



# **Strategic analysis for Tarkwa Gold Mine – Ghana**

**G**old Fields Ghana Limited selected SRK (UK) Ltd to conduct a strategic analysis study for the long-term development of the Tarkwa Gold Mine in Ghana.

The Tarkwa mine was commissioned in 1997 as an open pit, contract mining operation using heap leach processing, and since then has significantly increased production and throughput to achieve the present process capacity of 14 Mtpa of ore. The heap leach recoveries will fall as the pits deepen and less weathered fresh rock is mined. Tarkwa is considering alternative operating strategies for converting to owner mining and/or to constructing a carbon-in leach (CIL) gold processing plant.

The Tarkwa mineral resources comprise approximately seven separate deposits, each containing multiple reefs that are thin, shallow dipping, and exhibit vary-

ing thickness, grades and metallurgical characteristics. The geological models were proportional models, whereby a distribution of gold grade is estimated and held for each ore block. Determining an optimized plan for extracting these deposits is clearly complex.

The strategic analysis investigated over thirty alternative scenarios for processing, mining, and operating, at varying gold price levels. The specific issues that were addressed included mining dilution; determining representative mining costs for pit optimization; setting production and process schedules; and modelling the capital and operating costs with cash flows for each scenario.

Particular emphasis was placed on adopting a standardized methodology for evaluating all the scenarios to ensure they could be compared, 'like with like'.

The SRK team spent nearly six months on site and worked closely with Tarkwa's management and operations personnel. Brendan Walker, Vice President – Projects, Gold Fields Limited for this study, said, "The results and conclusions for this strategic analysis study have complemented our other feasibility study investigations, and have enabled Gold Fields Ghana to identify an optimized strategy for future operations at Tarkwa."

Rick Skelton: [rskelton@srk.co.uk](mailto:rskelton@srk.co.uk)



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## Foreword

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In this world of ever increasing regulation and accountability to shareholders and stakeholders, the need for independent advice, and objective verification has never been greater. This, together with the continued uncertainty of the global economy and varied impact on commodity prices places even greater responsibility on those charged with the evaluation, financing, development and closure of mining assets.

Examples of underachievement are as many as they are varied and span the full spectrum of mining assets and scale from single project failure through to suites of underperforming assets which, for example, promised the unlocking of so much “hidden” value at the time of their merger, acquisition or privatization.

Fortunately for the resource sector, there are also many examples where the contrary applies, where underperforming assets have been turned around in the face of lower received prices, where synergies have been exploited and full value realized, where perceived country risk has been favourably exploited.

This dichotomy of experience begs the questions why and how?

SRK suggest that this wide range of project performance can be attributed to a combination of project fundamentals, process, people and commitment. While the fundamentals of a single or suite of mining assets cannot be changed, the process of evaluation, selection and design of exploitation strategy, blend of and the constructive and consistent application of board, management and labour skills in project implementation can and invariably do dictate success or failure. Of course a degree of good fortune can also play a part.

During the past fifteen years the SRK Group has become increasingly involved in the field of mining project evaluation and in its widest sense. From early forays as

technical advisor to management buyouts and the privatization of British Coal, the competent person to the formation of Gold Fields, AngloGold and Kumba, over 300 due diligence commissions for project finance, mergers and IPOs and 200 feasibility studies worldwide to its most recent roles as technical advisor to the restructuring of Konkola Copper Mines plc in Zambia and the formulation of business improvement strategies for the assets of BCL in Botswana and Assarel in Bulgaria. Sponsor companies and their financiers have commissioned SRK to undertake independent project-wide audits prior to acquisition or merger or before making major capital commitments or have used selected SRK consultants to supplement their own in-house evaluation teams often citing the multiple attributes of SRK’s breadth of experience, vision and ability to “think out of the box” in the quest to find and guarantee value.

This reliance on SRK engenders a high degree of responsibility and accountability, liabilities which demand focus, proper process, commitment and experience. We too need to sleep at night!

