Australian Bulk Minerals
(A subsidiary of Shagang Mining Pty Ltd)

Savage River
Tasmania’s Largest Quarry
Australian Bulk Minerals
(A subsidiary of Shagang Mining Pty Ltd)

Semi-temperate climate with an average rainfall of 2m per year
Geology of NW Tasmania

Australian Bulk Minerals
(A subsidiary of Shagang Mining Pty Ltd)

Arthur Metamorphic Complex
Regional Geology

Ore Lenses
Geologic Section

Australian Bulk Minerals
(A subsidiary of Shagang Mining Pty Ltd)

Competent Calcite Chlorite Schist
(Amphibolite)

Weaker Schistosic Rocks

Weaker Schistosic Rocks?
Processing 1

Ore Blending and Crushing

Blending of ore is carried out on the ROM where a Cat 994 loader feeds the crusher according to a blend set by grade control.

The ore is crushed to 200mm size in the gyratory crusher.

It is then sent up a 1.65km long conveyor to the mill stockpile (a vertical height change of 210m).
Magnetic Separation

At the mill the ore is processed through two circuits; each containing a 9.75m diameter by 3.7m long autogenous mill and a 4.0m diameter by 8.8m long ball mill.

The crushed ore is processed by magnetic segregation. The primary separation is carried out on undersize from the autogenous mill utilizing 5 drum separators.

Cyclones and hydroseparators are then used to further separate the ground materials within the ball mill circuit. The magnetic concentrate is screened at <53µm.
At the mill we end up with two products:

**Magnetite Concentrate and Tailings**

The magnetite concentrate contains the 67% iron.

The concentrate is pumped 83 km through a 229mm diameter pipe to Port Latta for further processing!

Tailings that contains pyrite, which can oxidize to sulphuric acid, and must be disposed of properly to protect the environment!

Disposed of in the tailings dam
Port Latta and Pellet Production

The magnetite concentrate is pumped to Port Latta where it is processed into a pellet.

Firstly the concentrate is separated from the water through vacuum filters.

It is then mixed with a bit of coal and bentonite mud and rolled into a ball the size of a marble.

This green feed ball is then dropped about 20 m down through a very hot furnace fueled by the natural gas that is pumped from Victoria!

This heating process changes the magnetite into a hematite pellet, which is the product that we sell to Bluescope Steel and now also to our Chinese owner.
**Australian Bulk Minerals**
(A subsidiary of Shagang Mining Pty Ltd)

**PMI**
1966-1995
Electric drill & face shovel,
50-80 tonne truck operation

**ABM**
1996-present
Rotary – DTD hammer drilling,
100-250 tonne hydraulic excavators,
100-150 tonne end dump truck fleet

**ABM MLEP**
Rotary – DTD hammer drilling,
350 tonne hydraulic shovels,
225 tonne end dump truck fleet

**ABM future!!**
Australian Bulk Minerals
(A subsidiary of Shagang Mining Pty Ltd)

1966 to 2005:
Total Concentrate: 74M tonnes
Total Ore: 179M tonnes
Average grade: 41.8%
Total remaining resource 245.6Mt @ 49%

ABM 1996 to 2005:
Average daily movement 22,000 bcm
Concentrate production 1.6M - 2.3M tonnes/annum

ABM MLEP:
Average daily movement 45,000 bcm
Concentrate production 2.4M tonnes/annum
Shagang requesting 3.5M tonnes/annum
or 6M tonnes/annum????
Australian Bulk Minerals
(A subsidiary of Shagang Mining Pty Ltd)

Mining

Current fleet
Mining

Australian Bulk Minerals
(A subsidiary of Shagang Mining Pty Ltd)
Australian Bulk Minerals
(A subsidiary of Shagang Mining Pty Ltd)

Titan 600 and D45K’s
Minning

NORTH PIT

East Wall - intermediate slope angle 63°

West Wall – intermediate slope angle 37°

Pit Water Level RL85
NORTH PIT

Main Ore Zone
120m wide

300m
Rockfalls are a continuing hazard in open pit mining and need to be properly managed to create a safe working environment for mining personnel and equipment.

Operational measures aimed at reducing the potential for rockfalls include:

- smooth wall blasting with pre-splits to reduce the amount of loose material
- intensive scaling by excavators to remove any subsequent loose material
- rock bolting to secure material to the rock face and prevent loosening
Smooth Wall Blasting with Vertical Pre-Splits
Extensive scaling to remove large rock blocks
Australian Bulk Minerals
(A subsidiary of Shagang Mining Pty Ltd)
Mining

Rock bolting and meshing
ROCKFALL HAZARDS

Knowing we can’t always prevent conditions for rockfall events we normally rely on mitigating the consequences by leaving catch benches.

