Hazardous Waste (mis)Management in South Africa:

Mapping Primary Areas of Concern

Contents

Introduction

During the Climate Change Conference in 2023 (COP28), global leaders and representatives shared a commitment to decarbonise the waste management sector, recognising the waste sector as a primary contributor to the decline of the environment. Africa has an important role to play in this. While African countries collectively generate less waste than countries in the Global North, Africa is particularly vulnerable to the impacts of waste proliferation and mismanagement. The environmental and climate vulnerability of the continent have a direct and measurable impact on local populations, disproportionately impacting black communities living in low-income and rural areas.

In South Africa, waste is proliferating at an astounding rate, rapidly outpacing capacity. It contributes 8% to continent-wide waste sector emissions (Sama & Bérenger, 2023). In 2022, the Department of Forestry, Fisheries and the Environment (DFFE) reported that South Africa generates around 107.7 million tonnes of waste annually, 49 million tonnes of which is hazardous waste (DFFE, 2022; Basel International, 2023). Currently, a staggering 92.7% of hazardous waste, and 65% of general waste are landfilled each year (DFFE, 2022). These figures only reflect waste that was reported. Approximately five million households in South Africa lack access to regular waste collection services which makes waste dumping and open-burning a common waste management practice.

Ironically, South Africa was among the first countries to recognise the right to "an environment that is not harmful to [one's] health or well-being" in its Constitution (1996). This was nearly thirty years before it was recognised by the UN General Assembly in 2022. Today, the South African waste sector falls short of the country›s constitutional aspiration.

This is especially true in the case of hazardous waste. The South African waste sector suffers a fundamental issue of resourcing, both in terms of physical and soft infrastructure - from collection services, to adequate bins, monitoring systems, trained personnel, and functional waste management facilities. Where legislation, infrastructure, compliance and enforcement are lacking, impacts are devastating, particularly for local communities living in close proximity to waste management facilities.

This report attempts to create a snapshot of a selection of hazardous waste categories, and investigate the maladaptive means through which they are managed to the detriment of local communities. It will address landfills and dumpsites, mineral waste management, health care risk waste (HCRW) incineration, and hazardous waste co-processing in cement kilns. These will be framed through corresponding areas of struggle where possible. This is done in an effort to amplify the voices of those with lived experience of a degraded environment as a direct result of hazardous waste and inadequate waste management methods.

Hazardous Waste

The Waste Act (2008a) defines hazardous waste as any waste that contains organic or inorganic elements or compounds that may, because of their inherent physical, chemical or toxic characteristics, have an adverse impact on the environment and human health. Hazardous waste originates from a number of industrial, agricultural, commercial and domestic streams, including the medical and mining industries, the energy sector, and metal manufacturing.

Governing Bodies and Legislation

The South African waste sector is bound by several guidelines, spanning local policies and legislation, as well as international obligations. The DFFE is responsible for ensuring that waste management policies and legislation are implemented and enforced in line with waste management directives, authorisations, and agreements. Below is a non-exhaustive list of such instruments relevant to hazardous waste management in South Africa:

- **The Hazardous Substances Act (1973)** provides a general snapshot of the control of hazardous substances, their classification, trade and management.
- **The Minimum requirements for the handling, classification and disposal of hazardous waste (1998)** forms part of a wider series of documents compiled by the Department of Water Affairs and Forestry (now DFFE) called the 'Waste Management Series'. At the time, it aimed to increase the standard of waste management in South Africa and provide a system through which waste disposal could be regulated. This document was not legally binding, and was eventually superseded by the Waste Act.
- **The Basel Convention (1992)** is an international treaty that controls the transboundary movement of hazardous and other wastes in an effort to ensure its sound management as close to the source of generation as possible. South Africa has been party to the Basel Convention since 1994, meaning it can both receive and export hazardous waste for treatment to other countries party to the Convention, as long as both parties provide prior informed consent.
- **The Waste Act (2008a)** is South Africa's central legislative instrument governing waste. It provides regulations for waste management that aim to protect public health and the environment (SAWIC, n.d.). The Waste Act refers to the Hazardous Substances Act of 1973 as a guiding principle for hazardous waste management.
- **The South African National Standard (SANS) 10234 (2008b)** provides classifications for hazardous substances according to their properties, and the kind of environmental, health and physical hazards that they pose. For example, some waste types may be labelled as unstable explosives, very toxic to aquatic life, or fatal if swallowed. These guidelines assist manufacturers and suppliers with the correct labelling of hazardous substance containers and waste, so that they are handled appropriately.

- **The South African Bureau of Standards (SABS) Code 0228 (2010)** provides another classification system used for the transportation of hazardous substances and waste, in line with their degrees of danger and their properties – be they corrosive, explosive, radioactive, flammable, and more.
- **The National Waste Information Regulations (2012)** provide a list of hazardous waste types e.g. gaseous waste, inorganic waste, waste oils, etc. This system is used to report waste-related information to the South African Waste Information Centre (SAWIC or SAWIS), responsible for publishing routine data on the management of waste, encompassing generation, recycling, and disposal of waste in South Africa (DFFE, n.d.) All entities, including municipalities, that generate, treat, dispose of, and export hazardous waste are required to report to SAWIC.
- **The National Waste Management Strategy (2020)** is a policy framework for waste management that emphasises the role of circular economy principles to promote waste minimisation, reuse, and recycling. It aims to reduce the reliance on landfills. It briefly covers hazardous waste statistics, impetus for safe hazardous waste management, and the need and means for waste minimisation.

Despite the range and gradual evolution of guidelines on hazardous waste management, the system is still failing. Waste is proliferating, and compliance and enforcement are limited.

Generation, Management and Trade

In South Africa, hazardous waste generation is increasing at an alarming rate. The Electronic Reporting System of the Basel Convention suggests that South Africa produced 49 million metric tonnes of hazardous waste in 2022 - up by 9 million metric tonnes from the previous year (Basel International, 2023). According to SAWIC, about 2.5 million metric tonnes of hazardous waste were treated in 2023 (SAWIC, 2023)[1].

In its most recent State of the Environment Report (2018), the DFFE claims that fly ash is the most common hazardous waste type (63.9%), followed by bottom ash (11.3%), brine (11.1%), slag (5.6%) and mineral waste (1.6%)[2]. These waste types reflect South Africa's reliance on coal – for the electricity sector and the country's active mining sector.

In 2018, most hazardous waste (93%) was dumped in landfills, then recycled (6.6%), stored (0.6%), and treated (0.1%) (DEA[3], 2018). This is not least alarming because most landfills do not comply with waste management regulations.

Disposal rates are increasing due to South Africa's imports of hazardous waste, which it is unable to treat at scale. South Africa is yet to become party to the Bamako Convention which aims to ban the import of hazardous substances into Africa altogether. It has, however, ratified the Basel Ban Amendment, which bans "exports of hazardous wastes, including waste for recycling, from States members of OECD, States members of the European Union and Liechtenstein, to other countries." South Africa still accepts hazardous waste from a number of other countries, who are able to claim that they do not have adequate waste management facilities (Basel International, 1994). In 2022, South Africa reported importing about 8,500 metric tonnes of hazardous waste (see Table 1), and did not report exporting any. Most imports were from countries in the Southern African Development Community (SADC) region, apart from ammunition and explosives, which were imported from Singapore.

Table 1: *Imports of hazardous waste types in South Africa, 2022 (Basel International, 2023)*

Hazardous Waste Material	Quantity Imported (Metric Tonnes)	Country of Origin
Asbestos	1 705	Botswana
Petrochemicals (e.g. HDPE plastic bottles that contained Tobralin Super and PPE, plastic poly-backed sachets of Coprox Super and EVOH plastic ampoules of Lambda)	5 898	Malawi
Asbestos material	220.5	Botswana
Oil and diesel filters	100	Lesotho
Ammunition and explosives	100	Singapore
Oil-contaminated waste	100	Lesotho
Oil contaminated peat sorb and used oily rags	30	Botswana
Pesticides	20	Malawi
Expired drugs (kanamycin sulphate and sulphate capreomycin)	50	Swaziland
Contaminated soil	55	Malawi
Crushed containers contaminated with oil	20	Botswana
Expired and redundant chemicals	9	Swaziland
Total	**8 436.5**	

1 It must be noted that figures on hazardous waste generation vary significantly depending on the source, and are often outdated. The South African Waste Centre, responsible for communicating national waste-related statistics, warns that data are generic and unverified and should instead be derived from the DFFE where possible (SAWIC, 2023).

