



GUARANTEED PERFORMANCE FOR PROMINENT HILL - MINE BACKFILL SYSTEM PLUS OPERATION, MAINTENANCE AND MANAGEMENT SERVICES

Complete peace of mind – Outotec EPC backfill system, plus BOO management services – instrumental in achieving mine’s targets

OZ Minerals is a world-class mining business who owns and operates Prominent Hill, a high quality copper-gold mine in South Australia. They are Australia’s third largest copper producer, with quality assets, a healthy cash balance and no debt.

CHALLENGES

- Timely delivery of backfill critical for mine performance
- Reduce capital investment
- Control operating costs

SOLUTION

- State-of-the-art EPC backfill system
- Build own operate (BOO) backfill plant for ongoing operation
- Best practice tools and expertise for operation, maintenance and management
- Access to offsite expertise

BENEFITS

- Fixed price m³/fill
- High plant availability, exceeding mine initial requirements
- Plant operating at higher than design fill rates
- Shared risk in backfill schedule compliance
- Flexible technical design for evolving mining needs

Background

OZ Mineral's Prominent Hill underground copper-gold mine is relatively new, with copper concentrate production beginning in 2009. Prominent Hill produces one of the highest grades of copper concentrate traded on the open market. There are three mines now in production at Prominent Hill (Ankata underground, Malu open pit and Malu underground).

OZ Minerals is renowned for delivering consistent quality performances, with for example, key financial commitments achieved or exceeded in 2015 (130,305t of copper and 113,028 oz of gold produced). This success is due to its management team and their strong working relationship with world class operations contractors.

Malu underground mine backfill

The Malu mine is in a large sub-vertical sulphide copper orebody. Mining is carried out using long-hole stoping with mine backfill to achieve 100% ore extraction. The stoping sequence involves mining to the side of and under very large backfill masses, requiring high volumes of high strength fill. As with many mines, backfill reliability and quality is critical to the success of the Malu underground mine.

In 2013 Outotec was requested to help optimise Ankata's functionality by providing operational expertise and infrastructure upgrades to this paste backfill operation.

Backfill scope at Malu

Prominent Hill's second underground mine, Malu, was due to come online in 2015. In 2014, OZ Minerals issued a request for tender for the supply of a 100m³/h cemented

hydraulic backfill (CHF) plant. Scope, which Outotec won, was for the Engineering, Procurement and Construction (EPC) of the CHF plant. The plant was to be operated by OZ Minerals.

Further discussions were subsequently held around Outotec's backfill expertise, including our capability to operate, maintain and manage backfilling operations. In line with their proven philosophy of using expert contractors to support operational activities, as well as Outotec's optimisation of Ankata, OZ Minerals engaged Outotec not only on an EPC basis, but to also manage the entire Malu backfill plant as a build, own, operate (BOO).

Fixed rate m³/fill = peace of mind

Outotec was able to offer OZ Minerals a fixed rate per unit volume of fill for each of their strength targets, backed by a series of quality control KPIs. This arrangement of a fill product at a given quality for a pre-defined cost gave OZ Minerals ultimate peace of mind, knowing they would not be subject to fill mix inefficiencies that can create substantial cost over-runs.

Partnership with backfill specialists

James Shaw, Underground Mining Superintendent at Prominent Hill, says that "having a partnership with a specialist backfill contractor provides advantages including fixed price per cubic metre of fill with respect to UCS (strength) provides budgeting clarity; shared risk associated with construction and commissioning processes; shared risk with regard to backfill schedule compliance"

Mr Shaw continues that additional benefits include "onus



Malu CHF plant in operation



Cyclone cluster, key to Malu CHF plant

“...a partnership with a specialist backfill contractor provides advantages including:

- Fixed price per cubic metre of fill with respect to UCS provides budgeting clarity
- Shared risk associated with construction and commissioning processes
- Shared risk with regard to backfill schedule compliance
- Onus on contractor to minimise binder usage
- Contractor responsibility for QA/QC
- Clear process for QA/QC non compliance
- Contractor responsibility for plant maintenance
- Access to offsite expertise for modelling fill strength requirements
- Provision of a backfill engineer on site”

James Shaw, Underground Mining Superintendent at Prominent Hill

on contractor to minimise binder usage; contractor responsibility for QA/QC; clear process for QA/QC non-compliance; contractor responsibility for plant maintenance; and provision of a backfill engineer on site.”

