CASE STUDY: WATER TREATMENT PLANT AT OCEANAGOLD’S DIDIPIO GOLD-COPPER MINE, PHILIPPINES

The mine required a robust, flexible design to accommodate the unique environment...the water treatment plant is a major milestone in the mine’s evolution, representing an important environmental initiative.

In Q3 2013, OceanaGold identified an opportunity for a new water treatment plant to treat the existing tailings storage facility outflow in order to reduce total suspended solids. The plant would also take into consideration future removal of metals precipitated from solution.

Outotec and OceanaGold have a strong track record of collaboration together, with Outotec supplying all the main processing equipment for the Didipio Mine, including comminution circuit, flotation, filters, thickeners, and...
Outotec also installed the world-first flotation cell, TankCell 300, at OceanaGold’s Macraes mine in New Zealand, which at the time was the largest flotation cell ever built.

Process design
Outotec was engaged to carry out pre-feasibility engineering studies for the water treatment plant, as well as subsequent pre-study work. An extensive testwork programme was also undertaken on site to design the process using Outotec’s dynamic bench scale high rate thickener. The programme was critical to proving the process performance could meet stringent targets across an extensive design envelope, with the water treatment plant feed fluctuations being seasonally driven.

Scope
Outotec supplied a complete water treatment solution for Didipio Mine, comprising equipment; plant supply; and detailed engineering. The detailed engineering included process, civil, mechanical, structural and electrical design of the water treatment plant.

Fabrication was performed both locally and from other regionally competitive low cost countries to ensure the lowest project capital requirements. Outotec provided installation advice for a high quality plant construction managed by the local Didipio Mine project team.

Challenges
The Didipio Mine is situated in a remote, mountainous location, where there are significant seasonal variations in rainfall. After high rainfall, there is a marked increase in rain run-off matter from wash-down sediments, impacting on tailings slurry and ore levels in solids. The geographical constraints also necessitated a small installation footprint, adding to the complexity.

The mine required a robust and flexible design to accommodate the unique environment, incorporating a water treatment plant that accommodates fluctuating water quality and that is easily stopped and resumed as required, dependent on dam volumes.

Additionally, the remote location meant that there is no regular water supply to service water treatment requirements.

Testwork programme
The Didipio Mine water treatment plant is required to reduce the environmental impact of outflow waters from the existing Tailings Storage Facility (TSF). For the majority of the year outflow solids levels are significantly below operating licence levels, with solids level only increasing due to seasonal or one off rainfall events. With these conditions in mind, the testwork programme on site was designed to ensure the already low outflow levels were further reduced and that during periods of high rainfall (high flow/high solids), target outflow solids levels could be met or exceeded.

An extensive testwork programme was undertaken across a broad range of process scenarios to ensure target levels could be met or exceeded and form the part of water treatment plant performance warranties. The test work data also provided critical input to the plant process design.

The water treatment solution
The Didipio Mine water treatment plant treats outflows from the mine’s TSF. It is an important environmental initiative to treat total suspended solids so that the water used by Didipio Mine is returned clean and of high quality to the ecosystem.

At the heart of the water treatment plant is the 34m clarifier and associated steel pipework designed and fabricated by Outotec. The plant operates at 50% capacity and can stop operation as required, dependent on water levels in the tailings dam.
To address the water supply issue, clarified water was used to service the treatment plant requirements.

**Commissioning**

Upon commissioning, the water treatment plant was immediately fully operational. Commissioning was undertaken by an integrated team comprised of Outotec and OceanaGold representatives and adopted a process of introducing concentrated solids from the tailings storage facility to the plant externally in order to seed the solids bed in the clarifier. This approach also simulated the process performance of the plant with a stable level of solids present.

Through five days of commissioning, testing showed overflow solids concentration to be under 30ppm, and as low as 3ppm – far exceeding design specifications of 70ppm, and with potential operational savings in reagent use. Outotec has also been able to confirm successful process commissioning under a ‘worst case’ scenario with concentrated solids being fed into the system. Through this collaborative approach, the water treatment plant at Didipio Mine not only meets but well exceeds regulatory requirements. The plant had been granted a class D permit in effluent water quality standard (criteria of 50 to 150ppm) but OceanaGold was committed to delivering a plant which exceeded this criteria, taking its water quality to the next level.