2 Components of mineral waste are not considered hazardous, even though they may contain harmful constituents. In this view, it may be argued that this figure is not complete.

3 The Department of Environmental Affairs and Tourism (DEAT), and subsequently the Department of Environmental Affairs (DEA) are now known as the Department of Forestry, Fisheries and the Environment. Both the DEAT and DEA will be referred to as the DFFE outside of referencing.

Shipments of hazardous waste also transit through South Africa - at times illegally. For instance, in July 2024, shipments of Electric Arc Furnace dust originating from Albania were expected to transit through South Africa and Singapore, before arriving at their final destination in Thailand. This waste had not been declared and was thus illegal. The shipment was seized and sent back to Albania. Shipments are usually made to countries where environmental standards are lower, placing a higher burden on the environment and human health in recipient countries (Basel Institute on Governance, 2021). This is another crucial area requiring improvement in the hazardous waste sector: urging the upgrading of detection, investigation and prosecution worldwide.

With a majority of recorded hazardous waste being dumped to landfills while waste continues to proliferate through local generation and imports, using the terms *waste management* is misleading. It implies that waste generation can continue to increase because there is a workable system to handle it appropriately and safely. However, this is far from reality. Waste *minimisation* is the only way to decrease landfilling and dumping rates, and with it, all associated environmental and health impacts.

Environmental, Climate and Human Health Impacts

To date, the environmental, climate and human health impacts of the hazardous waste sector have been poorly studied, especially in South Africa where monitoring and reporting efforts have been few and far between.

South Africa's waste sector is a primary contributor to waste sector-related emissions on the continent, ranking second. In 2023, it contributed 8% of waste emissions in Africa, behind Nigeria at 15%, followed by Algeria, Egypt and Morocco, each contributing 7% (Sama & Bérenger, 2023). No equivalent aggregated emissions data exist for hazardous waste.

From production, to use, and disposal, hazardous waste materials have a range of impacts depending on their characteristics and properties. These impacts will be reported on when discussing each hazardous waste category, and the means through which it is managed.

Key Waste Management Companies

- **EnviroServ** is South Africa's largest waste management company. It has been operational since 1979, and oversees hazardous and non-hazardous waste management - from transport, to treatment and disposal. It currently operates 11 hazardous and non-hazardous waste treatment and landfill sites (EnviroServ, 2025).
- **Averda** offers services from waste collection, to recycling, composting, and incineration. It has worked with hazardous waste for over 30 years - landfilling, incinerating, and transforming toxic waste into fuel for use in cement kilns as fuel.
- **Interwaste** handles both general and hazardous waste from classification to collection, incineration, treatment, and landfilling.
- **Oricol Environmental Services** aims to reduce waste through waste recovery and recycling. It has managed hazardous waste for over 20 years. It collects waste, claims to 'recycle' contaminated soils, and treats waste for use as fuel in cement kilns. Services span Durban, Johannesburg, Gqeberha and Cape Town.
- **Mpact Waste Management** supports a range of different industries with waste management services - from printing to retail, commercial and manufacturing industries. In terms of hazardous waste, it provides liquid waste treatment, waste-derived fuel blending, and refuse-derived fuel production.

Landfills and Dumpsites

Landfills are the most commonly used form of waste management in South Africa; in 2022 more than 630 operational landfill sites were dotted around the country. Overall, a staggering 92.7% of hazardous waste is landfilled in the country (DFFE, 2022).

Landfills are classified according to the risk level of the waste they accept:

- Class A Landfills (Type 1 Waste) accept high risk, hazardous waste
- Class B Landfills (Type 2 Waste) accept moderate-risk waste
- Class C Landfills (Type 3 Waste) accept low-risk waste
- Class D Landfills (type 4 Waste) accept inert waste

Audits conducted in 2023 reveal that 82.5% of landfills do not comply with national legal requirements and regulations. While compliance rates remain alarmingly low, landfills continue to receive licences to expand in number and in size (De Klerk, n.d.).

A common compliance issue is the improper lining of landfills, which allows leachate (contaminated liquid that percolates into subsurface areas) to spread into surrounding soil and water streams. In many cases, landfills have no, or insufficient top cover to deal with landfill gas emissions, or have poor gate control which facilitates illegal dumping or grazing animals to enter the management facility. Low compliance rates point to the systemic failure of the state to apply, monitor and enforce standards of practice which are intended to minimise environmental and human health impacts.

Illegal dumbing is a common practice. Waste is placed illegally in landfills or dumpsites, abandoned, and often burnt. Every year, over 3.5 million tonnes of waste bypass the formal waste disposal system and are instead dumped, particularly in rural areas where adequate waste infrastructure is absent (Polasi, Matinise & Oelofse, 2020; Royal Academy of Engineering, 2022).

For a number of reasons, low compliance rates and illegal dumping are particularly alarming in the case of hazardous waste. Hazardous waste is toxic and its impacts are rarely considered or monitored. In the absence of monitoring efforts, research, and attention from relevant environmental authorities and waste management facilities, communities continue to face a range of harmful consequences.

Three case studies will be considered to illustrate the failures of South Africa's hazardous waste management system: the EnviroServ Gqeberha hazardous waste landfill; the Shongweni hazardous waste landfill; and the Thor Chemicals mercury dumpsite.

EnviroServ: Gqeberha

The EnviroServ hazardous waste landfill in Gqeberha has been a notorious site of struggle for the past three decades. Surrounding communities, notably the Aloes community, has been active in opposing this site. Until 1998, the Aloes community was also faced with the impacts of a medical waste incinerator operated by EnviroServ, which was shut down due to public concern over health risks (Parliamentary Monitoring Group, 2001).

The EnviroServ hazardous waste landfill located near community members' homes is still operational. The facility accepts most categories of hazardous waste except for radioactive waste, compressed gas, explosives and untreated medical waste. The landfill accepts solid hazardous waste (30%), industrial waste (22%), and liquid and solid sludge (32%) (CHWMEG, 2024).

"We are a small community, and our battle is huge. We don›t have a huge number of residents or resources to help us fight for betterment." - Aloes community member.

Environmental and health impacts have been recorded by community members despite claims by EnviroServ that "treatment and disposal facilities meet the strictest standards for safe and environmentally responsible waste management" (EnviroServ, 2021).

The Swartkops River flows past the Aloes community, for whom the main source of income is fishing. Toxic blue and green algae have been identified in the river (see Picture 1). This form of algae has been linked to the presence of leachate in the environment. Leachate is a "mixture of rainwater, waste byproducts, and organic compounds that infiltrate and collect in landfills" (Stefanakis & Tsihrintzis, 2014). This infiltration is most likely due to the inadequate lining of hazardous waste basins at the EnviroServ landfill site, as well as poor leachate management systems.

The composition of leachate depends on the waste it is derived from, but in general terms it contains a range of concentrated contaminants such as heavy metals, ammonia, and other chemicals (Youcai, 2018). The composition of leachate from the EnviroServ facility has not been reported on.

If leachate is not properly contained within waste management facilities, it can enter surrounding waterways and cause an increase in algae production - a process called eutrophication (Shaari et al., 2021; Stefanakis & Tsihrintzis, 2014). It is possible that the algae present in the Swartkops River is a consequence of eutrophication.

Among other effects, eutrophication reduces the availability of oxygen underwater, causes an increase in toxin secretion and CO_2 production, increases water acidification and the accumulation of hydrogen sulphide. The accumulation of these effects causes the mass mortality of fish and other aquatic organisms (De Luca & Muller, 2023). In the Aloes area and the Swartkops River specifically, fish are dying, limiting the community's access to food and income.

Picture 1: Toxic algae in the Swartkops River, November 2023

Picture 2: Dead fish found in the Swartskop River

Community members have also raised concerns regarding air pollution. While it is not as severe as it once was when the medical waste incinerator was operational, community members have noted health impacts consistent with those caused by exposure to landfill gas (LFG). LFG is a mixture of methane, CO_2 and other small amounts of non-methane organic compounds. These gases are classified as greenhouse gases, with methane being at least 84-87 times as potent as CO_2 over a 20 year timeframe (IEA, 2021). High winds and the lack of suitable cover on landfill cells may aggravate LFG and dust emissions (Mannie, 2008; EPA, 2024). Symptoms reported as a result of LFG exposure include headaches, eye irritation, weakness of the body and asthma (ASTDR, 2001; Njoku et al., 2019) – all of which are listed as common symptoms experienced by residents of Aloes (Ellis, 2021).

