Metals only. (Note, the highlighted numbers from these thresholds represent exceedances of the components in their total concentration and/or their leachable concentrations. NO leachable components were exceeded)

Parameter	**SSV1**	**SSV2**	**SSV2**	**SSV2**	**Protection of water Resource**

	All Land-Uses Protective of the Water Resource (mg/kg)	Informal Residential (mg/kg)	Standard Residential (mg/kg)	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
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
Flourides	30
Nitrate/Nitrite	120
Sulphates	4000

Note: refer to Table 5: LC and TC laboratory results for the ISSM filter cake for classification and waste assessment. This table was used to assess the SSV 1 and 2 values.

- < The laboratory detection limit for a test is higher than the required specification limit
- < The bold highlighted results show the upper value assumption of the data for waste management purposes. The red bold highlighted values show exceedences for SSV as assessed by

the laboratory. The other highlighted values are presented for conservative management measures.

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 indication here is that the total concentration values presented some exceedances, but no leachable components were exceeded. Hence caution needs to be exercised in exposure of the material to people in all residential areas through water sources and the ecosystem. The use needs to be protective of people and the environment, away from possible run-off to water sources.
Using the classification for physical hazard, the filter cake is hazardous due to the risk of fire, however this can be mitigated by correct procedures outlined in the SDS as given in section 9.4 above:

10.5. Long term stability and functionality

The SDS indicates that there were no issues with the stability and reactivity of the filter cake, other than to avoid heat. Other conditions to avoid are static electricity, no smoking in the area. The storage of the filter cake on the farm lands must be short and it must be ploughed into the soil as soon as possible as there is heat build up within the body of th filter cake, due to the decomposition taking place in the presence of organic materials, particularly sugars.

The filter cake's functionality will remain consistent for it use as a fertilizer pre-beneficiation, however, it must be managed even stored on the mill site. The decomposition process is a process that leads to the stabilization of the material as the sugars get used up. A well decomposed filter cake is very beneficial as a soil enhancer, conditioner and fertilizer.

There is no data for incompatible materials however general care is always needed when handling it.

10.6. Reactivity with environmental factors

The following section gives an indication of the responses of the receptors to the concentrations of the exceeded components in the filter cake. The system in total remains stable under natural environmental conditions.

10.6.1. Leaching potential showing long term stability and functionality, reactivity with environmental factors.

The leachability testing is done as per requirement for waste management at a landfill site. The sample was subjected to an Australian Standard Leaching Procedure (ASLP2 Acetate pH 5.0 (P/NP)) as per National Environmental Management Waste Act 59 2008, for the National norms and Standard for

the assessment for waste for landfill disposal. The resultant leachate was analysed for various components. However, the requirement is for the filter cake to be used as a soil enhancer. The stored filter cake (pH 5.3) may be exposed to rain water intermittently. Rain is only slightly acidic (pH 5,6) but is slightly higher than the pH of the filter cake. This may affect the solubilities of the chemical compounds resulting in a possibly lower leachability than the acidic leachability test solution at pH 5,0 submerged over 24 hours. However, the leachability results given would be used as a conservative approach to what may be presented to the environment.

No leachable components were exceeded in the SSV1 and SSV2 test thresholds. However, caution is needed because of the potential to leach out arsenic, lead, manganese and selenium. There were some total concentration exceedances for arsenic as per the TC test results for the SSV thresholds. This implies that the filter cake would need management to reduce any potential impacts for all land-uses protective of the water resource and protection of human health (drinking water usage). There were no environmental and human risk concerns. The physical risks for potential fire hazard can be managed. The appointment of an agronomist is required in good agriculture practice to ensure that no negative impacts would be seen in the crops or soils. The total dissolved solids is high, however the general composition of the filter cake shows Nitrogen (N), Phosphorous (P), Potassium (K), Calcium (Ca) and Magnesium (Mg) levels which are good nutrients for sugar cane. (https://sasri.org.za/wp-content/uploads/Information_Sheets/IS_7.4-Filtercake.pdf.). The high dissolved solids will need to be managed, if it is a problem by the agronomist.

11. CHEMICAL AND TECHNICAL SPECIFICATIONS – POST-BENEFICIATION

The overall outcome of the various guidelines used was that the filter cake is chemically a low risk waste stream to be used in the intended applications. The impacts from the respective uses will be as follows:

- A well decomposed filter cake is beneficial to the soil,
- The soils will disperse the components and hence dilute any negative impacts. The monitoring of the soils and the crops are required to ensure that these are safe.
- The soils require fertilizer, and properly managed dispersion as recommended by best practice is very beneficial.

11.1. Intended users of the waste stream

The intended users are farmers, and nurseries.

11.2. Long term stability and functionality

Filter cake is stable in the long term in its end use and remains functional.

11.3. Reactivity with environmental factors

No adverse reactivity nor instability are expected in the long term once incorporated into the soils. The SDS report noted no concerns and had no data to make any comment. At this stage there are no impacts from heat.

12. IDENTIFICATION OF POTENTIAL RISKS AND THE MANAGEMENT THEREOF

Refer to: Attachment 4: Risk Assessment filter cake ISSM and Attachment 5**:** Risk management plan for ISSM filter cake Attachment 7: Sezela Mill WULA Sensitivity map, shows the sensitive areas to consider for the management of the filter cake waste beneficiation project.

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14. 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 Sezela Sugar 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.

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