

# Environmental Risks and Management of Tailings Storing Facilities



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# Mining waste – four important issues

- Modern mining => large amounts of solid waste
- Risk for contamination
- Mine waste facilities are often large, and if poorly designed and/or managed, they may fail
- Mine closure => long term risk / liability



# 1. Modern mining => larger amounts of solid waste

	Cu
In the past: 1,000,000 tons of ore (often underground)	2 %
Modern: 4,000,000 tons of ore (often open cast)	0.5 %



■ e.g. Sweden: >80 % solid waste is from mining.



# Types of mining waste

- **Overburden & Waste rock**



- **Tailings**



# What do we do with mining waste?

- Waste rock and overburden
  - Use or recycle – often appropriate and possible within mine site; but to a very minor extent outside.
  - Backfill in underground workings and open pits – sometimes possible.
  - Safely store – normal procedure.
- Process tailings
  - Remine – quite common for old gold mines.
  - Use – very seldom possible.
  - Backfill in underground workings and open pits – sometimes possible.
  - Safely store – normal procedure.



## 2. Contamination

- Process chemicals
- Metals (from ore or waste rock)
- Acid Rock Drainage  
$$2\text{FeS}_2 + 7\text{O}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{Fe}_2^+ + 4\text{SO}_4^{2-} + 4\text{H}^+$$
- Nitrate / ammonia from undetonated explosives

# Possible to reduce contamination with modern techniques and management

- Abandoned mines in Sweden (pre 1969):  
Flow of metals to surface waters - 100:s tons/yr
- Large Swedish mine (Aitik):  
~40 Mt/yr and with discharge permit (Cu) = ~20 kg/yr





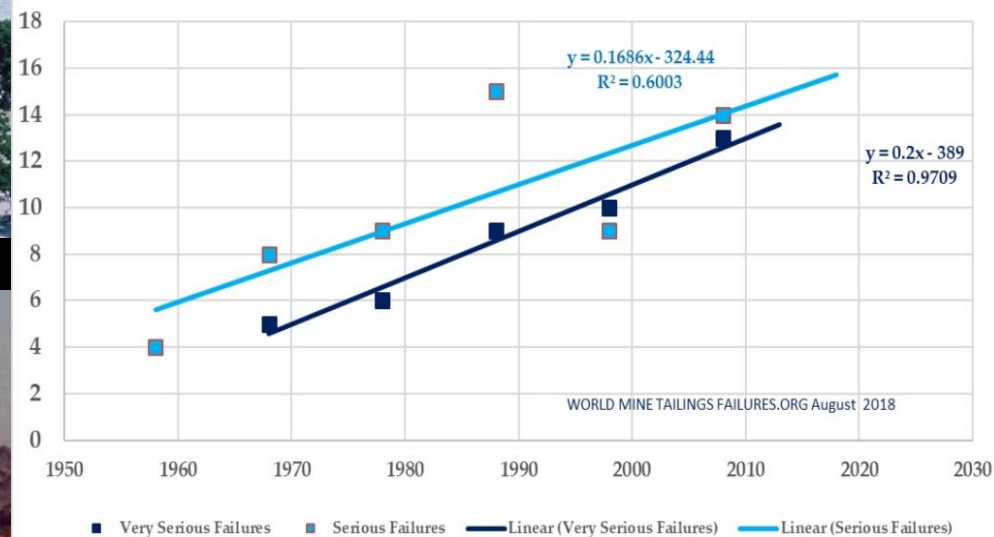




# 3. Failures of tailings storage facilities



Fig 1 VERY SERIOUS & SERIOUS TSF FAILURES  
1958-2017



Graph copied from <https://worldminetailingsfailures.org/>



4 Aug 2014,  
Mt Polley - Imperial



5 Nov 2015,  
Fundão/Mariana –  
Samarco



25 January 2019,  
Feijão/Brumadino -  
Vale



# Mining and Tailings Safety Initiative

- Church of England Pensions Board
- Swedish Council of Ethics of the AP Funds



## Global Tailings Review & Standard



Draft:  
6 Areas, 17 Principles & 77  
Requirements

## 1 – Knowledge Base

Social, economic and environmental  
Downstream area  
Location / alternatives

## 4 – Management & governance

*"Accountable executive", "Responsible  
Tailings Engineer"*  
Grievance mech.

## 2 – Affected communities

*"Human rights due diligence process"*  
Respect for individuals

## 5 – Emergency response

Plan  
Build capacity  
Cooperate

## 3 – Technical issues / monitoring

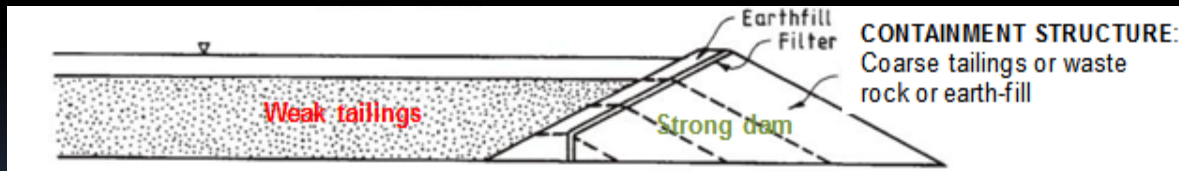
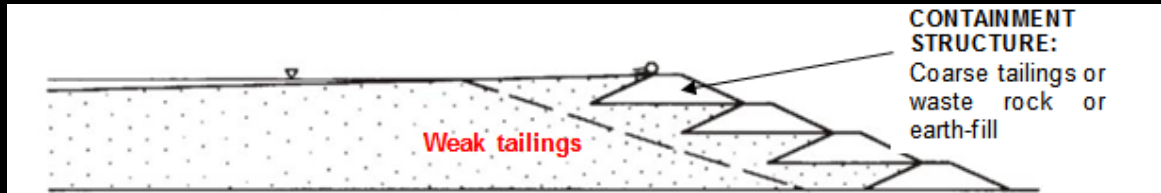
Assume extreme risk:  
Design, construction, monitoring,  
rehabilitation

## 6 – Public disclosure & access to info.

Systematic response  
Full transparency



# Up-stream vs. downstream





## 4. Mine closure

