

Legislative challenges hindering mine waste entering the circular economy in South Africa

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Context: Putting mine waste into perspective

Mining produces significant amounts of waste

Global mine waste deposited \approx hundred billion tonnes*

Metal and mineral waste \approx 15 billion tonnes*

\approx hundred million hectares*
i.e. waste could cover 84 000 km² of Ireland to a depth of more than 2 m[#]

10 times more than global municipal waste[@]

**20 tonnes of mine waste produced to make a gold wedding band²
1 ton copper generates 110 tonnes of waste[^]**

Blight, G. 2011. Chapter 5: Mine Waste : A brief overview of origins, quantities and methods of storage. In: Waste: A handbook for management. Pg 77-88

[^] Das, R and Choudhury, I. 2013. Waste management in mining industry. Indian Journal of Science Research 4(2): 139-142

*Lottermoser, B.G. 2010. Mine Wastes: Characterization, Treatment and Environmental Impacts. Springer, Berlin: Germany

[@] Worldwatch Institute, Global municipal solid waste continues to grow <http://www.worldwatch.org/global-municipal-solid-waste-continues-grow>

Context: Putting mine waste into perspective: South Africa

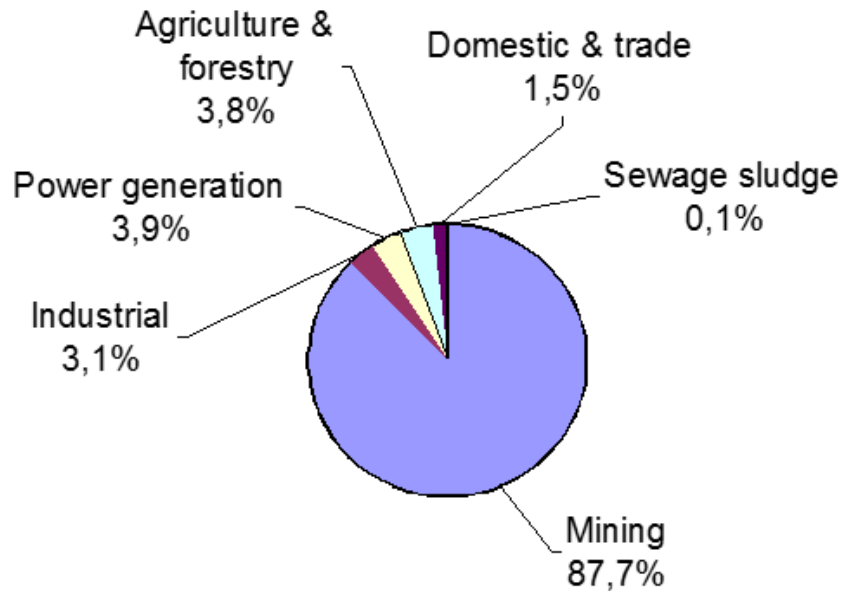
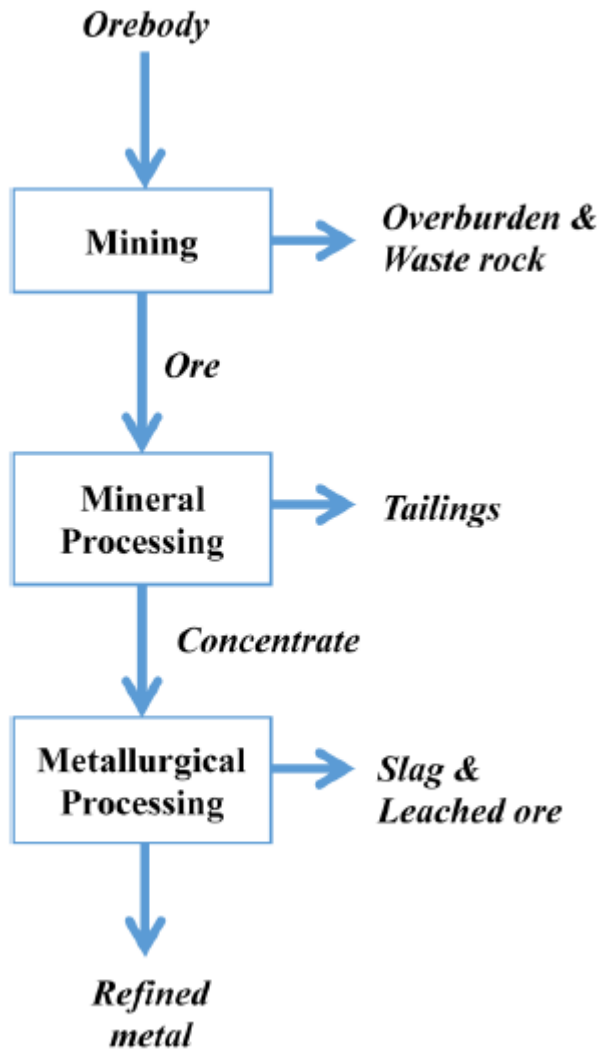