Outotec was able to bear a significant portion of the backfill plant capital costs with this BOO model, as we could use the plant for other future clients, once the contract at Malu was completed. OZ Minerals also had an attractive combination of reduced capital upfront investment as well as reduced risk on the ongoing operational costs.

Accelerated and smooth commissioning

The Malu backfill plant was installed and commissioned using best practice design and implementation strategies, resulting in an accelerated startup phase. Furthermore, as the plant was fully integrated with the upstream process plant as well as the downstream underground reticulation and management systems, the entire operation worked seamlessly.

James Shaw explains “The CHF plant was commissioned quickly. The plant was able to run consistently after an approximate two week commissioning period into the underground mine”. Compared with their experience with the Ankata paste fill system, he says that “the CHF commissioning process was completed in a significantly shorter timeframe”

Mr Shaw continues “we could not afford to have a prolonged commissioning period as stoping had commenced and filling was important to the immediate mine schedule”. He adds “the successful commissioning of the CHF plant has been instrumental in achieving budgeted outcomes for the mine...if extended delays had been experienced in the commissioning process, we



Less than 2% free water (from Malu CHF)

“The successful commissioning of the CHF plant has been instrumental in achieving budgeted outcomes for the mine...” James Shaw, Underground Mining Superintendent at Prominent Hill

would not have been able to achieve budgeted ore tonnes from Malu underground mine.”

Operation - using Fill Management System

Post commissioning, the plant moved immediately into full production. As part of our management of the ongoing backfill operation, an Outotec Fill Management System was developed for Malu underground. This Management System includes detailed reticulation designs, as well as designs of both containment bulk-head and the fill mix. Additionally, the System comprises comprehensive procedures on technical design, CHF operation and CHF underground construction, as well as a detailed CHF technical manual.

Flexible technical design for evolving needs

While the Fill Management System addresses design and construction requirements for most cases, evolving mining strategies often result in the need for design flexibility. As part of Outotec’s ongoing operation of the backfill system, our technical experts are available to also update fill designs to most effectively address evolving mining needs. As James Shaw explains, one of the major benefits of the partnership has been this “access to offsite expertise”

Best practice tools and experts 24/7

The Malu backfill system is operated by Outotec experts on a 24/7 basis, with our plant operators covering both day and night shifts and also supported by a backfill engineer on site during all day shifts.

Optimal operation with high density fill

One major risk associated with CHF is excessive (CHF) water in underground stopes. Excessive water results in low strength fill, as well as production delays while stopes are left to drain. The Prominent Hill backfill design has addressed this aspect in a world-leading manner.

Through extensive testing and detailed design considerations, Outotec developed a system capable of generating,

mixing and transporting CHF at a solids concentration that is almost always well in excess of 52% solids by volume (close to 80% solids by mass). This is one of the highest density fills generated by a CHF plant. This solids concentration at Malu underground often exceeds that produced at the Ankata paste fill plant.

Plant operating at higher than design fill rates

As part of Outotec’s Fill Management System, in situ monitoring instrumentation is installed into every stope prior to filling. Real time data from this instrumentation is then used, in conjunction with back analysis tools, to ensure that stopes can be filled as quickly as possible without compromising safety. Results have shown that this high density hydraulic fill is generating very little free water, which has allowed stopes to be filled very quickly, at higher than design fill rates, with minimal interruptions required for stope drainage.

Shared risk in backfill schedule compliance

The other major benefit of Outotec constructing and subsequently operating the Malu CHF system is that, even though we only maintain ownership over the CHF plant itself, our operational profitability is directly related to the reliability of all other fill system components. This provides OZ Minerals reassurance that any warranty related issues on other system components will be quickly rectified.

Summary

Malu underground mine has achieved its budgeted outcomes through partnership with Outotec’s backfill specialist team, who delivered a high quality CHF plant. The project has afforded Outotec a unique opportunity to deliver a state-of-the-art EPC backfill system, as well as being responsible for its ongoing operation, maintenance and management.

As Outotec is responsible for the CHF plant’s ongoing operation, it is delivering significant benefits to OZ Minerals which include fixed price m³/fill, high plant availability which exceed the mine’s initial requirements and operation at higher than design fill rates. Our ongoing management has also resulted in further customer benefits such as access to best practice tools and experts 24/7, shared risk in backfill schedule compliance and flexible technical design for evolving mining needs, which will help support Prominent Hill’s successful financial and agile business for the future.