In this newsletter are example case studies of how SRK approaches the evaluation of the fundamentals of mining assets, how it deploys teams of experienced consultants, ensures consistency of approach and the process of working intimately with sponsor management, how we commit to a definitive outcome and subsequently assist in project implementation to assure this.

We cannot change the project fundamentals but we can and do combine process, people and commitment to assist in achieving a successful outcome.

Neal Rigby: [nrigby@srk.co.uk](mailto:nrigby@srk.co.uk)

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## US\$187.4m refinancing for Minera El Tesoro (“MET”)

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*Mr. Mark Parry, Head of Mining for Royal Bank of Scotland amidst some of the first Copper Cathodes produced*

**MET**'s open-pit, SX-EW copper project in Chile's Region II, owned by Antofagasta Minerals S.A. of Chile (61%) and Equatorial Mining of Australia (39%), had its Refinancing named the "Latin American Mining Deal of the Year 2002" by the Project Finance Magazine as featured in its March 2003 issue. SRK (UK) led an SRK group team for the technical advice on all aspects of the project for the banking syndicate, led by The Royal Bank of Scotland in London and Credit Lyonnais in New York.

SRK project leader Bruce Evans says, "Throughout the 5½ years of SRK's involvement, the team not only carried out due diligence effectively, but also contributed to the Project's success through identifying potential problems and solutions and sound procedures. I believe that success was assisted by the excellent cooperation and flexibility of different groups namely the lenders, borrowers and their team and advisors. We followed

a pragmatic approach, concentrating on the significant items but without losing attention to detail."

Following the first bankable review with a full due diligence team, MET spent a year improving the project design and equipment specifications, and project finance was agreed during 1999.

Construction was then completed ahead of time and below budget. During the build-up and production phase our team monitored progress quarterly and made annual site visits; "Project Completion" was achieved, and verified by SRK, in December 2001.

The team reviewed, reported and signed off on the improved mine plan for the refinancing in early 2002, that included a production increase of 13%; refinancing normally occurs once a project is up and running satisfactorily because risks are lower and the cost of the loan can be reduced. Good performance on the project and

our rigorous check of the reserves (backed up by actual mining results), recoveries and costs, contributed to the successful refinancing and the "Project Finance" award. This was achieved during a difficult part of the commodity cycle.

El Tesoro has been one of the most successful projects from plan to execution that we have reviewed and monitored. Even in times of record low prices, it has resulted in material payments to shareholders in its first full year of operation.

Bruce Evans: bevans@srk.co.uk

**Back: Rick Skelton, Jerry Archeleta, Cam Scott, Jerry Jergensen, John Miles**  
**Seated: Bruce Evans, Patricia Acker, Bill Crowl**



# Independent technical audit: Luismin properties, Mexico

**SRK** Consultores was commissioned by Standard Bank London Limited to undertake a technical audit related to financing for Wheaton River Minerals Limited in connection with their plan to acquire the operations of Minas Luismin, S.A. de C.V. in Mexico.

To complete the requirements of the project, we assembled a team consisting of George Even (SRK Chile, geologist), Ricardo Palma (NCL, mining engineer),



and Umit Imre (an independent consultant, metallurgical engineer).

The purpose of the audit was principally twofold. First: to verify that the plans for the proposed mining operations, processing facilities and associated infrastructure and services had been based on appropriate and adequate data and developed according to sound engineering principles and generally accepted industry guidelines and practices. Second: to review the critical success factors needed to ensure that the operation can continue to achieve its planned output of gold and silver over the next 10 years.

The work included site visits to the operations in the San Dimas District (150 km west of Durango, Mexico) and the San



George Even

Martín District (50 km east of Querétaro, Mexico). Both are historic mining districts that have accounted for significant gold and silver production over the years. In total, we visited 5 mines and 2 milling facilities, including tailings disposal systems. We found typical epithermal vein-style deposits with subordinate manto-style mineralization. The veins are mined by the cut-and-fill method and the mantos by room-and-pillar.