> "We need more people to help us with our community and keep it clean and pollution-free. Our health is more important to us, and most of these industries don't care at all." – Aloes community member

EnviroServ: Shongweni

The Shongweni landfill in Kwazulu-Natal, operated by EnviroServ, is licensed to manage hazardous waste. The site is located in close proximity to a number of communities in the Upper Highway area, including Ntshongweni, Salem, KwaNdengezi, Buxfarm and Cliffdale. In April 2017, the DFFE suspended the landfill's licence, only three years after it had been issued, because EnviroServ had failed to comply with the law and the conditions of its Waste Management Licence (Liedtke, 2018; Savides, 2017).

> "There is still an unacceptably high level of landfill gases being emitted from the Shongweni landfill site, which the authorities have confirmed to be the source of the malodour emanating from the site." – Statement by the DFFE (2017) (Savides, 2017).

Communities have been vocal about their lived experiences, both in terms of the environment and their health, but also as a result of social impact. The Upper Highway Area (UHA) community, a non-profit organisation founded by community members to expose Shongweni's environmental and health impacts, spent years opposing the Shongweni landfill. In 2017, UHA conducted an air quality impact and odour assessment to quantify the toxic impacts of the landfill and found elevated levels of toxic hydrogen sulphide, a volatile organic compound. Hydrogen sulphide smells of rotten eggs, and in combination with decomposing organic waste, explains the bad smells community members experience every day, as well as upper respiratory tract irritation (Upper Highway Area, 2017).

As part of a landfill audit commissioned by Enviroserv, community members were invited to comment. A community member reports that "the air is unbearable, [their] skin burns [and] lungs hurts." (Dorean Environmental, 2018).

During the same year, a petition was filed by community members living in close proximity to the Shongweni landfill. They claimed that mismanagement of the site had had a disproportionate impact on black communities, and that they had not been afforded Air Quality Monitoring Systems, which had been delivered to neighbouring white communities. The petition demanded the closure of the site and for measures to be put in place to account for disproportionate impacts. They demanded that EnviroServ hold community meetings with black communities to address complaints, and conduct a Social Impact Analysis as part of their Environmental Impact Assessment (Chonco, 2017).

Community activism remained consistent across the area but despite this, Shongweni was granted a new licence in 2018, on condition that it traded only solid, inorganic waste containing no sulphur, and that it upheld regulations on the management of leachate, gas emissions and waste pH levels (Highway Mail, 2018; Dorean Environmental, 2018). This licence is valid until 2028, compared to the original licence's expiry date of 2024 (Harper, 2020).

In 2020, two years after EnviroServ's second licence was issued, residents of the Upper Highway area in Shongweni, Dassenhoek and KwaNdengezi, as well as individuals living up to 30 kilometres away, continued to file complaints due to the strong odour from the landfill (Harper, 2020).

"I moved up to Upper Highway for its clean fresh air and beautiful views; however, with [the] EnviroServ's suspension being lifted and fully operational again, I'm really considering leaving, for my family's health." - Upper Highway community member (Molope, 2019).

In 2018, the EnviroServ landfill received a total of 32,020 metric tonnes of hazardous waste, including flammable solids and liquids (5,660 metric tonnes), toxic wastes (23,585 metric tonnes), corrosive wastes (162 metric tonnes), and hospital and infectious wastes (2,613 metric tonnes) (Dorean Environmental, 2018). An audit from the following year indicated excessive levels of methane, CO_2, and hydrogen sulphide, components of landfill gas which may cause symptoms such as headaches, eye irritation, weakness of the body, and asthma (Dorean Environmental, 2018; ATSDR, 2001; Njoku et al., 2019).

> "Our eyes are sore and we have sinus problems. This is ridiculous. Everyone›s health is getting worse. Not just my family but everyone in Hillcrest." (Dorean Environmental, 2018).

In addition to these harmful emissions, residents have been exposed to emissions caused by gas flaring - the means through which EnviroServ has sought to manage landfill gas emissions (Dorean Environmental, 2018). Landfill gas flaring emits volatile organic compounds, hazardous pollutants including carcinogens, endocrine-disrupting chemicals, and greenhouse gases. These include, but are not limited to, benzene, black carbon, methane, and nitrous oxide (Wang, et al., 2023; BBC News, 2022). In part, the emissions caused by gas flaring may explain the bad odours reported by surrounding communities. These emissions are also known to cause a range of health symptoms such as cancers, endocrine and respiratory health issues, liver damage, headaches, tremors and irregular heartbeats (Wang, et al., 2023; BBC News, 2022).

> "Stop whatever you have changed on site. The flaring or whatever else has changed. It is extreme, we are in pain here, you are poisoning us non-stop day and night." (Dorean Environmental, 2018).

In 2020, EnviroServ was convicted on charges of the violation of environmental and air quality regulations and was served with a number of fines (Upper Highway Air, 2020; Mackenzie, 2020). To date, the landfill remains operational, and community activism has slowed down.

Thor Chemicals: Cato Ridge

Cato-Ridge is a small, industrial village in Kwazulu-Natal. It houses a number of chemicals, and waste management companies, including Thor Chemicals, Darchem, ChemerG, Assmang, NCP Chlorchem, and Makhathini Medical Waste. For dozens of years, community members have complained of the impacts of air, land, and water pollution by companies located in proximity to their community.

> "Our communities have been used as a dumping zone for all hazardous chemicals, we are exposed to mercury, manganese, and many other hazardous chemicals that are spilling from the companies." – Cato Ridge community member.

The Thor Chemicals dumpsite is a notorious site of struggle. It is a non-operational factory containing a stockpile of hazardous mercury waste. In 1988, The British company transferred its operations to South Africa to avoid environmental repercussions and prosecution in the UK due to elevated mercury levels. Operations at the South African facility continued for ten years before the factory was shut down. At least four workers died of mercury poisoning, while several more became seriously ill or disabled due to exposure to toxins that cause damage to the brain and nervous system (Carnie, 2021).

Just a year after Thor Chemicals began operating in Cato Ridge, mercury levels in the Mngcweni River were 1,500 times higher than the United States limit for sediment to be declared toxic, totalling 1.5 million parts per billion (Michigan University, n.d.). The Mngcweni River runs past the Thor Chemicals facility and through the Cato Ridge community, then flows into the uMngeni River which carries water to the dams that supply water to the greater Durban area (South African River Health Programme, n.d.). Both of these rivers have been a source of drinking water for cattle, irrigation for food crops, a means of washing clothes, water for human consumption, and a place of recreation (Brighton, 2013).

The World Health Organisation (WHO) considers mercury to be one of the top ten chemicals of major public concern (WHO, 2017). Since 1988, in and around Cato Ridge, residents have been at great risk of mercury poisoning, through air, water, and soil contamination.

> "In the past the hazardous waste has killed cattle as they were grazing around the companies, fish has been contaminated which resulting in people being hospitalised who have consumed the contaminated fish unknowingly, even community people who were tested (hair and nails) and were found to have mercury which belongs to Thor Chemical company." – Cato Ridge community member

In 2010, researchers investigated the levels of mercury present in fish in the Inanda dam, which is supplied by the uMngeni River, and examined the hair of residents living close-by. Half the fish and 17% of the hair samples contained levels of mercury exceeding guidelines set by the WHO (Papu-Zamxaka, 2010). Recent research found that mercury levels in fish in the uMngeni River still exceed concentration guidelines (Misra, et al., 2023). Alarmingly, the concentration of mercury increases through the food chain as a result of biomagnification. This means that humans are most at risk for mercury poisoning after eating fish, locally-grown produce, or consuming meat or milk from local grazing animals (Misra, et al., 2023). Exposure to mercury, even in small amounts, affects the nervous, digestive, and immune systems, as well as lung, kidney, skin and eye problems (WHO, 2017). Despite these known health impacts, little has been done to safeguard their health and prevent further impacts.

In 2021, the former parent company of Thor Chemicals, the Tato Holdings Group, funded an initiative to ship all stockpiled mercury to Switzerland for treatment (Michigan University, 2017). That same year South Africa's Minister of the DFFE, Barbara Creecy, confirmed that over 1,000 tonnes of mercury waste had been successfully removed from the stockpile (Carnie, 2021). The programme was due to be completed in June 2022 yet stockpiles of mercury remain. No information has been published online since 2021 about the status of this initiative. However, a Cato Ridge community member confirmed that the clean-up campaign now is expected to conclude its work in 2025.

