Cemented backfill at the Porgera Gold Mine: Economical and environment-friendly

The Porgera Gold Mine is situated in the Enga Province in the central highlands of Papua New Guinea, approximately 600 km north west of Port Moresby. The Porgera gold mine is located at an elevation of 2200 to 2700 m.

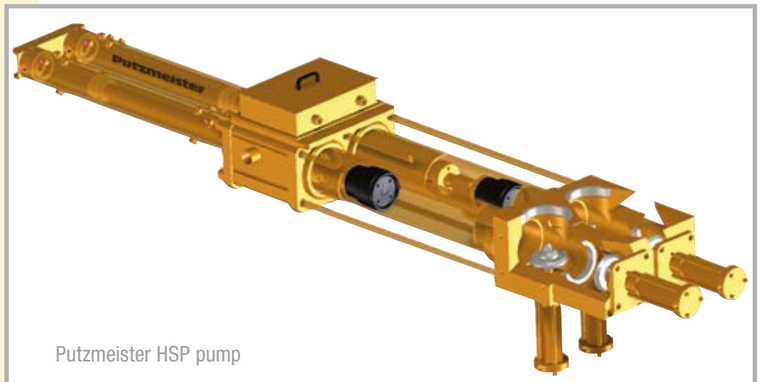
The mine is operated by Porgera Joint Venture (PJV), which is owned by Barrick Gold Corporation (95 %) and Mineral Resources Enga (5 %). The production began in 1990 and PJV operates both open pit and underground mines.
At the end of 2010, a Putzmeister paste backfill pumping plant was taken into operation. This is part of the environmental plans of Barrick to improve and reduce the discharge of tailings and increase the safety in the mine.

Preparation and pumping plant for the backfill material.
Power pack HA 800 E (2 x 400 KW) to drive the HSP 25100 HPS.

Advantages of the paste backfill system

- **Approximately 8 % of the tailings will be used for permanent underground backfill and will not be released into the environment.**
- **Better mechanical control of the mine excavation hollows due to dense filling**
- **Better mine mechanical control enables more selective excavation and, due to this, less tailings.**
- **Hermetically sealed conveying path for the paste material within the pipeline. Persons do not come into contact with the paste.**
- **No truck transport is needed for the paste transport and vehicle gases have been eliminated.**
- **No or only little residue water in the mine, less accumulation of mud and no danger of water in abandoned workings compared with slurry backfill.**
- **Increasing the ore production from the underground mine could give the opportunity to store more tailings underground as backfill material.**

HSP 25100 HPS double piston pump with PCF Control



Putzmeister HSP pump

Technical data of the pump system:

HSP 25100 HPS double piston pump	
Max. theor. output	133 m³/h
Max. delivery pressure	15 MPa
Delivery cylinder length	2500 mm
Delivery cylinder diameter	360 mm

HA 800 E (2 x 400 kW) power pack
with PCF System (Putzmeister Constant Flow) to reduce the pressure peaks

The backfill plant and the paste material:

Dry solids content by weight	approx. 73.5 %
Cement content by weight	4.0 %
Specific gravity of the paste	approx. 1900 kg/m³
Slump	240 mm – 9.5 “

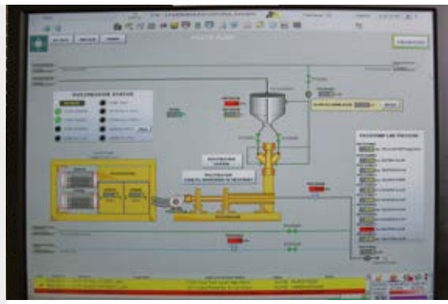
Grain size distribution

Max. grain size	1000 µm
P 90	221 µm
P 80	166 µm
P 50	88 µm
P 10	4 µm

Big suction connection from the 7 m³ paste hopper to the HSP 25100 HPS

The tailings slurry is dewatered by a disc-filter, then transported by a belt into the paste mixer.
There the 4 % cement will be added and the slump adjusted to the requested value which depends on the pumping distance. Pipeline diameter is 6” – 150 mm and the max. pumping distance up to 3000 m. From the mixer, the paste is fed into the 7 m³ paste hopper which is placed directly above the suction inlets of the HSP 25100 HPS double piston pump.