**Conclusion**

This water treatment plant represents a major milestone in Didipio Mine’s evolution, offering an important environmental solution to treat total suspended solids to safely reintroduce into the adjoining river. The treatment solution reflects targeted values for both Outotec and OceanaGold for sustainable accountability in mineral operations.

The cooperative relationship between Outotec and OceanaGold throughout the project has been an important factor in its success. Thanks to an honest and collaborative partnership, emergent challenges during the course of the project were able to be expediently resolved, resulting in a plant solution that achieves its targeted goals. This success provides an excellent platform for future collaborative projects between Outotec and OceanaGold.

FOR FURTHER INFORMATION PLEASE CONTACT:

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Reintroducing water into the adjoining river.
PRODUCT NEWS: TANKCELL e630 - WORLD’S LARGEST FLOAT CELL

The Outotec TankCell® e630, launched earlier this year, is the latest addition to Outotec’s flotation portfolio, which already offers the widest range of cell sizes on the market. With an effective volume of 630m³ as standard, and volumes of close to 700m³ depending on the chosen configuration, it is the largest flotation cell in the world.

Suitable for all flotation applications, the e630 meets market demand for increased capacity combined with improved production and energy efficiency. It incorporates proven innovations such as the Outotec FloatForce® mixing technology, which enables superior pumping performance, as well as better air dispersion and mixing capability, improved efficiency, and longer component wear life.

The TankCell® e630 outperforms smaller cells in terms of energy efficiency while enabling a significant increase in production capacity. Compared to an equivalent plant using the smaller Outotec TankCell® e300, total capital cost can be reduced by as much as 10-20 percent. Typical installed power for the e630 is 500 kW / 600 hp and specific power consumption is lower than that of smaller TankCells®. Outotec recommends using a variable speed drive to enable optimization of both metallurgy and power consumption in these high-capacity production units.

Its large capacity makes the Outotec TankCell® e630 particularly suitable for rougher and scavenger duties in gold and base metal applications. The unit has a diameter of 11 meters and a lip height of approximately 7 meters.

For more information please visit www.outotec.com/tankcell or contact flotation@outotec.com.

WEBINAR - THE FILTRATION OF TAILINGS

Increasingly, more and more sites require solutions to handle and dewater vast quantities of difficult tailings. Filtration technologies, for example, can improve water usage in mining and metallurgical industries and substantially decrease the footprint of tailings disposal sites by making dry stacking of tailings a reality.

This short webinar introduces some of the applications where large filters are making a difference and the equipment Outotec has developed to achieve those results.

Click here to join the webinar...

PRODUCT NEWS: FLOAT FORCE VALUE CALCULATOR

FloatForce is a next-generation flotation mixing mechanism which improves performance, lowers costs and saves energy. This handy, easy-to-use online tool enables you to quickly evaluate potential savings from the FloatForce mechanism.

Simply input some key data and the calculator will do the rest...Obviously site testwork is another important consideration but this simple calculator provides valuable information for return on investment calculations and is an important first step when deciding to upgrade your circuit...

Contact sherwin.morgan@outotec.com for more information on Outotec’s online FloatForce calculator or follow this link...
CASE STUDY: A NEW BENCHMARK FOR SUSTAINABLE COPPER PRODUCTION IN CHINA

Outotec’s complete Flash Smelting and Flash Converting solution and process design expertise ensures excellent quality, availability, and environmental performance for Jinchuan Group Co. Ltd.

Jinchuan Group Co. Ltd, one of the largest mining groups in China, chose Outotec’s Flash Smelting and Flash Converting process, anode casting shop, and tankhouse equipment for its new copper smelter in China’s Guangxi Zhuang Autonomous Region. The delivery included operating licenses for both Outotec Flash Smelting and Kennecott-Outotec Flash Converting technologies. Smooth cooperation between Outotec representatives and local service personnel from the beginning of the design phase enabled quick installation and start-up, while the state-of-the-art smelting technology ensures clean, cost-effective, and safe production.

When it came to selecting the most appropriate solution for smelting, the decision was an easy one according to Mr. Guo Wanshu, Vice General Manager of Jinchuan-Guangxi Non-ferrous Metal Co, Ltd: “Outotec’s double flash process outperforms those of competitors’ and matches our expectations perfectly.” In addition to the smelting technology, Outotec also delivered basic and detailed engineering for the facilities.