The Cato Ridge case study is a poignant example of the disproportionate and long-term impacts that improper waste management has on rural black communities. The initial relocation of hazardous mercury stockpiles to rural South Africa point to discriminatory and flippant decision-making on the part of Thor Chemicals. The deliberate subjection of South Africans to conditions considered unsafe for some, but suitable for others, is exacerbated by the fact that local communities were living in, and continue to live in poor conditions – in the absence of proper governance and safekeeping.

> "We have to learn from this governance failure to inform future environmental justice governance, as it is prescribed in the Constitution." – Bobby Peek, groundWork.

Mineral Waste Management

The mining industry plays a central role in South Africa's economy, contributing 7.53% to GDP in 2023 - a steady increase from previous years (Mineral Council South Africa, 2023). South Africa has some of the world's largest commodity reserves, including platinum and gold, and is one of the largest international coal exporters (University of Witwatersrand, 2024). While mining is an asset to South Africa's economy, its irreversible destruction of the ecosystem and consequent impact on human health, demands that its practice in the country be questioned (Mining Watch, 2022). Mine workers and local communities bear the brunt of the damage caused by the mining industry, at the hands of large, mostly foreign conglomerates (War on Want, 2016).

Hazardous waste is generated throughout the mining process and includes tailings, gas emissions, acid mine drainage, dust, and bottom and top ash. Added to this waste generation is the mismanagement, or lack of management altogether, of these hazardous substances. In 2023, SAWIC reported that only 145,800 tonnes of mineral waste were treated; however, no generation figures were reported (SAWIC, 2023). The overall environmental and health impacts of mineral waste cannot be avoided while the mining industry continues to operate at this rate and by these means. However, increased corporate compliance with waste management standards, the implementation of mandated monitoring, and the strict enforcement of legislation would help to alleviate risks across the board.

The mining industry threatens the rights of South African people to health and a healthy environment, as enshrined in South Africa's Constitution. It is thus imperative that reforms are initiated to protect the livelihood and dignity of the communities most impacted. It is important to note, also, that the environmental and health impacts of mineral waste vary according to the substance being mined.

The next section of this report will touch on the coal and gold mining industries, two of South Africa's most profitable mining industries, and will expand on the risks of tailings dams as a means of mineral waste management.

Witwatersrand: Gold Mining

The Witwatersrand basin is the world's largest gold and uranium basin and has been a mining hotspot since its discovery in 1886 (Frimmel, 2019). It comprises a number of basins, namely the Far East Basin, Central Rand Basin, Western Basin, Far West Basin, the Klerksdorp-Orkney-Stilfontein-Hartbeesfontein (KOSH), and the Free State gold mines. The Witwatersrand plateau is home to more than 120 operational mines, from which about 43,500 tonnes of gold have been extracted in the last century, as well as 73,000 tonnes of uranium which were extracted between 1953 and 1995 (The SA Institution of Mechanical Engineering, n.d.).

Gold mining is the largest source of waste and pollution in South Africa, accounting for about 47% of mineral waste generation country-wide (Mpanza, et al., 2020). Tailings are a waste byproduct of the mining industry and are of particular concern because of their hazardous properties. Tailings comprise crushed rock, water, trace quantities of metals such as copper and mercury, and additives used during the mining process, such as petroleum byproducts and sulfuric acid (Earthworks, 2024). Tailings are stored in dams in an effort to keep hazardous waste substances contained, so that they have minimal impact on the surrounding environment, and consequently, on human health.

As a result of long-term and extensive mining on the Witwatersrand escarpment, over 270 tailings dams spanning about 400km^2 have been constructed to store mineral waste. The most recently available data indicates that these tailings dams contain about 6 billion tonnes of pyrite tailings, which in turn contain 600,000 tonnes of uranium (Chevrel, et al., 2008). As a result of the high uranium content, tailings are radioactive. Exposure to uranium may cause a range of serious health impacts, including impairment of renal function, kidney failure, and cancer (Zupunski, et al., 2023). While tailings dams are meant to contain hazardous mineral waste, studies have revealed that the air, soils and waterways in the Witwatersrand area are contaminated with radioactive uranium. This poses a serious risk to surrounding communities who are dependent on water for human and animal consumption, and soil for agriculture.

In 2016, soil samples collected 50 to 200 metres away from tailings dams contained between 256 and 278 Bq per kilogram[4] of radiation - Measurements that far exceed the standards set by the International Committee on Radiation Protection (ICRP). The standards state that uranium-related radioactive concentration in soil should contain between 100 and 200 Bq per kilogram (Njinga & Tshivhase, 2016; ICRP, 1994).

Similar research was conducted in 2023 at the Wonderfonteinspruit River, located within the Witwatersrand area, to assess the concentration of uranium in water used for crop irrigation and as a source of drinking water for humans and livestock (Zupunski, et al., 2023). Uranium concentration averaged at 156 micrograms per litre, about five times higher than the standards set by South Africa and WHO for water used for drinking and agricultural activity (WHO, 2005).

The transference of soil and water contamination to animals and humans in the area is well documented. Grazing animals were found to have uranium levels in their kidneys 4,350 times higher than cattle living in uncontaminated areas (Njinga & Tshivhase, 2016). Grazing animals represent another means through which humans can be contaminated through the food chain. This is emphasised by an investigation into uranium concentration in the scalp hair of children and adults living in proximity to a cluster of mines in the Witwatersrand. The samples collected in Diepkloof, Noordgesig, Soweto, and Johannesburg found uncharacteristically high levels of uranium in all the participants. On average, children had a uranium concentration of 149 micrograms per kilogram, compared with 63 micrograms per kilogram in adults. Similar studies conducted on the general populations of Slovenia, Brazil, and Japan found significantly lower uranium concentrations in scalp hair, varying between 13.6 to 38 micrograms per kilogram (Zupunski, et al., 2023).

The contamination of soil and water by mineral waste, and, consequently, that of animals and humans, points to the inadequacy of tailings dams as a reliable means of hazardous waste management. In the Witwatersrand, communities spanning multiple cities and informal settlements are vulnerable to serious health impacts, purely as a result of the location of their dwellings.

To make matters worse, communities living in proximity to mines must also contend with Acid Mine Drainage (AMD), a primary contaminant of water and solids in Witwatersrand and surrounding areas. This is another type of mineral waste formed as

4 Becquerel (Bq) per kilogram is the only unit found in databases, globally, for the category of Specific Radioactivity.

a result of the reaction between oxygenated water and exposed pyrite-containing rocks underground and in mine dumps (Usher, et al., 2004). It is highly acidic, metal-rich water that disrupts the growth and reproduction of aquatic life, acidifies surrounding water streams, and contaminates food crops (US Environmental Protection Agency, n.d.). It increases the availability of heavy metals for uptake by fish, creating a clear pathway for introduction into the human food chain (Dhir, 2018).

Research into the impact of AMD on human health is in its infancy; however, evidence suggests that when ingested, either directly through water sources or through the consumption of produce or livestock, health impacts are consistent with the ingestion of heavy metals. For instance, high levels of copper may lead to gastrointestinal issues and liver damage, and arsenic exposure may cause cancer (JOUAV, 2024). Direct contact with AMD can burn human skin due to its acidic and corrosive nature (First Nations Environmental Health Innovation Network, n.d.).

The Tudor Shaft Informal Settlement houses about 40, 000 people and is located on the mining belt; some of its shacks are built directly on top of mine dumps polluted by AMD and other heavy metals. There is no fencing to delineate dumps and prevent children or grazing animals from entering hazardous areas (Njinga & Tshivhase, 2016). Residents of the Tudor Shaft Informal Settlement are impacted by mineral waste as a result of their living situation, what they eat, and what they drink. The legacy of air and water pollution has a disproportionate impact on low income, marginalised communities, whose livelihoods and health are not safeguarded by the South African and local governments, or corporations responsible for mineral waste generation.

It is imperative that the South African government addresses the colossal generation of mineral waste country-wide, in order to target the root cause of environmental, climate and human health impacts. Simultaneously, corporate compliance with legislation and standards must be monitored and companies must be held to account. The government has been criticised for lacking the resources to enforce relevant legislation in the mining industry. Mining conglomerates are not held accountable for monitoring closed mine shafts and rehabilitating or eradicating tailings dumps, which are crucial measures for the adequate management of waste (Mabaso, 2023).