Paste mixer



Visualisation of the pump system in the control room

Disk filter for dewatering the slurry

PCF System
(Putzmeister Constant Flow)

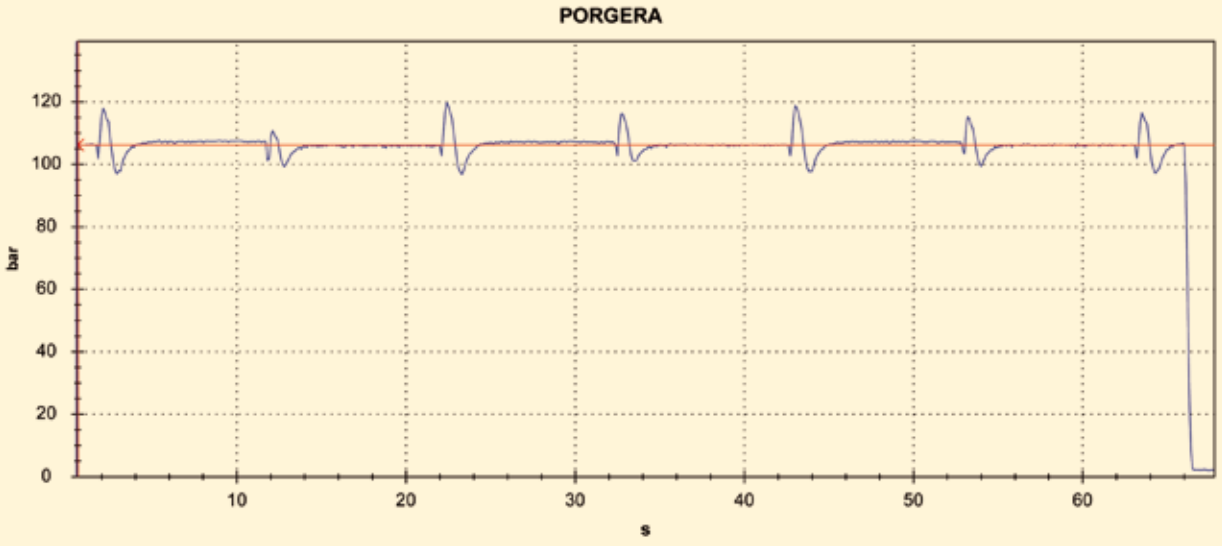
Thanks to the Putzmeister PCF system, the pressure peaks in the pipeline are reduced to approx. +/- 10 % of the maximum delivery pressure. While the first delivery cylinder is pushing the paste into the pipeline, the second piston sucks the paste into the delivery cylinder fast, the seat valve switches over and precompresses to the pipeline pressure. At the end of the stroke of cylinder one, the speed of this piston is reduced and the other starts pushing. Thanks to this, the big pressure peaks of a standard double piston pump are eliminated, and the lifetime of the pipeline is increased.

With this backfilling plant, environmental and economical tasks will be fulfilled

The PCF system has been proven effective over the past 10 years.

- **Small PCF system:** The first plant was at the sewage treatment plant of Augsburg for a small HSP 1470 double-piston pump driven by a HA 30 E. The max. output was 25 m³/h and the max. pressure 30 bar.
- **Medium PCF system:** At Efemcukuru a HSP 2180 HP double piston pump, driven by a HA 132 E pumps goldmine backfill paste. The max. output is 53 m³/h and the max. pressure 85 bar.
- **Big PCF system:** Beside Porgera there are
  - » Belchatow in Poland: 6 pumps HSP 25150 driven by 6 HA 400+400 E-SP for Flyash 200 m³/h, 85 bar and 185 m³/h, 95 bar
  - » Barrick Golstrike in USA: 1 pump HSP 25100 HPS driven by 1 HA 500 E for Gold Mine Tailings, 95 m³/h at 120 bar
  - » Lisheen Mine in Ireland: 2 pumps HSP 25100 driven by 2 HA 500 E for Lead Zinc 131 m³/h at 80 bar

Even KOV double-piston pumps with ball valves can be equipped with this PCF system.



Pressure variation of a PCF pump at 110 bar pumping pressure

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