

AZMET TECHNOLOGY AND PROJECTS

TECHNOLOGY SPECIALISTS at your side

Professional engineering design and project management services company AZMET Technology and Projects (AZMET) is proactively investing in optimisation opportunities through engineering innovation and new technologies and processes to increase the profitability of current metallurgical operations.

This is in response to plummeting commodity prices resulting in operational closures, budget cuts and long-term stoppages on capital projects. Future growth is recognised through expanded production, with minimal capital budgets, without losing sight of operational efficiency and cost optimisation.

AZMET's vision is to add value to its clients during the current global recession. This has led to the development of numerous innovative and cost effective products and processes that have positively impacted on operating expenditure (OPEX) and capital expenditure (CAPEX) for Greenfields and Brownfields projects, converting uneconomical projects into viable projects.

Working alongside its clients and understanding their needs, being flexible, timeous and committed to service excellence are all core values contributing to AZMET's success.

PROJECTS AND DESIGN

Kibali: SMPP desliming cyclone installation project

In March 2015 AZMET was awarded an SMPP contract for Randgold Resources' Kibali Operation to implement a desliming cyclone circuit which was part of an optimisation project to improve the overall pumpcell plant recovery. The SMPP contract period included procurement, fabrication,



Kibali desliming cyclone circuit

shipment, erection and commissioning.

Various modifications and tie-ins were required to retrofit the circuit in the existing gold processing plant. Approximately 3 km of HDPE piping were installed.

Tongon: LSTK gold room scrubber installation project

On 15 February 2015 AZMET was awarded an LSTK contract for Randgold Resources' Tongon Operation in the Ivory Coast to implement a gold room scrubber system as part of an optimisation project to clean the fumes generated in the gold room.

Tongon: EPCM crusher upgrade project

In September 2015 AZMET was awarded an EPCM contract for Randgold Resources' Tongon Operation in the Ivory Coast to implement a fourth stage crushing

circuit as part of an optimisation project to improve the overall plant capacity. The EPCM contract includes procurement, fabrication, shipment, erection and commissioning.

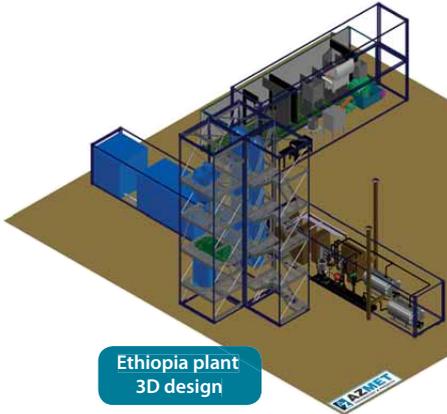
LSTK desorption and recovery plant for a gold plant in Ethiopia

AZMET has been awarded a contract for the design, supply and commissioning for a 2 t carbon batch gold desorption and recovery plant, incorporating carbon loading and attritioning, acid wash including hydrochloric acid reagent dosing, elution including caustic reagent dosing, electrowinning, gold room, MCC and PLC. Containerised modules were ordered for supply with completion planned for Q2, 2016.

This plant offers numerous advantages for gold and silver end users and EPCM



Tongon construction – crusher circuit upgrade



Ethiopia plant 3D design

contractors. It is assembled and cold commissioned prior to shipment. Thus, time to install and hot commission on site is limited with minimal changes. Design of supply is flexible and can be adjusted according to the client's needs; with a total supply consisting of six independent modules.

STUDIES

Copper and cobalt tailings retreatment technical assessment

This study was conducted to develop an understanding of the metallurgical and infrastructure requirements for the retreatment of flotation tailings dams in Zambia.

This study considered various options and tested these in the laboratory to identify the optimal flowsheet, which ultimately included:

- The recovery of tailings;
- Quick leaching of the recovered tailings with acid;
- Separation of cobalt and copper in a solvent extraction plant;
- Electrowinning of copper to produce a copper cathode; and
- Cobalt precipitated out separately as a cobalt salt.

