



## **Tailings and Waste Storages in China – An International Perspective**

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# Background


- Reported average GDP growth of >8% since 1976
- Increased need for raw materials
- Policy of promoting foreign participation in mining industry to:
  - Expand production capacity
  - Introduce international mining practices to improve efficiency and safety

# Social Issues

- China's rural areas have historic and well established agricultural communities.
- Rapid development has impacted peasants and recent legislation seeks to protect rural communities from exploitation by developers
- Mining projects therefore have issues of resettlement and loss of farmland and habitat.
- Historically poor performance of tailings storages has impacted local communities – principally by degradation of air and water quality




# Environmental Issues

- There is a legacy of negative environmental outcomes caused by historic poor performance of tailings storages
  - Government has responded by introducing new environmental legislation and increasing monitoring and enforcement
  - International mining companies are receiving most attention – they therefore should implement “Best Practice” in design and operation
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# Mine Approval Process

- The Chinese legal and administrative system is a “Top Down” process
  - National Peoples Council (NPC) promulgates laws
  - Implemented by complex hierarchy of National, Provincial, County and District legislators and regulators
  - Mining in China is highly regulated and licences and permits must be obtained at planning, design, construction and operating stages
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# Design of Tailings Storages

- 3 stages of design
  - Preliminary Design (Scoping Study/Conceptual Design)
  - Basic Engineering (Feasibility Study)
  - Detailed Engineering (Approved for Construction)
  
- Chinese design requirements presented in “ZBJ 1-90 Standard for Design of Mine Tailings Storages”
  
- Combines theory and practice and addresses
  - Types of embankment
  - Proportions for containment embankments
  - Construction materials
  - Slope stability methods and min FoS
  - Seismic design criteria
  - Stormwater design criteria and freeboard

# Classification of Tailings Storages

Category (Class)	Capacity (Million m <sup>3</sup> )	Height (m)
1	High Hazard Storages requiring independent design	
2	> 100	> 100
3	10 to 100	60 - 100
4	1 to 10	30 - 60
5	< 1	< 30

# Storm Design

Return Period Storm (yrs)	Tailings Storage Class				
	1	2	3	4	5
Operating Conditions	Designer to select	100 - 200	50 - 100	30 - 50	20 - 30
Closure Conditions	1000 - 2000	500 - 1000	200 - 500	100 - 200	50 - 100

# Environmental Regulations

- The *Environmental Law of PRC – NPC 1989*: provides framework for environmental management and pollution control (plus 3 *Synchronies Policy*)
- *PRC Water Law 1988 – NPC* all enterprises should prevent water pollution and protect water quality
- *PRC Water Pollution Prevention and Control Law 1996 – NPC*: provides framework for water quality standards and waste water discharge standards
- *Implementation Guidelines to Water Pollution Control Law 2000 – NPC*: Guidelines for reporting to EPB what pollutants discharge to off-site water
- *Environmental Quality Standard for Surface Water (GB3838-2002) – SEPA*: defines 5 classes of receiving water and sets discharge standards
- *Integrated Wastewater Discharge Standard (GB8978-1996) – SEPA*: presents limiting concentrations for pollutants to be discharged

# Liners for Tailings and Waste Storages

- Seepage water (leachate) from mining waste is classified using industrial waste standards
- Leachate from Class I wastes does not exceed limiting concentrations in GB8978 and can be placed in a Type I storage. Leachate discharge must be monitored but storages do not need to be lined
- Leachate from Class II waste has some chemical species at concentrations in excess of GB8978 limiting concentrations, but below concentrations which define hazardous waste. These must be placed into a lined Type II storage. Liners may either be clay or geosynthetic (geomembranes or GCL)

# Monitoring and Inspections

- Dam Safety Committee:
  - Responsible for assessing the safety of dam structures (possibly also waste rock storages)
  - Inspection and certification of dam structures during and at completion of construction
  - Regular inspections during operation and review of operating records
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- Environmental Protection Bureau (EPB)
  - Responsible for assessing environmental conformance of waste storages
  - Emphasis on quality of discharged water
  - Regular sampling and testing of groundwater downstream of storages is required
  - Regular inspections during operation and review of monitoring records

# Closure and Rehabilitation

- At present closure and rehabilitation requirements are not comprehensively addressed
- Requirements contained in various standards ie “Greening” policy for tree planting may be applied to rehabilitation of storage embankments
- Closure designs to be included in Basic Engineering and Detailed Engineering package and reviewed by expert panel
- Expectation that where possible rehabilitated land will be returned to the community for agricultural use

# International Perspective

- Chinese design process is prescriptive and design standards are legally binding
- Designs must be prepared by licensed institutes
- Current design standards are in most cases similar to international “Best Practice” standards
- There are many standards and overlapping of requirements can sometimes create problems
- Some regulations can be restrictive ie co-disposal is prohibited
- Strict interpretation of regulations and process and documentation requirements
- Heavy emphasis on dam safety and environmental conformance – especially for international operations