Figure 1. National waste generation rates in South Africa in 1997.

Purnell (2009), using StatsSA indices for mining: production and sales as a basis, estimated that approximately 510 million tonnes of mining waste was produced in 2007 in SA.

The extent of “... problems related to mining waste may be rated as second only to global warming and stratospheric ozone depletion in terms of ecological risk” (EEB, 2000)

Generation of mine waste



Waste can be in the form of:

- solid waste
- water waste
- gaseous waste

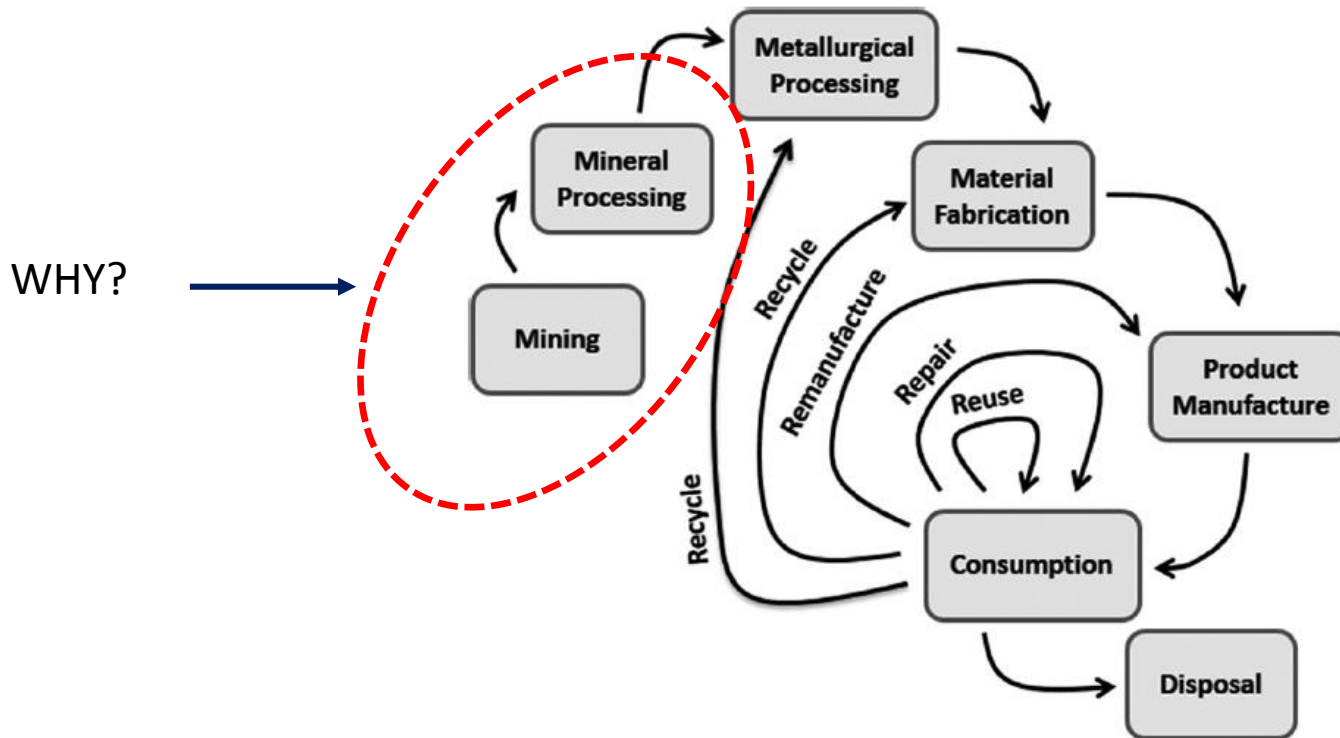
The waste can be:

- mineral or non-mineral waste
- Hazardous or non-hazardous

Common impact:

- AMD
- Sinkholes
- Displacement of settlements
- Destruction of biodiversity
- Air pollution

Mine waste and the circular economy

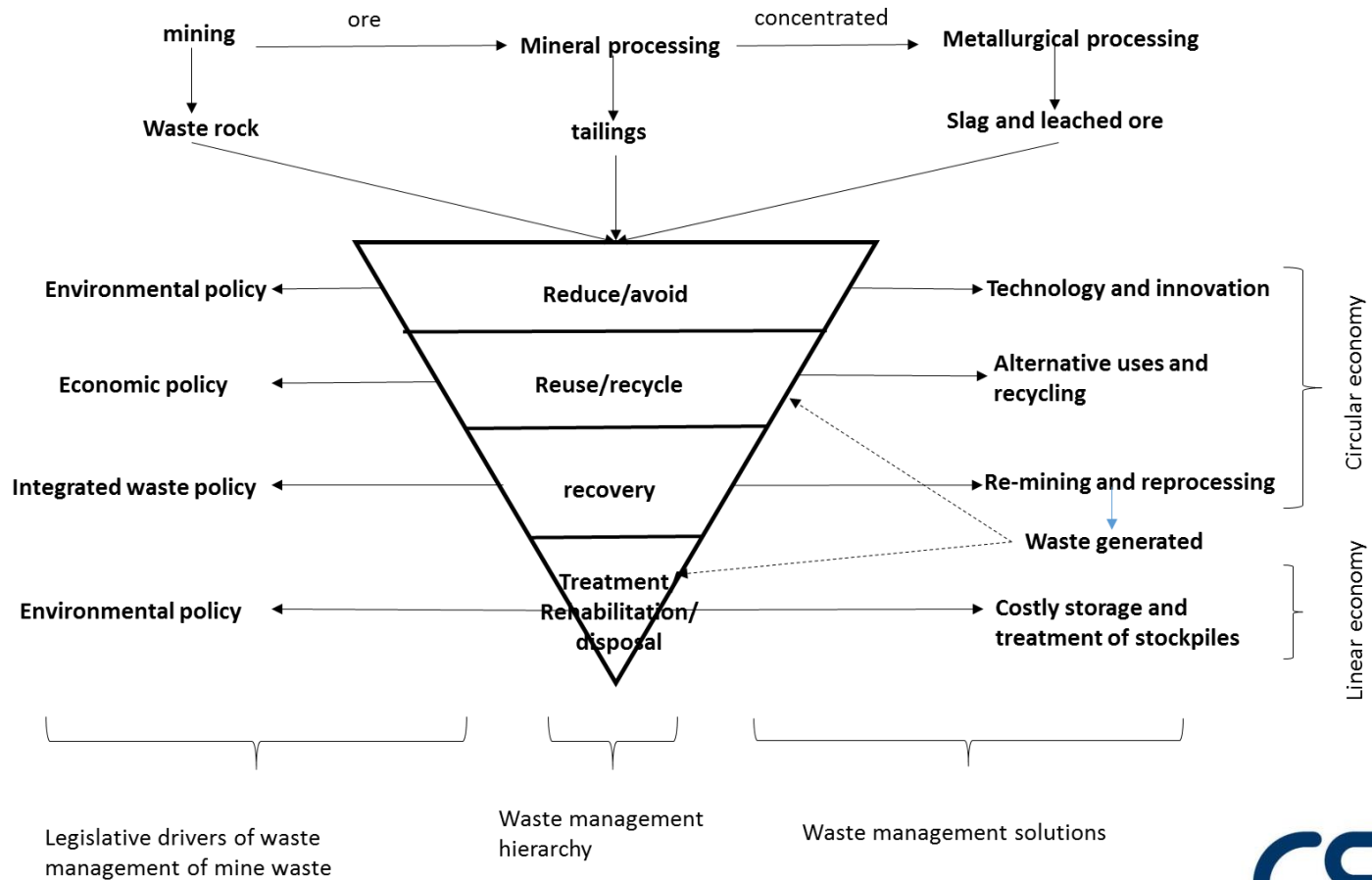


Lebre, E., Corder, G. and Goler, A. 2017 The role of the mining industry in a circular economy. *Journal of Industrial Ecology* 21(3): 662-672

Mine waste uses

Waste type	Reuse and recycling option
Waste rock	<ul style="list-style-type: none"> • Resource for re-mining of minerals and metals • Backfill material • Landscaping material • Substrate for revegetation • Aggregate in embankments, roads, pavements, foundation and building construction • Asphalt component • Feedstock for cement and concrete • Carbon capture and sequestration • Production of ceramic materials
Mine water	<ul style="list-style-type: none"> • Dust suppression • Recovery of metals from AMD water • Drinking water • Industrial and agricultural use • Coolant or heating agent
Mine sludge	<ul style="list-style-type: none"> • Extraction of hydrous ferric oxides for paint pigments • Extraction of Mn for pottery glaze • Flocculant/absorbant to remove phosphate from sewage and agricultural effluent • Used as fuel in co-generation facilities
Tailings	<ul style="list-style-type: none"> • Reprocessing to extract minerals and metals • Waste reduction through targeted extraction of valuable minerals during processing • Sand-rich tailings mixed with cement used as backfill in underground mines • Clay-rich tailings as an amendment to sandy soils and for the manufacturing of bricks, cement, floor tiles, sanitary ware and porcelains • Resurfacing
Slag	<ul style="list-style-type: none"> • Roof shingles • Railway ballasts • Used for sub surface drainage material • Road and civil construction

Waste hierarchy



Legislation impediments

