Acquisition of the Biox Group

Bateman Engineering has acquired the Biox technology business, the owner of the proprietary and patented technology known as the BIOX® process, from the Gold Fields Group.*

The BIOX® process was developed for the pre-treatment of refractory sulphide gold ores ahead of conventional cyanide leaching for gold recovery, and offers many advantages over conventional refractory processes such as roasting, pressure oxidation and nitric acid leaching. These include improved rates of gold recovery, lower capital cost, low operating expenditures, low levels of skills required for operation, robustness of the technology making it suited to remote areas, and being environmentally friendly.

Included in the sale is a second technology, currently in development, for the efficient removal of thiocyanate and cyanide from leach solutions. The technology, known as ASTER (Activated Sludge Tailings Effluent Remediation), is currently being tested in a number of pilot plants and if commercially viable could be applied to many conventional gold processing plants worldwide.

The purchase of the Biox business will bolster Bateman Engineering's technology offering and strategically position it for several gold opportunities over the coming years. The business will be incorporated into the Bateman Engineering Projects Strategic Business Unit and will become a Centre of Excellence within the Bateman Engineering Group.

The BIOX® process

In refractory sulphide gold ores, such as pyrite, arsenopyrite and pyrrhotite, the gold is encapsulated in sulphide minerals which prevent the gold from being leached by cyanide. The BIOX® process thus destroys the sulphide minerals and exposes the gold for subsequent cyanidation, increasing recovery rates.

The process itself uses a combination of three bacteria that occur naturally, Acidithiobacillus Ferrooxidans, Acidithiobacillus Thiooxidans and Leptospirillum Ferrooxidans, to break down the sulphide mineral matrix in the ore being treated, thus freeing the occluded gold for subsequent cyanidation.

As the bacteria require nutrients to sustain growth, nitrogen, phosphorous and potassium are added to the primary reactors in various forms and quantities, depending on the composition of the concentrate being treated.

The overall residence time in the bio-oxidation reactors, which is mainly a function of the mineralogy, typically varies between four and six days. For an ore where the gold is locked mainly in arsenopyrite, a shorter residence time is expected to achieve optimum gold liberation than with an ore where most of the gold is occluded in pyrite.

Some ores require only partial sulphide oxidation to liberate the gold. The circuit can be simplified for such ores and the residence time reduced.

After oxidation, the BIOX® product is washed in a counter-current decantation circuit and the solution is neutralised in a controlled two-stage process with limestone and/or lime. The precipitates formed meet environmental standards and can be safely deposited onto tailings dams. The BIOX® process is thus a non-polluting, environmentally clean means of treating refractory ore.

To save water, the neutralised effluent can be mixed with flotation tailings and thickened. The overflow solution can be recycled as dilution water in the milling, flotation and BIOX® sections of the plant. This makes the process ideally suited for arid regions.

The operating parameters of the BIOX® process are a temperature of between 40 and 45 ºC; a pH of 1.2 to 1.6; a percentage solids in the feed of 20 %; >2 ppm of dissolved oxygen; and a retention time of 4 to 6 days. The nutrients are fertiliser type ammonium, potassium and phosphorus salts.

Operating BIOX® plants

A total of 11 commercial BIOX® plants have been commissioned over the last 20 years. Eight of these plants are currently still in operation.

The BIOX® plant at the Fairview mine in Barberton, South Africa, which was the initial pilot plant, has been fully operational for 20 years and has played a vital role in the ongoing development of the process. It was originally designed to treat 10 t/day but has over the years been expanded numerous times to the current capacity of 62 t/day of concentrate.

The Coricancha Mine, previously known as the Tamboraque Mine, and located in the Viso-Aruri mining district of Peru, operates a 60 t/day day BIOX® plant for the treatment of stockpiled tailings and run-of-mine ore. An interesting feature of the plant is the very high arsenic content of the feed material, with the process therefore expected to be acid consuming. This problem was overcome by the use of

The Fairview BIOX® Plant.

* The acquistion has conditions precedent that need to be fulfilled.

The BIOX® team. Seated from left to right are Mpho Dingalo, Wallies Olivier and Nobuzwe Makhotla. Standing are Niresh Deonarain, Jan van Niekerk and Rudolph van Deventer.

acid mine drainage from old mine workings as dilution water to the BIOX® plant. The processing plant is currently being relocated to a more suitable site for tailings dam construction.

The plant in operation at Wiluna Gold Mine, Western Australia, was originally designed to treat 115 t/day of concentrate but this was subsequently increased to 158 t/day. Now under new ownership, the Wiluna mine's BIOX® plant is scheduled to be recommissioned at the end of 2008 and will act as a central processing facility for the new owners, treating ore/concentrates from a number of gold deposits in Western Australia.

Commissioning of both the Fosterville BIOX® project in the Victoria province of Australia and the Suzdal project in Kazakhstan occurred in 2005. The Fosterville BIOX® plant has a design capacity of 211 t/day concentrate at a sulphide sulphur grade of 21.5 %, while the Suzdal plant is designed to treat 192 t/day concentrate at a sulphur grade of 12 %. The Bogoso BIOX® Plant, owned by Golden Star Resources, and located in Ghana, was commissioned in 2006/2007 and is designed to treat 820 t/day of concentrate at a sulphide sulphur grade of 20 %. With the successful commissioning of this plant, BIOX® took another step in the development of the technology with the installation of the first 1,500 m^3 BIOX® reactors.

The Jinfeng BIOX® plant, owned by Sino Gold Limited and located in the Guizhou Province of the Peoples Republic of China, was commissioned in 2007 and is currently achieving >96 % sulphide oxidation. The capacity of the first phase of the recently commissioned Kokpatas BIOX® plant, owned by Navoi Mining and Metallurgical Combinat and situated in the Kyzylkum desert in Uzbekistan, is 1,069 t/day concentrate. This is currently the biggest BIOX® plant, with plants currently under discussion to double the capacity of the plant in the near future.

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The Suzdal BIOX® Plant.

The Fosterville BIOX® Plant.