Dynamic leach pad system

Ore and waste handling system for Spence mine in Chile

In 2003 BHP Billiton planned a heap leach facility for the Spence copper mine located 1,700 m above sea level, in the Atacama Desert of northern Chile. In 2004 FAM Förderanlagen Magdeburg was awarded the contract for the turnkey erection of this complex system. For commissioning by August 2006 FAM had to deliver and assemble about 7,500 t of materials handling technology and undertake trial operation. Despite this short lead time FAM completed the project successfully.

The Spence copper cathode operation, located near the mining town of Sierra Gorda, 150 km northeast of Antofagasta, was officially opened in March 2007. At capacity it produces 200,000 t/y of copper cathode. The operations include an open-pit mine, sulphide leaching and oxide processes, and an SX-EW plant.

Ore is crushed, agglomerated, and transferred to leach pads at a rate of 50,000 t/d. Sulphide and oxide ores are leached on separate dynamic (on–off) pads.

Heap leaching on a large scale like this requires systematic and technologically advanced handling of huge bulk material masses. In addition to the required conveying systems and facilities, FAM delivered and installed the complex control engineering for automatic operation. While the FAM parent company in Germany engineered and manufactured the more complicated structural steel elements, basic steelwork was contracted out, mostly to Chilean suppliers. The electrical and process control and instrumentation systems incorporating advanced features such as GPS, WLAN und ZEDAS, a condition and event monitoring facility, were developed and built by GPA, a FAM subsidiary.

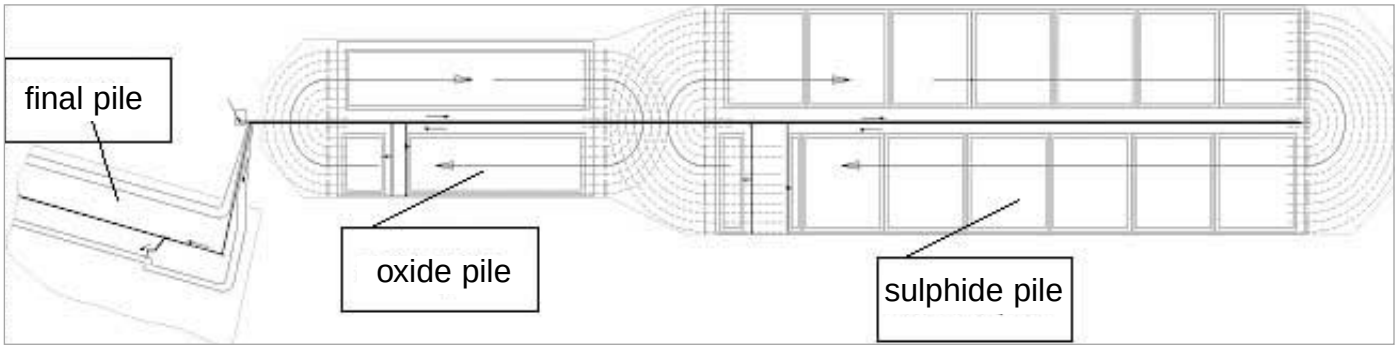
The copper oxide and sulphide ores, already crushed and pretreated, are discharged onto two separate large heaps (2.5 x 1 km). These reach a maximum height of 10 m. The mine uses dynamic leach pads for an effective use of the huge leaching area required. The piles are continuously reclaimed after leaching has been completed, and subsequently rebuilt with fresh ore. The leached material (*ripios*) is conveyed to the final storage by a dumping system.

Crawler-mounted conveyor system with tripper car – capacity 3,500 t/h of copper ore

FAM's scope of supply included the following main items:

- One crawler-mounted stockpiling belt conveyor (300 m long) for the oxide pile
- One crawler-mounted stockpiling belt conveyor (425 m long) for the sulphide pile
- One crawler-mounted recovery belt conveyor (300 m long) for the oxide pile
- One bucketwheel reclaimer

Diagram of the dynamic leach pad system at Spence.



FAM bucketwheel reclaimer – compact design, capacity 4,000 t/h of ripios

- One spreader on crawlers
- One belt wagon on crawlers
- Four stationary conveyor systems, total length 5,700 m
- One shiftable conveyor system, 950 m long
- Five tripper cars and two hopper cars

Stockpiling system

Ore is crushed and chemically preconditioned at the agglomeration plant and subsequently conveyed by a longitudinal conveyor to the stockpile. A tripper car transfers the material supplied by the belt conveyor running along the pile to a crawler-mounted conveyor system, which moves along the length of the leach pile. This in turn carries a tripper car with a cross belt for stockpiling the material systematically in one line after another. In this way continuous operation is ensured and the required highly accurate leach pile shape (achieved with GPS control) is built up.

Depending on the ore to be conveyed it is fed either to the oxide pile (width 245 m) or to the sulphide pile (width 375 m).

For operation on the sulphide pile, the tripper car is switched over to through delivery. As a result, the material is delivered to a second belt conveyor running along the pile. The further operation is effected as above. Both piles have a designed stacking capacity of 3,500 t/h and an average rated capacity per day of 50,000 t of copper ore.