It is also important to note that, because a significant proportion of mine shafts and tailings dumps precede current legislation such as the Mineral and Petroleum Resources Development Act (2002), current provisions do not apply and cannot be enforced (Mabaso, 2023). This gap in the legislation must serve as the impetus for development of comprehensive and protective measures across the board. The culmination of these conditions is compounded by poverty and structural inequality, leaving communities working in, and living in, proximity to the Witwatersrand vulnerable to the impacts of South Africa's inadequate waste management system.

eMalahleni: Coal Mining

eMalahleni is a coal-producing region in South Africa. It comprises 53 operational mines, 22 of which are coal mines, owned by a range of national and international conglomerates. Because of the ubiquitous nature of mining in the region, it has become an intergenerational occupation, whether it be through contracted work, or in an artisanal capacity. For many, artisanal mining, which means mining without a working permit, using low technology and

minimal equipment, is a necessary means of subsistence. Living in proximity to or working within mines is a trade-off between income and health.

> «It pollutes our water, our air. Asthma is a common sickness here. But it also keeps us warm and feeds us.» (Harrisberg, 2020)

Mineral waste is a pressing issue for community members in eMalahleni, who bear the brunt of one of South Africa's most profitable industries. Coal mines produce a variety of waste, from tailings, to waste oils, and dust. The National Waste Information Regulations (2012) classifies mineral waste as hazardous waste because of the potential impacts it may have on surrounding environments and human health. For several years, eMalahleni residents and coal mine workers have been vocal about the impacts of mineral waste on the wellbeing of their community. Despite persistent collective activism, eMalahleni remains a heavily mined region where air pollution is a priority concern, due to routine coal mining, coal combustion in the 12 regional coal power stations, and regular blasting which occurs in the Kwa-Guqa and Vosman areas (Tunatazama, 2021). The Nkangala District Municipality, where eMalahleni is situated, is part of the Highveld Air Quality Priority Region because pollution levels in the area frequently exceed limits set for acceptable air quality (Denoon-Stevens & du Toit, 2022).

> "Living in eMalahleni is like living in a very dark pit." (Tunatazama, 2021)

Air Quality Index (AQI) databases reveal high air pollution levels in eMalahleni and warn against long-term outdoor exposure, especially for the elderly, children, and those with respiratory diseases (AQI, 2024; WU, 2024). The most prevalent air pollutants in the region are particulate matter and gas waste resulting from mining activities. Particulate matter is present in coal dust, which is produced throughout every stage of the mining process, from mine construction, to extraction, processing, storage (Davda, 2024). Gas wastes include, but are not limited to, sulphur dioxide, ozone, and carbon monoxide (Straupnik, 2022). As a result of consistently high air pollution, residents of eMalahleni are advised to wear masks, use air purifiers in their homes, stay indoors, and keep their windows shut (AQI, 2024; WU, 2024).

Picture 3: Dust cloud and emissions resulting from coal mine blasting in eMalahleni

Coal mining and blasting generates particulate matter, present in coal dust, silica and other associated contaminants (Vanka, et al., 2022).

In a longitudinal study conducted between 2012 and 2015, particulate matter levels in the region were twice as high as the limit set by the WHO every year, except for 2015, during which levels were thrice as high (Denoon-Stevens & du Toit, 2022). The WHO suggests that both long-term and short-term exposure to particulate matter is associated with morbidity and mortality as a result of respiratory and cardiovascular diseases, the most common of which is a string of incurable respiratory diseases called Coal Mine Dust Lung Disease (CMDLD) (WHO, 2024; Perret, et al., 2017).

Another concern in the region is the generation of toxic gas wastes as a result of coal extraction, mine blasting and coal-fired power generation. High levels of sulphur dioxide, ozone, and nitrogen oxides are reported every day. According to the WHO, all of these are strongly associated with public health concerns (AQI, 2024; WHO, 2024). The inhalation of these gases is primarily linked to the development of respiratory ill health, with conditions ranging from lung cancer to asthma, coughing and difficulty breathing, as well as a list of other conditions including heart disease, eye and throat irritation, and headaches (Anhauest, et al., 2020; WHO, 2024; ATSDR, 2014). Residents in eMalahleni have reported an overwhelming number of these health impacts.

> "It affects everyone, people are suffering from diseases like asthma, lung cancer, sinuses." (Tunatazama, 2021).

Health impacts could be reduced significantly with the implementation of stringent dust suppression safety measures, compliance with air quality regulations, and the use of adequate protective gear for mine workers (Davda, 2024). The eMalahleni Local Municipality has developed an Air Quality Management Plan to monitor air quality in the region. The only report available so far is an Air Quality Management Plan dated 2019. The Municipality has since disclosed that existing air quality stations are not fully functional, and that air quality data is currently sourced from the South African Weather Services (eMalahleni Local Municipality, 2024). This points to the severe lack of resources available for air quality monitoring, which is a prerequisite for assessing and demanding corporate compliance with related legislation and standards. The mining industry has been left to operate in a manner that is incompatible with the principles of sustainability, climate health, and human health.

In addition to air pollution concerns, coal mining produces large quantities of coal discards and tailings which are a source of AMD. In coal mining, AMD is generated as a result of a chemical reaction between pyrite (an iron sulphide present in coal), host rocks, and oxygenated water (rain). AMD is toxic to animals and plant life, and contributes to soil and water pollution. Its acidic properties also means that it dissolves heavy metals, further increasing its toxicity (McCarthy & Pretorius, 2009).

AMD from coalfields in Emalahleni have contributed to water pollution in the Olifants river and Vaal river basins (Moyo et al., 2024). As the industry continues to develop in Emalahleni and coal grades decrease, the continued generation of AMD may cause irreversible and costly damage to water in the region (Moyo et al., 2024). According to the municipality, Olifants River supplies over 70% of the municipal water provision capacity (Emalahleni Local Municipality, 2025), posing a significant risk of AMD entering the human and animal food chains.

The human health risks of AMD remain largely unknown. The presence of heavy metals in AMD act additively in terms of adverse health effects, and dictate symptoms variability. For instance, the presence of arsenic may cause respiratory issues and cardiovascular failure,

while cadmium may cause renal failure (CSIR, 2013).

In the past decades some solutions have been put forth to deal with AMD contamination in the region. For instance, a Water Reclamation Plant, or the use of evaporation dams which allow for contaminated water to evaporate into the atmosphere, or the controlled release of waste water to keep contamination levels at a minimum (McCarthy & Pretorius, 2009). None of these solutions address the root cause of the problem, or eliminate the risk of AMD - they simply displace it. Research into the impacts of AMD on human health and on communities living in coal-mining regions remains in its infancy. It is imperative that these impacts be studied in order to devise robust protective measures and hold mining conglomerates accountable for harms caused to human health, land, and water biodiversity.

The generation of hazardous waste by the mining industry in this particular region, and its continued impact on local communities, indicates the wider, systemic issue of waste mismanagement. Despite a successful court case in 2022, during which air pollution was recognised as a violation of Constitutional rights in the broader Highveld Priority Area, residents of eMalahleni continue to suffer the burden of excessive coal mining and inadequate waste management (CER, 2022). Residents and national civil society organisations continue advocating for the protection from air pollution in the region, and in August 2024, the Deadly Air Case was taken to the Supreme Court of Appeal (SCA), and the government's failure to protect citizens in the region was challenged (CER, 2024).

Tailings Disasters

Tailings dams are large structures designed to store hazardous byproducts of the mining industry. South Africa has more than 200 active tailings dams (MacRobert, 2018). About 52 of these are upstream dams, which are the cheapest to construct, but also the most dangerous. Due to their structure, the risk of erosion by tailings, causing the structure to rupture is high (Reuters, 2020). The risks of tailings dams in South Africa are heightened by low compliance rates of mining companies in the management and monitoring of tailings dams.

In recent years the critical risks of tailings dams were emphasised by two major tailings disasters in South Africa – both dams failed, causing the run-off of hazardous mineral waste into surrounding areas. In December 2021, the Zululand Anthracite Colliery (ZAC) dam in Kwazulu-Natal failed, resulting in at least 1.5 million litres of coal mine tailings surging into the Black uMfolozi and White uMfolozi river systems, reaching several rural communities and the Hluhluwe-iMfolozi and iSimangaliso wildlife reserves. Coal mine tailings produce highly acidic waste containing toxic heavy metals like arsenic, copper, lead, and manganese. The Jahidada community - whose primary source of drinking water is the uMfolozi River - was uniquely impacted by this tailing disaster (Carnie, 2022).