“Outotec’s double flash process matches our expectations perfectly.”
The equipment package included:
- Five loss-in-weight feeders
- Concentrate burner and matte burner
- Four air slides
- Tapholes for flash smelting furnace (FSF) and flash converting furnace (FCF)
- Integrated cooling elements (ICE) for FCF
- Complete Outotec Sentinel system for FCF and critical areas of FSF
- Outotec Process Advisor process control model for the FSF and FCF
- TWIN M18 anode casting equipment
- Permanent cathodes and robotic full-deposit cathode stripping machines for refinery tankhouse

**Integrated solution maximizes customer value**
Outotec participated in all aspects of the smelter design and project management from the beginning of the plant layout design process. "The customer gets the best value when plants are considered as complete processes instead of islands of single equipment," explains Kari Pienimäki, Director of Flash Smelting at Outotec. "For example, the distance from the furnace to the slag cooling area and slag concentrator was made as short as possible to minimize the need for transportation and to improve safety."

Outotec’s furnace feed system and burner designs ensure high concentrate and matte feed, resulting in better overall capacity and longer campaign life. The campaign life is extended by controlling the furnace’s hearth temperature in order to reduce the impact of blister impregnation and infiltration.

Outotec solutions play a critical role in ensuring an optimal process, excellent equipment availability, and a high quality end product. Outotec Process Advisor is an online dynamic process control model with a user interface that allows operators to analyze the process behavior, monitor temperatures and slag chemistry in real time. Outotec also provided training on the automation system and maintenance of the furnaces. Outotec Sentinel is an online furnace integrity monitoring system for cooling elements. “It’s a new, patented intelligent measuring system that enhances furnace integrity and reduces wear by enabling analysis of data from the cooling waters. It protects the furnace by alerting operators to issues such as drops in water flow, heat-load peaks, and deviation in return temperatures. It also shows when there are abnormal process conditions such as buildup, and estimates the condition of the furnace refractory lining,” Pienimäki explains.

In terms of the end product, Outotec’s proven anode casting technology ensures high physical quality of the output from the smelter. The anode casting shop achieved quality and performance requirements within a month.

**Ensuring clean, safe, and efficient tankhouse operations**
The refinery’s new tankhouse was started up at the end of 2013 and is rated for an annual production of 400,000 tons of high-grade cathode copper. The key elements for smooth copper cathode production are efficient plating of copper on the cathode blanks and reliable stripping machines. Over 70,000 Outotec permanent cathodes and two robotic full-deposit stripping machines, both state-of-the-art technologies, ensure this. Jinchuan Group Co. Ltd
required gentle, automated handling of the cathode blanks, with the aim of maintaining cathode quality, ensuring cleanliness and convenience in the stripping area, and increasing efficiency and safety.

“Outotec’s fully stainless steel, permanent cathodes were chosen because of their high quality materials, high mechanical strength, corrosion-resistant structure, good electrical performance, and long life time,” says Eero Tuuppa, Director - Tankhouse Equipment, Outotec. “The design of the automated stripping machines is perfectly suited to the selected cathode blanks.”

The installation and start-up of the cathode stripping machines was a joint effort between the Outotec technology experts and the local service organization. The fast implementation and short start-up – one of the shortest ever for a project of this nature in China – were highly valued by Jinchuan Group Co. Ltd. “The team spirit, motivation, and work ethic have been great. Everyone has been working together for a common goal,” highlights Outotec’s Kari Pienimäki.

“Outotec flash smelting technology is the cleanest smelting method available. The combined FSF/FCF process is based on sealed furnaces, which allows for better control of gas flows and process conditions with greater flexibility. Using concentrated reaction heat reduces reliance on external fuel sources, is highly energy-efficient, and allows a total of more than 99.9% of sulfur capture thanks to the constant flow of high-strength SO\textsubscript{2} process gas from the furnaces.

The low sulfur dioxide emissions not only mean a safer and more hygienic working environment for employees, but also enable compliance with ever-stricter environmental legislation. Outotec’s flash smelting process is rated as the Best Available Technique (BAT) by the European Union. It has been nominated as the ‘Metallurgical innovation of the 20th century’ and awarded ASM Historical Landmark status due to its excellent environmental performance.