Mine waste having no legal definition

- MPRDA (2002): mine residue stockpile/deposit
- definitions imply a type of waste resulting from the exploration, mining, quarrying, and the physical and chemical treatment of minerals but fails to legitimatise it as an actual waste
- Mine waste is a resource – re-mining as technology advances (DMR)
- Schedule 3 of the Waste Act (2014): hazardous waste streams

Legislation impediments

Cradle-to-grave approach to environmental management

- Regulation 73 of the MPRDA Regulations: EIA report and EMP/R.
- Lifecycle consideration: construction, operation, closure and rehabilitation: ‘take, make, consume, discard’
- mining company liable for the damage and degradation caused by the mining activities throughout the life-cycle of the mine
- Cradle-to-grave approach does not promote circularity
- Cradle-to-cradle approach: encourage and force the mining applicants to reconsider the economic value of the mine residue and encourage its reuse into other streams

Legislation impediments

Hazardous waste

- NEMWA (2008) exempt mine related waste from the waste classification system
- NEMWAA (Act 26 of 2014) included mine residue stockpiles and deposits as forms of waste
- Mines required to obtain a waste management licence for the creation and management of the stockpile
- Waste hierarchy applies but no discussion on the reuse of waste stream
- Schedule 3, Category A: hazardous waste



Warning
Hazardous
Waste

Way forward

- Residue to be defined as a resource – would enable it to be used as a by-product
- Change focus from cradle-to-grave to cradle-to- cradle: integrated waste management to be a focus
- Process to separate and distinguish mine waste from hazardous and toxic waste

Benefit for a mine: generate income from selling waste and reducing their environmental footprint



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