> "This water was polluted by ZAC, and Jahidada residents continued drinking from this source until now. We therefore feel that this was unethical and it compromised our health." (Carnie, 2022).

In January 2023, the Menar Group which owns the Zululand Anthracite Colliery proposed various remediation measures, including supplying water to the community. According to the iMfolozi Community Wilderness Alliance (ICWA), the Menar Group did not deliver this redress, leaving community members reliant on contaminated water (Save our iMfolozi Wilderness, 2022). To this day, no audits or research have been conducted to identify the impacts of the 2021 tailings disaster on water quality in the uMfolozi River, and human health.

In September 2022, another tailings disaster occurred in South Africa. The Jagersfontein tailings dam in the Free State Province failed, causing a rush of 6 billion litres of tailings to travel approximately 8.5 kilometres, destroying over 50 homes, killing 4 people, and injuring another 40 (Earthworks, 2022; Marais, et al., 2024). Cars were swept away; power lines were disrupted; more than 300 people were displaced, and at least 500 animals were killed. Tailings entered the Wolwas Dam, Prosesspruit, and Rietrivier (Logard, 2024). Both Jagersfontein Developments, who owned the tailings dam, and the South African government had been warned by the local municipality, employees and residents of the dangers posed by the dam. Despite this, the mining company continued to pour mineral waste into the dam, and reinforced the dam wall using the tailings themselves - a practice known to be unstable and unsafe. To this day, residents who were displaced as a result of the disaster continue to live in rented accommodation across several locations. The mining company has since resorted to disposing the remaining tailings into the site of its original mine (Bench Marks, 2023).

Both of these disasters point to the risks of hazardous waste proliferation, especially when compounded with corporate mismanagement and, in the case of the Jagersfontein disaster, government complicity and negligence.

Health Care Risk Waste Incineration

Waste produced by the healthcare industry is a priority environmental concern on a global scale. It is the fifth largest contributor to greenhouse gas emissions, and produces incrementally larger quantities of waste each year (Massei & Specchia, 2023). In South Africa, the generation of Health Care Risk Waste (HCRW) is estimated to increase 1.5% annually, caused by a growing population and the expansion of the healthcare system and its services (Zikhathile, 2022). While HCRW is not a top contributor to hazardous waste generation in the country, its management has long been criticised by researchers and civil society alike. It has come into question both as a result of speculations around the safety and efficiency of the technology used to treat it, and because of inadequate national resourcing.

The term HCRW describes all waste generated by the medical, sanitary, and other health services industries. In South Africa, HCRW is classified under one of three streams: pathological waste, infectious waste and sharps, and chemical waste. Statistics for HCRW vary significantly depending on the source and typically centre on treatment figures. In 2017, the DFFE reported that South Africa treated 48,000 tonnes of HCRW, compared to more recent figures reported to SAWIC, suggesting that in total, nearly 2 million tonnes of HCRW were treated in 2023 (chemical waste: 3,384 tonnes; infectious waste and sharps: 1,925,025 tonnes; pathological waste: 30,520 tonnes) (DEA, 2017; SAWIC, 2023). These figures do not include treated HCRW in the Free State, Kwazulu-Natal, Mpumalanga, and the Northern Cape as these provinces did not report any treatment figures during the same year.

A research study published in 2022 suggests that South Africa generates on average 42,000 tonnes of HCRW a year, although SAWIC has not reported any figures (Zikhathile, et al., 2022). The variability and inconsistency in HCRW generation and treatment data points to the unreliable nature of waste-related information in the country. It foreshadows and, ultimately, contributes to the mismanagement of HCRW in the country.

A significant but unreported amount of HCRW bypasses the waste management system every year due to a lack of adequate resources, poor guidelines, and slack enforcement measures in the sector. Often, medical facilities, such as hospitals and pharmacies, are not acquainted with guidelines for the classification of HCRW and have limited funding for contractual services such as waste removal, transportation, and storage. Consequently, employees often are unguided and unsupported in managing waste (Chisholm, et al., 2021). It is thus common for HCRW to be dumped, or improperly labelled and thrown together with mixed or general household waste in municipal waste facilities (Chisholm, et al., 2021). This creates a sector of high-risk informal waste management.

Officially, HCRW management in South Africa is governed by the Draft Health Care Risk Waste Management Regulations (2012), which provide that HCRW is to be treated either through incineration or an alternative non-combustion technology such as autoclaving, microwaving, and electro-thermal deactivation. These processes sterilise HCRW, rather than destroy it (Pilusa & Seodineng, 2017). In 2023, SAWIC reported that 25 facilities in the country had treated infectious waste and sharps, 10 had treated pathological waste, and 2 had treated chemical waste (SAWIC, 2024). It is unclear whether these facilities overlap, and which treatment method is used by each facility. In 2018 there were 18 HCRW treatment facilities countrywide, compared with 12 in 2014 (SAWIC, n.d.). It appears that the number of HCRW treatment facilities is increasing to match the rate of HCRW generation nationwide.

Incineration is the favoured method for the treatments of HCRW, followed by autoclaving (Zikhathile, et al., 2022; Pilusa & Seodineng, 2017). The viability of incineration as a treatment method has come into question due to concerns about harmful emissions and residual materials, due to poor enforcement measures in the sector, with several facilities operating without a valid Atmospheric Emissions Licence (AEL) (Chisholm, et al., 2021; Pilusa & Seodineng, 2017).

HCRW incineration generates toxic emissions known as Persistent Organic Pollutants (POPs). These include dioxins and furans, particulate matter, sulphur dioxide, oxides of nitrogen, and hydrogen chloride. While the Air Quality Act (S21) provides limits for dioxins and furans,[5] there is no national comprehensive programme to monitor whether POP emissions are in line with the Stockholm Convention on POPs, to which South Africa has been a party since 2012.

As their name indicates, POPs are persistent – which means that they take a long time to break down once they have permeated the environment. For example, dioxins accumulate in the body through atmospheric exposure and through the food chain. Once dioxins have entered the human body, they will remain there unless they are passed down through childbirth. Dioxins may cause cancer, damage to the immune system, endocrine disruption, and a range of reproductive and developmental problems (EPA, 2023; Clean Air Action Network, 2020). In the absence of comprehensive monitoring standards and, in some cases, valid AELs, HCRW incineration poses a serious threat to surrounding communities as a result of exposure to toxic POP emissions.

These risks are compounded by additional emissions of particulate matter and toxic gas emissions, which are generated throughout the incineration process. Incinerators often burn waste 24 hours a day, with few breaks in operation throughout the year. Research into the impacts of HCRW incineration on community health is in its infancy, and activism in the area is yet to gain national traction. Incinerators are usually located in industrial areas, near informal settlements. An unequal burden is placed on low-income black communities who bear the brunt of health impacts together with the absence of governmental and corporate protection (Cairncross & Nicol, 2005).

Two Averda incinerator facilities will be used as case studies to illustrate HCRW incineration in the country. This will provide a baseline for further research on community impacts and advocacy efforts. Facility AELs and WMLs are not available online, so they were obtained from Averda directly.

Averda: Klerksdorp

The Averda Healthcare Klerksdorp Incinerator is located in South Africa's North West province and is South Africa's largest medical waste incinerator. As per its WML (approved by the DFFE in 2013 and valid for ten years), it is authorised to incinerate 28 tonnes of HCRW a

5 Subcategory 8.1: 0.1 ng I-TEQ /Nm3 under normal conditions of 10% O_2 , 273 Kelvin and 101.3 kPa in a facility treating 10kg waste per day

day, 340 days a year – in total, this amounts to about 9,500 tonnes a year. It accepts laboratory, anatomical, isolation, infectious, sharp, pharmaceutical, veterinary, nappy, sanitary, and low level radioactive, genotoxic and cytotoxic waste. An external audit conducted in 2023 confirmed that it incinerates on average 11.3 tonnes of HCRW a day, adding capacity when necessary. While it currently incinerates less than it is permitted, the Klerksdorp facility plans to upgrade its incinerators to handle 35 tonnes of waste a day, or 11,900 tonnes a year. This will undoubtedly increase the facility's emissions and the subsequent environmental and health impacts.

