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

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Mining produces significant amounts of waste

Global mine waste deposited ≈ hundred billion tonnes*

Metal and mineral waste ≈ 15 billion tonnes*

≈ 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^
Context: Putting mine waste into perspective: South Africa

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)

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

Ellen MacArthur Foundation
Mine waste and the circular economy

WHY?

### Mine waste uses

<table>
<thead>
<tr>
<th>Waste type</th>
<th>Reuse and recycling option</th>
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| Waste rock | • 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 | • Dust suppression  
|            | • Recovery of metals from AMD water  
|            | • Drinking water  
|            | • Industrial and agricultural use  
|            | • Coolant or heating agent |
| Mine sludge | • 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 | • 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 | • Roof shingles  
|            | • Railway ballasts  
|            | • Used for sub surface drainage material  
|            | • Road and civil construction |
Waste hierarchy

[Diagram showing the waste hierarchy with stages from waste generation to material recovery and reuse.]
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
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
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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