EARTH SYSTEMS
Environment · Water · Sustainability

Waste Rock Pile Construction to Lower Closure and Relinquishment Costs

As a world leader in the management of geochemical stability for mineral wastes, Earth Systems can design and help implement Base-Up, Layered and Compacted (BULC) waste rock piles to lower the cost of managing AMD/ARD during operations and facilitate rapid closure and relinquishment.

Sulfidic waste rock produces the majority (60-80%) of acid and metalliferous pollution at most active and decommissioned mine sites. By implementing leading practice waste rock pile construction methods, the generation of acid and metalliferous drainage (AMD) can be significantly lowered.

Conventional end-dumping practices result in angle-of-repose pathways for air and water, exacerbating pollution generation and discharge from waste rock materials. Understanding the role of air entry mechanisms for influencing pollution generation rates is an essential step in the development of geochemically stable waste rock dumps.

Base-Up, Layered and Compacted (BULC) waste rock piles can solve many water pollution issues, avoid or minimise AMD treatment and facilitate successful closure and relinquishment across the mining sector.

BULC DUMP CONSTRUCTION METHOD

The BULC waste rock dump construction method employs geochemical engineering principles to overcome persistent AMD issues associated with conventional construction methods. The fundamental elements of the BULC Piles includes:

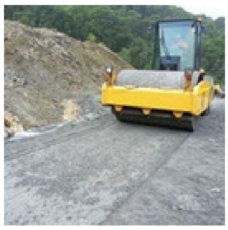
- Construction from the base, and progressing upwards, even in undulating or steep terrain.
- Commencing construction with paddock dumping, and initial dozer compaction to produce a uniform layers.
- The final thickness of each flattened layer should be between 1–3 m. Thinner layers result in more effective compaction and oxygen exclusion.
- Ongoing compaction of each layer with dedicated, conventional compaction equipment to achieve optimum permeability reduction and to lower air entry.
- Water addition to facilitate optimum compaction if required.
- Each thin, compacted lift should be constructed to control surface runoff.
- Site specific field trials are necessary to quantify detailed construction criteria.

PROJECT EXPERIENCE INCLUDES

- Base-up construction avoids the production of preferential pathways for air and water, lowering AMD generation and acidity discharge.
- Thin-lift configuration also prevents the creation of preferential pathways, as well as enhancing the opportunity for effective compaction.
- The compaction of thin layers lowers the potential for AMD generation and AMD discharge.
- Increased residence times of pore water in waste rock enhances carbonate and silicate neutralisation reactions.
- Stringent air entry control can be achieved by the occasional, strategic construction of thinner layers with greater compaction (eg. <1 m).
- Water addition to optimise compaction can further lower air entry.
- Complete reliance on cover systems can be avoided if multiple waste rock layers help control air entry.
- Intermittently distributed very thin, compacted layers of low permeability or reactive carbonate materials can further lower reliance on cover systems.
- The risk of spontaneous combustion is dramatically minimised by lowering porosity, permeability and air entry into waste rock;
- Historic PAF waste rock piles can be encapsulated with BULC piles, providing pollution control from legacy materials.
- Potential to improve the geotechnical stability of waste rock storages.
- The initial cost of BULC piles may be higher than end-dumping procedures at some sites, but these are predicted to be far outweighed by the savings in lower AMD management and water treatment costs, as well as closure and relinquishment expenses.





earthsystemsglobal.com

AUSTRALIA
enviro@earthsystems.com.au

MELBOURNE
4/290 Salmon Street, Port
Melbourne, VIC 3207
+61 3 9810 7500

PERTH
BRISBANE

EUROPE
enviro@earthsystemseurope.com

BRISTOL
Generator Building,
Counterslip, Bristol BS1 6BX,
United Kingdom
+44 117 373 6153

AFRICA
enviro@earthsystemsafrica.com

DAKAR
3ème étage
Route de
l'aéroport Ngor,
Dakar Senegal
+221 3386 83023

KIGALI
M&M Plaza, 5th
floor 24W3 +JCW,
KG 8 Ave, Kigali,
Rwanda
+250 787 807 499

ABIDJAN
II Plateaux Vallon,
Sainte Cécile, Lot
219, Cocody-Abidjan,
Cote d'Ivoire
+225 07 89 92 71 13

ASIA
enviro@earthsystemsasia.com

VIENTIANE
Suite 801, Kolao
Tower II, 23 Singha
Road, Ban Nongbone,
Vientiane, Lao PDR
+856 (0)21 454 434

HANOI
5th Floor, No. 85 Nguyen
Du Street, Hai Ba Trung
District, Hanoi, Vietnam
+84 (0)28 3535 8200

COLOMBO

CHINA
enviro@earthsystems.com.cn

SHANGHAI
Room 1105, Jing'an
China Mansion 1701
West Beijing Road
Shanghai, China
+86 216 887 2968