The facility's AEL, valid from 2021 to 2026, provides a list of permitted emissions (mg/nm^3) in line with national guidelines for averaging periods of either 1 hour or 24 hours. This includes emissions of particulate matter, carbon monoxide, sulphur dioxide, hydrogen chloride, oxides of nitrogen, dioxins, furans, and more (DEA, 2013). In 2023, the facility was issued a pre-compliance notice for non-compliance with its AEL. This notice is not available and external audits for compliance with the AEL have not been provided by Averda.

In 2020, Averda Klerksdorp exceeded the emissions targets listed in its AEL. It also breached the conditions to its WML, failing to comply with its duty in respect to managing waste, and failing to provide documents required to demonstrate compliance (DFFE, 2021). Averda was issued a pre-cancellation notice in 2021, with the opportunity to make representations to the allegations presented. It is unclear what came of this, but the facility runs to this day. This breach of compliance is alarming, especially as the facility is planning a threefold increase in its operations. Given the facility's location in the centre of Klerksdorp, residents are exposed to excessive emissions 340 days a year.

In early September 2025, the facility caught on fire. This incident went unreported until it was picked up by local news several days later. Parts of the facility including the Continuous Emissions Monitoring System station were destroyed, and due to strong winds, nearby waste piles in the yard were set alight. Unlike ordinary waste incineration which involves gas-cleaning equipment to reduce (at least in part) harmful emissions, this uncontrolled fire certainly emitted uncharacteristically large amounts of air pollution containing dioxins, furans, and POPs. Communities living in proximity to the site have already experienced elevated emissions due to breaches at the hands of Averda, however, this fire will likely cause further and more serious impacts.

According to the DFFE, the facility had been issued a warning in February 2025 after a compliance inspection. It is unclear where compliance had been lacking - however, some suspect it may be linked to the fire.

Averda: Optimum

The Averda Optimum Incinerator located in Groeneweide Park, George, in the Western Cape has an active WML (2019 to 2029) for the incineration of HCRW. The facility has a capacity of 12 tonnes a day, 365 days a year, with a maximum waste consumption of 4,380 tonnes a year. The last external audit for compliance with its WML stated that the Optimum facility incinerated about 3.5 tonnes of HCRW a day, or 1,300 tonnes a year. It accepts multiple HCRW materials: laboratory, anatomical, genotoxic and cytotoxic waste, plus isolation waste, infectious waste, sharp waste, low level radioactive waste, pharmaceutical waste, veterinary waste, nappy waste and sanitary waste.

The facility's AEL expired in May 2024 and is currently being renewed. No further information has been provided on the renewal for this AEL, however Averda does not list Optimum under its 'licensed facilities' (Averda, n.d.). It is unclear what this means about the facility's current operations, or what consequences Averda would face, were the facility not licensed.

Its most recent AEL prescribed emission (mg/nm^3) limits are in line with national legislation, allowing for particulate matter, carbon monoxide, sulphur dioxide, hydrogen chloride, nitrogen oxides, dioxins, furans, and more (DEA, 2013). No audits or further information is available regarding the facility's actual emission rates. The incinerator is located in a residential area, near farmland, the Gwaingrivier, and a number of businesses. In the absence of audits and publicly available monitoring data, it is impossible to know the impact that emissions may be having on surrounding communities; however, their proximity to the incinerator is concerning.

The lack of transparency at the hands of waste management companies, specifically in terms of compliance with AELs, obscures a complete image of the impact of HCRW incineration on the environment. It is imperative that transparency becomes a priority, in order for companies to be held accountable for their role in creating an unhealthy environment for residents living nearby.

Cement Kiln Co-Processing

In light of hazardous waste proliferation in the past few decades, there is a growing need for expansion of the waste treatment sector, both in terms of capacity and innovation (DEA, 2008C). Co-processing is a method of waste management that utilises waste as a source of energy to replace fossil fuels such as coal, gas, and petroleum in energy-intensive industries (Cembureau, 2024). Since the 1980s, the cement industry has utilised co-processing of multiple waste types, including hazardous waste, as an alternative fuel for the manufacture of cement in cement kilns.

Cement kilns in South Africa began using alternative fuels and raw materials in 2001, with the burning of spent pot liners from the aluminium industry (DEA, 2007). Permissible waste streams have since widened significantly, providing five classes of alternative fuels to be used for co-processing: gaseous alternative fuels (coke oven gases, refinery waste gas, landfill gas); liquid alternative fuels (low chlorine solvents, vegetable and lubricating oils and fats, distillation residues); pulverised, granulated or fine crushed solid alternative fuels (ground wood, sawdust, planer shavings, dried sewage sludge, granulated plastic, animal flours, fine crushed tyres); coarse crushed solid alternative fuels (crushed tyres, rubber, plastic waste, waste wood); and lump alternative fuels (whole tyres, plastic bales) (DEA, 2007).

In the context of waste-derived fuel for cement production, it is important to note the case of waste tyres, not only because of the rate at which their use is increasing but also because of their current legal classification in South Africa as general waste (DEA, 2012). The Basel Convention (1993), to which South Africa is signatory, considers tyres hazardous for many reasons. Waste tyres are composed of about 1.5% hazardous materials such as zinc and copper compounds, lead and cadmium. When disposed of via inadequate methods, these materials block water channels, which increases the risk of erosion and flooding. When burnt, tyres generate smoke, oils and toxic pollution which contaminate the surrounding air, soil and water (Basel International, 2011; Mahlangu, 2009). Despite this, their use as alternative fuels is increasing, with previous initiatives such as the Recycling and Economic Development Initiative of South Africa (REDISA) partnering with a number of cement companies, including NPC, Afrisam and Afrimat, to supply waste tyres for controlled burning in kilns (REDISA, 2023; Green Economy Media, n.d.). This section of the report will consider the use of tyres in co-processing alongside other hazardous waste materials.

While the intention to use co-processing may seem advantageous on paper because it reduces the need for fossil fuels and presents a waste solution, its adverse impacts are seldom mentioned or studied (Engineering News, 2020; DEAT, 2008). This method does not address the central question of hazardous waste generation and, if anything, legitimises it, as it can be streamlined into a circular economy of sorts. The cement industry benefits from co-processing because it reduces its fossil fuel costs and 'greens' its image as one of the most polluting industries on earth, contributing 7% of the world's carbon dioxide emissions (Brock, et al., 2021).

The cement industry is already a major polluter, contributing about 1% to nationwide emissions (WWF, 2018). The addition of a hazardous component to cement manufacture increases the environmental burden generated by cement production. Emissions vary according to the characteristics of each combustible and volatile material incinerated, precluding a standard emission pattern. Generally, cement kilns that co-process waste report emissions of persistent organic pollutants, as well as nitrous oxide, sulphur oxide, ozone, particulate matter, carbon monoxide, and cement kiln dust among others, each entrenching a range of environmental and health impacts (Harley, 2007).

Unlike other methods of waste combustion such as modern waste incinerators, cement kilns are not designed to burn waste and are thus ill-equipped to limit the emission of exit gases (Oakleigh, 2007). Persistent organic pollutants such as dioxins and furans are of special concern because they are highly persistent pollutants, i.e. they take a long time to break down once they have permeated the environment. Dioxins and furans are toxic and can cause an array of diseases and symptoms, such as cancer, endocrine disruption, and a range of reproductive and developmental problems (EPA, 2023; Clean Air Action Network, 2020; Ministry for the Environment, 2021). Research into these emissions has revealed that kilns that burn hazardous waste emit 80 times more dioxin than kilns that use fossil fuels (Harley, 2007).

Using hazardous waste as feedstock in cement kilns also impacts the composition of cement kiln dust which contains, on average, 9 times more lead, 5 times more cadmium, and 7 times more chromium than kilns that combust traditional fuels (Harley, 2007). This increases the toxicity of cement kiln dust, which is already a large risk factor due to the particulate matter it contains. When inhaled, particulate matter causes a range of respiratory issues including lung cancer and emphysema (Harley, 2007). Despite these key concerns, several cement kilns are authorised to co-process hazardous waste. Four case studies of cement kilns are detailed below, intending to create a snapshot of the scale of hazardous waste co-processing in cement kilns, in order to understand possible impacts on the environment and surrounding communities.

Picture 4: Cement kilns co-processing hazardous waste and waste tyres

Natal Portland Cement: Simuma

Natal Portland Cement (NPC), also known as Intercement or Huaxin, is a cement company that operates in South Africa, Mozambique and Egypt. Across its international cement manufacturing operations, NPC has replaced 50–70% of traditional fossil fuel sources with waste (Engineering News, 2020). In 2021, NPC used about 750,000 Gj of refuse-derived fuels, 615,000 Gj of mixed industrial waste, and 1.3 million Gj of other fossil-based waste (InterCement, 2021). No aggregated data is available regarding the use of alternative fuels and Refuse-Derived Fuel (RDF) for South African operations.