“We have been very happy with the cooperation with Outotec in this project. Combining Chinese and foreign technologies is always challenging, but with good and open communication and cooperation these challenges can be, and have been, overcome to the benefit of all,” concludes Mr. Guo Wanshu, Vice General Manager of JNMG.
EVERY DROP OF WATER COUNTS - FROM LIABILITY TO A VALUABLE RESOURCE

This issue, our “Experts thinking ahead” blog talks about water management. The blog, from Mika Martikainen, discusses how water at sites has moved from being viewed simply as “water treatment” to actually seeing it as a valuable resource, one which requires proper management.

To read the full water blog follow this link...

To read all previous blogs follow this link...

Mika Martikainen, Business Development Manager, Industrial Water Treatment

BUSINESS NEWS: OUTOTEC STRENGTHENS ITS ENERGY BUSINESS BY ACQUIRING THE BUSINESS OF KALOGEO ANLAGENBAU GmbH

Outotec has purchased the assets of KALOGEO Anlagenbau GmbH in Leobersdorf, Austria. KALOGEO has provided solutions for biomass, sludge and waste water treatment and designed, built and operated several mid-size thermal sludge treatment plants based on fluidized bed technology.

There is a growing demand worldwide for phosphates recycling and sustainable solutions for sewage sludge treatment. Outotec is currently designing and building large sewage sludge thermal treatment plants, for example the 100,000 t/a plant for the city of Zurich in Switzerland. With the technology, knowhow and references of KALOGEO, Outotec will expand its offering to small and medium-size sludge incineration plants. The KALOGEO technology also complements Outotec’s ASH DEC® technology acquired in 2011. The method is used to extract phosphorus fertilizer from ash produced in sludge incineration.

"The acquisition of KALOGEO Anlagenbau’s business supports our strategic target to expand to energy and industrial water treatment with high technological synergies. Energy production from biomass, sludge and waste in general is an interesting growth area for us. With our decades-long experience in developing fluidized bed technology and applications, we can offer our customers sustainable solutions for turning waste to energy and valuable products and thus reduce environmental impacts such as greenhouse gas emissions", says Outotec CEO Pertti Korhonen.

More information is available here...

BUSINESS NEWS: TWO RECENT SMELTER MODERNIZATIONS BY OUTOTEC

1. Botswana - Outotec has been awarded a contract by BCL Limited for modernizing the nickel flash smelting furnace in Selebi Phikwe, Botswana. In addition, the parties have made a service level agreement for the operation and maintenance for a period of 36 months.

BCL’s original nickel smelter was built in the 1970s using Outotec® Flash Smelting technology. The scope of Outotec’s modernization work includes the redesign of the flash smelting furnace, delivery of new advanced cooling elements and integrating them into the furnace. The service level agreement includes installation and commissioning supervision services, preventive maintenance planning, equipment maintenance and spare parts. More information is available here...

2. Russia - Outotec has also been awarded a contract by JSC MMC Norilsk Nickel to modernize and rebuild Norilsk Nickel’s nickel flash smelting furnace at Nadezhda smelter in Norilsk, Russia.

Norilsk Nickel has licenses for two Outotec® Flash Smelting Furnaces in Nadezhda smelter which has been in operation since 1981. More information is available here...
MANILA OFFICE OPENING

Outotec has opened a new office in Manila, the Philippines, September 2014, as part of the company’s expansion in the Asia Pacific (APAC) region. The new office was inaugurated by Mr Stuart Sneyd, President of Outotec’s APAC region, in the presence of customers, ministers and industry associations.

The Philippines is ranked as the fifth most mineralized country in the world and has some of the world’s largest resources of gold, copper and nickel. Approximately 30% of the country’s total land area is believed to contain important metallic mineral deposits. Outotec is committed to helping the Philippines develop its world-class resource industry in a sustainable way. The new office in Manila will focus on serving Outotec’s customers, driving sales in the growing market, and supporting project implementation in the Philippines.

Speaking during the event, Stuart Sneyd said, “Outotec has sold technologies for copper smelting and concentration in the Philippines since the 1960s. Through our industry-leading technologies we want to make a strong contribution to sustainable development of the Philippines mining and metallurgical industry. Apart from the mining and metals sector, this market also offers attractive growth opportunities for Outotec in industrial water treatment and renewable energy sectors. With the opening of our Manila office, we will take our capability to deliver sustainable technology solutions and local customer support services to a whole new level in the Philippines.

For further information, please contact peter.cunningham@outotec.com