After stacking the full length of a pile, the crawler-mounted conveyors swing round in a half circle to the side opposite the belt conveyors running along the piles and continue operation. In doing so, these crawler-mounted conveyors traverse the underfloor sections of the belt conveyors running along the piles in a clockwise direction.

The specific design of the crawler-mounted conveyors makes few demands on subgrade building. The crawler-mounted conveyors of the Spence project include novel function and control principles applied for the first time. Individual crawler undercarriages now incorporate new features, which make it easy to compensate for differences in level and inclination in every direction. The position of the entire mobile conveyor can be adjusted at any time, even lengthwise. The system is insensitive to temperature so that belts run with a high degree of reliability.

Reclaim system

After an appropriate idle period, leached ore is reclaimed for dumping on a final stockpile. During the reclaim operation, a bucketwheel reclaimer loads the leached ore in bench-type operation, line after line. Via mobile hopper car the ore is transferred over a crawler-mounted conveyor system to the belt conveyor running along the pile to remove the material.

The continuous reclaiming operation is briefly stopped to change the operational direction of the bucketwheel reclaimer for infeed renewal. This is effected by a specific cornering manouevre of the reclaimer. The resulting time loss is compensated by an increased reclaiming capacity of

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4,000 t/h. This compensation is necessary, to continue the stacking of fresh copper ore directly after finishing the reclaim of the leached material.

Particular design features make it possible to skip every other cornering operation. The system is automatically positioned via GPS ensuring accurate parallel running of the reclaimer and, at the same time, precise height control of the bucketwheel to produce a subgrade of desired cross section.

Maintenance and service

The Spence leach pad system for copper oxides has provided reliable operation since August 2006. The agreed performance data has been achieved. In the meantime copper sulphide system and conveying route for *ripios* are in full operation. The entire facility has been designed for easy maintenance, with a high level of component standardisation to reduce the number of spare parts to a minimum. This includes individual parts, drive assemblies and even complete undercarriages.

Diagnostic data for the most important drive assemblies is centrally collected by a teleservice station as a base for ZEDAS, a condition and event monitoring system, which uses these system parameters (transmitted by WLAN) to calculate servicing intervals and data for necessary maintenance and repairs, and even forecasts potential defect spots. Faults can also be diagnosed retroactively.

A Closed Circuit TV system has been installed using a large number of Ethernet-capable cameras and workstations, which are linked via another wireless network. The images from each camera are fed to the network and may be recorded or reproduced at any internal or external workstation.

A three-year maintenance contract for the facility has been awarded to the Chilean company FAM América Latina, a wholly owned subsidiary of FAM GmbH. ***IM***

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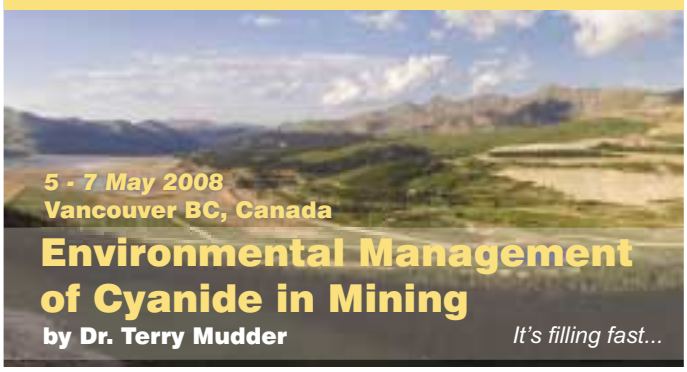

Course Summary
This 3 day course will aid those involved in the permitting, design and operation facets of the mining industry to ask the appropriate questions and to make justifiable and practical decisions.

Who Should Attend?
The course will be of particular interest to academics, consultants, agency and regulatory personnel, corporate and operational process and environmental staff, as well as auditors for the new Cyanide Code.

About the Author
Dr. Mudder holds a B.S. and M.S. degree in Chemistry, and a Ph.D. in Environmental Science and Engineering. He has 25 years experience in investigation of various aspects of cyanide wastes.

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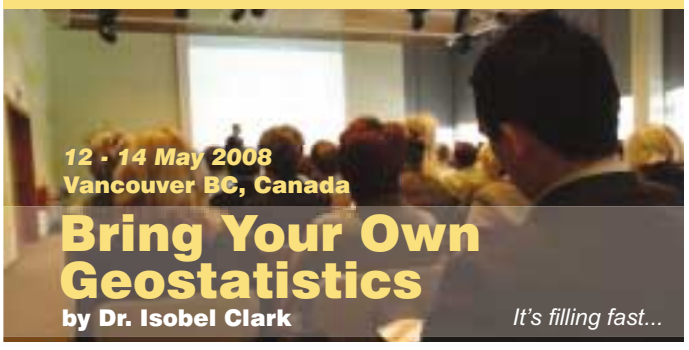

Course Summary
A three-day classroom course based on 28 years of teaching statistics and geostatistics to professionals in the mining industry. Participants are encouraged to analyse their own data using software provided.

Who Should Attend?
The course is aimed at geologists, mining engineers, statisticians, environmentalists, surveyors, biologists, agriculturalists and other professionals dealing with spatially related data.

About the Author
Dr. Isobel Clark provides consultancy through Geostokos Limited, almost exclusively in the field of mineral resource and reserve estimation, most often at feasibility or even pre-feasibility stage.

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