In South Africa, NPC operates cement plants in Durban, Newcastle and Port Shepstone. Since 2015, the Simuma Plant in Port Shepstone has been licensed to burn alternative fuels and resources in cement kilns 1 and 2. The plant is authorised to burn 1 tonne of hazardous waste, and 100 tonnes of general waste, per day. Engagement with NPC confirms that, on an annual basis, the Simuma plant burns 5,443 tonnes of whole tyres, 58 tonnes of shredded tyres, 160 tonnes of waste oils, and 7,683 tonnes of heavy ends (oil residuals left at the bottom of crude oil distillation towers).

In a Final Basic Assessment Report for proposed upgrades to the Simuma facility, NPC confirmed that an increase in production capacity will lead to an increase in fuel requirements, including alternative fuels. NPC's strategy is to maximise the use of alternative fuels as much as possible, with the use of whole tyres in kiln 1 and shredded tyres in kiln 2. NPC receives its whole tyres from the Waste Management Bureau (responsible for the interim management of waste tyres after the withdrawal of the RESIDA plan in 2017) but the Bureau has not supplied NPC with shredded tyres since August 2022. No further information is available to explain where NPC sources its shredded tyres.

The facility's AEL stipulates that both cement kilns are permitted to operate 24 hours a day, 365 days a year. In 2021, NPC reported emissions of nitrous oxide, sulphur dioxide, and volatile organic compounds. Given NPC's proximity to communities, farmlands, the Mzimkhulwana River, primary schools (Kwaluhlaza, Murchison, and Maris Stella), and the Murchison District Hospital, the perpetual emission of these gases is concerning. The communities living within this 10 kilometre radius are directly exposed to and impacted by the environmental and climate impacts of hazardous waste co-processing. Without considering the practical implications of using hazardous waste co-processing, the proximity of communities to the NPC factory is a clear indication that NPC's role is threatening the rights of individuals to an environment that is not harmful to their health and well-being.

Further, it must be noted that NPC generates a large amount of hazardous waste through cement manufacturing. No aggregated data is available for the amount of waste produced in South Africa. However, in total, cement operations generated 45,000 metric tonnes of hazardous waste in 2021, more than 42,000 of which were landfilled (Intercement, 2021). NPC continues to operate under the guise of providing a solution to hazardous waste proliferation while sending nearly all the hazardous waste it generates to landfills. This underlines NPC's interest in using the 'green' label of co-processing, while continuing to contribute to South Africa's hazardous waste problem.

Pretoria Portland Cement: De Hoek and Dwaalboom

Pretoria Portland Cement (PPC) is a South African manufacturer and supplier of cement operating in South Africa, Botswana, the Democratic Republic of Congo, Ethiopia, Rwanda and Zimbabwe. De Hoek and Dwaalboom are two of PPC's South African cement-manufacturing plants. Both factories are licensed to use alternative fuels for the production of cement, including refuse-derived fuels. Engagement with PPC confirms that it is authorised to burn RDF but currently, it is not doing so.

At the De Hoek plant, 2,428 tonnes of tyres were co-processed, compared with 1,321 tonnes in 2022 (PPC, 2023). This is a significant decrease from the year 2020, during which the facility co-processed 15,000 tonnes of waste tyres (PPC, 2020). No further information is available on the co-processing of other waste materials.

The Dwaalboom facility is authorised to co-process waste products in kilns 1 and 2, specifically, scrap tyres, rubber waste, de-watered treated pellets, hydrocarbon waste, oil contaminated general waste, coal fines (tailings), plastic waste, and biomass (paper waste, sawdust, wood chips and waste from biofuel production). The 2023 PPC annual report confirms that Dwaalboom burns refractory spent pot liners but does not specify the quantities used.

Both facilities are located in close proximity to communities. The De Hoek plant is located near a number of small towns such as Wittewater, Piketberg, and Korinberg. It is also located beside the De Hoek Golf and Recreation Club, near the Banghoek private nature reserve, and a few adjacent hotels and guesthouses. The Dwaalboom plant is located in a rural region in the north west part of the Limpopo province, but is situated less than two kilometres away from the Matlametlong community, and about a kilometre further from the Mokgalaneng and Disake communities, which house eight schools in total, between them.

Audits for both facilities are not publicly available; however in its integrated annual report, PPC confirmed that cement operations in South Africa emitted a total of 2,974,774 tonnes of CO_2 (PPC, 2023). In 2023, PPC De Hoek exceeded the sulphur oxide and nitrous oxide emission limits. It was consequently issued a compliance order for excessive emissions. On top of this, dust complaints were made at several PPC plants, including Dwaalbom and De Hoek (PPC, 2023). The combination of carbon dioxide emissions, dust complaints, and excessive sulphur dioxide and nitrous oxide emissions means that communities living close to both plants are vulnerable to the toxic health impacts of hazardous waste co-processing in the cement industry.

AfriSam: Dudfield

AfriSam is a South African cement, aggregate and ready mix manufacturer. Its cement manufacturing facility in Dudfield is authorised to co-process alternative fuels and raw materials in cement kilns 2 and 3, to replace coal. It is licensed to burn scrap tyres, hydrocarbon and carbon waste, plastic waste (excluding PVC), grease and oil contaminated textiles. It also is authorised to receive waste from the AfriSam/EnviroServ Waste Blending Platform in Roodepoort. No information is currently available on the waste materials or quantities used for co-processing. No AEL is available online, nor is data available regarding the Dudfield facility's emissions. This lack of transparency points to

a flawed waste management system, within which companies are able to operate with no regulations whatsoever, and are able to co-process whichever materials without facing the consequences.

The Dudfield plant is located about 6 kilometres from the centre of Lichtenburg, a farming town known for growing maize and producing meat. The town comprises schools, sports grounds, a golf club, and several hotels. Local and visiting communities are impacted through the air they breathe and through the food they consume. Despite the absence of emissions data, it is still possible to imagine the impact that emissions such as POPs may be having on local residents, through the ingestion of local meat and produce. Research into cement kiln co-processing has stagnated in the past few decades and most of it is fairly rudimentary. This underlines the impetus for independent research into the impacts of hazardous waste co-processing, and simultaneous advocacy for communities living in proximity to these industries. Industry transparency in terms of waste origin, volumes, emissions and actual waste continues to be a major barrier to these efforts. It is imperative that the relevant authorities hold cement companies to account in order for advocacy and research to be conducted.

Conclusion

This report aimed to create a snapshot of the hazardous waste management system in South Africa, focusing on landfills and dumpsites, mineral waste management, health care risk waste incineration, and cement kiln co-processing. Understanding and mapping these waste and management types is a first step towards uncovering the full extent of the hazardous waste management sector's contribution to environmental injustice in South Africa - particularly in terms of the measurable impacts it has had, and continues to have on communities around the country.

The communities mentioned in the report - be it the Aloes community living near the Shongweni landfill, or those living in Tudor Shaft Informal Settlement built directly on top of gold mineral waste in Witwatersrand - are too often overlooked. Government and waste management conglomerates have failed local communities for decades. Corporations have failed to operate in line with protective legislation, and the government has failed to enforce them. The sector is experiencing a cycle of low compliance, enforcement and accountability, leaving corporations to operate undeterred by the relevant authorities and civil society.

A majority of hazardous waste is not being managed - it is being dumped. This is a result of lacking resources, but also of waste producers' and managers' failure to properly classify, handle, delegate, and treat waste according to national and international provisions. There is an obvious disconnect between existing legislation and practice, urging a rethink of the current legislative system and corresponding enforcement measures. This includes making hazardous waste-related legislation more accessible to waste producers, and the potential creation of a new, workable and integrated legal framework. It urges corporate transparency and accountability - so that they may be held responsible for legal breaches, and community, climate, and environmental harm.

Finally, disproportionate emphasis is placed on *management* rather than waste *minimisation*. It is crucial to observe the root cause of the impacts of hazardous waste: waste generation. Only waste minimisation will directly alleviate the impacts of hazardous waste. As it stands, the waste management system must be changed to one that is workable, conducive to waste minimisation, prioritises compliance and enforcement, and finally, genuinely adheres to principles of environmental justice above all.

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