However!
At Savage River the majority of rockfalls occur directly after blasting.
Australian Bulk Minerals  Savage River Mine

or during rainfall events!

Source area

20m exclusion zone
NORTH WALL ROCKFALL EVENT
SAFE OPERATING PROCEDURES are therefore put in place. These include such things as:

- Daily Geotechnical Inspections of walls and berms
- Automated prism monitoring or radar monitoring to detect wall movements
- Job Safety Analyses (JSA’s) which includes a risk assessment and then procedures to reduce exposure to any risks
- Remote drilling and excavation where appropriate
- Exclusion zones
- Large temporary safety windrow construction

NOTE: These are SOFT SOLUTIONS to the potential hazard
Australian Bulk Minerals  Savage River Mine
Rockfall Management

**ELIMINATION OF THE HAZARD**

The best approach is to eliminate the potential hazard wherever possible.
Australian Bulk Minerals   Savage River Mine
Rockfall Management

**ELIMINATION OF THE HAZARD**

Rock Engineering and Earthtec
Australian Bulk Minerals  Savage River Mine

Rockfall Management

Rock Mesh Protection after blast

Cost: approximately $200,000
Australian Bulk Minerals  Savage River Mine

Rockfall Management

Hard Engineering Solution: **GEOBRUGG High Energy Catch Capacity Fence**

(supplied by Rock Engineering)
Australian Bulk Minerals  Savage River Mine
Fence Installation
Australian Bulk Minerals   Savage River Mine
Fence Components
The lead up time to order and take delivery from Switzerland was several months. ABM therefore procured all the available materials already in Australia. A risk analysis was carried out to determine where to best designate different combinations of fence heights and energy capacities.

This relied heavily on site knowledge such as rockfall histories and water flows over the pit crest.

To put these into context:
- a 70 kg rock free falling 60m can be caught by a 75 kJ fence.
- by doubling the capacity you can take multiple hits without needing repairs
Australian Bulk Minerals  Savage River Mine

Rockfall Management

Rock Fence Construction Sequence

1. Install 8 m cable bolt
2. Fire pre-split 24 hrs after cable bolt has been grouted
3. Drill and install fence posts and anchors
4. Attach fence mesh, working from trim shot
5. Fire trim shot

Production - may be fired and excavated before fence construction

Note that pre-split and cable bolt drilling may be carried out at the same time but pre-split must wait to be fired at least 24 hours after cable bolts have been grouted.
Australian Bulk Minerals   Savage River Mine

Rockfall Management

Major loss of 120m of berm and fence

Fence was dismantled and was re-erected further down slope
Total cost of 600m of fencing was $1.8M.

This was offset by a potential loss of $25M of ore.

The use of the fence also lead to a cable bolting program under the fence to ensure we did not lose further sections.

Although geotechnically we could possibly have reduced the amount of cable bolting it became a “routine pattern bolting” exercise!

This kept the operators and supervisors “comfortable”!
The remote controls for two Atlas Copco L-8’s was designed and built by our local drilling contractor, Maxfield Drilling.

Each rig cost about $50,000 plus the purchase of the backhoes to keep the drillers out of the weather.
Australian Bulk Minerals  Savage River Mine

Slope Movement Monitoring

Geodometer with remote control software from Softrock
Wedge Failure Monitoring with Prisms

A recent failure was monitored for several months that moved 60mm before failing during a three day rain event with 141mm of rain.

This wedge had been supported by 3 – 50 tonne twin strand cable bolts.
Australian Bulk Minerals   Savage River Mine

Slope Movement Monitoring

0.3 mm/day
March-July

Movement during blasting and excavation below

141 mm of rainfall in 3 days
Australian Bulk Minerals  Savage River Mine
Slope Movement Monitoring

GroundProbe trial for monitoring small scale rock falls
Prior to having the SSR our cable bolting crews were required to wait overnight before resuming work on the high wall. After two months of monitoring we were confident enough to allow the crews to work after about two hours.

The crew members themselves were often in the geotech office observing the movements and were eager to observe for themselves that it was safe to return to work!

$540,000 for 8 months
Australian Bulk Minerals  Savage River Mine

Remote Explosive Loading Project

Merlot

Drillhole marker drop device

Stemming bin
Next major project is to develop a remote controlled surface cable bolting machine.

We’re looking at options relating to expected cable bolt requirements over the next few years.

Do we make a stand alone unit to do only cable bolting? Can we justify that.

Do we use a remote controlled Titan to do the bolt hole and pre-split drilling; with a separate platform for installing the cables remotely?
Australian Bulk Minerals
(A subsidiary of Shagang Mining Pty Ltd)

Main River Crossing to Mine
After 141mm of rain in three days