AZMET's proprietary Reduced Leach Technology (AZ-RLT) was used, which resulted in an economical viable solution.

Copper and cobalt stockpile treatment desktop study

This desktop study was conducted to develop an understanding of the metallurgical requirements for the treatment of an existing tailings stockpile in the DRC.

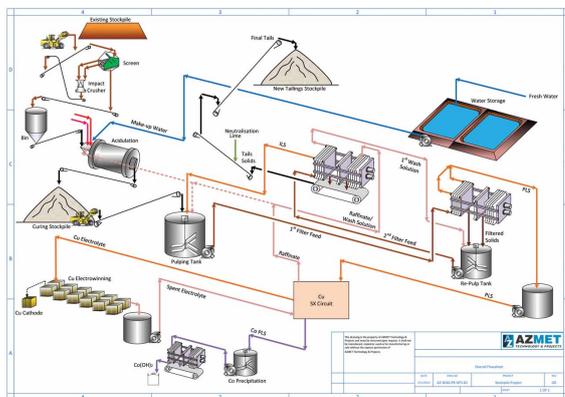
The establishment of operations for the stockpile project was based upon a simple dry recovery of the tailings from the stockpile using front end loaders.

The study assumes that acid leaching will provide the required dissolutions recovery based on historical sample assay results; and considered various flowsheet

options which evaluated conventional direct acid leaching to generate a copper and cobalt pregnant solution (PLS) that can be sold to the neighbouring process plants as the base case.

Alternative options also considered a final copper cathode and cobalt precipitate salt to increase the possible LME value. A high level financial trade-off resulted in selecting a small plant throughput, with the least capital cost, but still producing a final copper and cobalt product for maximum metal revenues.

Different flowsheets were compared. This included the provisional development of operating and capital costs for each flowsheet as part of an options study, before a choice was made to take the preferred flowsheet forward.



Copper and cobalt flowsheet

NEW TECHNOLOGIES AND DEVELOPMENTS

AZMET has been focused on the development of new processes and technologies specifically within the gold, copper and base metal industries. With the downturn in commodity prices the need is increasing for alternative process routes with lower operating costs, as well as finding solutions for "difficult to treat" complex ores.

AZMET has been developing the following technologies in the last year; two of these are pending patents:

AZMET cyanide recovery process

AZMET has developed a cost effective process methodology to recover cyanide from the plant tails stream. The benefits of this process include but are not limited to: OPEX savings through:

- Recovery of cyanide;
- Eliminating costly detox reagent costs;
- Environmental benefit on tailings disposal.

Recovery benefits: Increasing plant economics:

- Recovery of copper, if present in tails stream; and
- Additional gold recovery from tails solution.

AZMET Basic Leach Technology (AZ-BLT)

AZMET has developed a cost effective process route to recover copper from low grade secondary copper minerals utilising a basic leach process which can be used on existing tailings dumps and on the tails streams of operating flotation plants treating supergene ores.

The benefits of this process include but are not limited to:

- A process circuit for the treatment of both copper and precious metals;
- Simpler mine plan for complex ores (copper with gold and silver);
- OPEX savings; and
- CAPEX savings.

AZMET Reduced Leach Technology (AZ-RLT)

AZMET has developed an acid leach process for the beneficiation of base metal complex ores.

The process, which is AZMET's proprietary process, can be tested in its partner laboratories and holds the following benefits:

- Reduced leach retention times compared to conventional acid leaching;
- Reduction in reagent consumptions which results in the cost effective processing of difficult to treat ore bodies; and
- Lower CAPEX requirement compared to conventional acid leaching.

Ultra-fine screening classification testwork procedure (AZ-UFS)

AZMET has developed an IP test procedure in which the comparative hydrocyclone versus ultrafine screening testwork can be conducted. The testwork results together with the client's plant operating data are used to conduct trade-off and financial models which will indicate the possible payback period and NPV on implementing such a change.

AZMET's latest test results have shown a considerable increase in recoveries and mill throughputs. **MRA**

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