George Even: [geven@srk.cl](mailto:geven@srk.cl)

*Processing plants: Left: Tayoltita, San Dimas District, Below: San Martin*



# Reporting mining assets under new 43-101 regulations



Above: Bouchard-Hebert headframe; Below: Bougrine, Mochito, Nanisivik, Langlois, El Toqui

In order to fulfill a portion of their public reporting requirements, Breakwater Resources Ltd. commissioned SRK Consulting to complete a technical report for all of their mining assets around the world. The significance of this task was that it was one of the first technical reports to be prepared under the new Canadian National Instrument 43-101 for producing mines.

In order to complete this task, SRK provided a team of mining consultants specializing in the disciplines of geology, resource estimation, mining, mineral processing and environmental engineering, from several different offices in North America and abroad.



Mike Michaud

The challenge for SRK was to provide a comprehensive report for public reporting but at the same time be concise and manage the time and costs of a large due diligence assignment without artificially “raising the bar” for future reporting companies. The Breakwater operations in the review included:

- Nanisivik Mine, Nunavut, Canada
- Caribou Mine, New Brunswick, Canada
- Bouchard-Hebert Mine, Quebec, Canada
- Langlois Mine, Quebec, Canada
- Bougrine Mine, Tunisia

- El Mochito Mine, Honduras
- El Toqui Mine, Chile

Michael Michaud of SRK Toronto is of the opinion that the due diligence review was able to meet project time lines because of our ability to utilize knowledge and experience from several international offices. SRK was able to focus on the most important material issues that had potential to impact mine operations. The qualified individuals chosen for the project also provided the confidence in the review to the Securities Commission reviewers who accepted and approved the NI 43-101 technical report without modification.

Mike Michaud: [mmichaud@srk.com](mailto:mmichaud@srk.com)



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## Innovative underground coal mining in China: Yanzhou's Mine at Jining 3

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Longwall chock ready for transport

The Jining 3 coal mine was an underground longwall mine with coal seams up to 6 meters thick. In the past, thick coal seams had been extracted in two passes, often causing the second pass to face a range of difficult ground conditions and reduced productivity. Yanzhou developed an innovative method to mine coal at highly productive volumes.

The main innovation at Jining 3 was in the layout of the chocks and armoured face conveyor (AFC). The ground conditions and seam geometry allowed Yanzhou to install a second conveyor behind the longwall chocks that caused the seam to break and “cave.” After normal cutting of the seam by the shearer, Yanzhou operated “flippers” behind the chocks to open a “window,” allowing the caved coal to break to the full height of the seam. The manually operated flippers were monitored until the caved coal contained too much dilution from the seam roof, when the window was closed and the process continued from the adjacent chock.

Using this method the 6-meter-thick coal seam could be extracted and transported on the longwall conveyors with an overall coal recovery of about 85%.

Mike Warren: [mwarren@srk.com.au](mailto:mwarren@srk.com.au)

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## Assessing the value of a coal mine in China: Jining 3

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Mike Warren

An investment bank approached SRK Australia to assist a client by providing an Independent Expert report written to the standards required by the New York and Hong Kong stock exchanges. The client was Yanzhou Coal Mining Company Limited, one of the first Chinese mining companies to be listed on a non-Chinese stock exchange. Yanzhou's parent company had just completed commissioning the Jining 3 coal mine and proposed to transfer it to Yanzhou, the operating company. SRK's role was to help determine whether the sale price was valued appropriately.

An SRK team visited the mine site and held discussions with Yanzhou staff. The team consisted of two mining engineers (one was Chinese born and a skilled translator), a coal processing engineer, an environmental scientist from Australia and a coal geologist from SRK UK. The Chinese mining industry maintains good data and documentation, so SRK had access to up-to-date records for production, operating costs and capital costs.

The SRK team investigated the geology and reserves, mine design and planning, mining methods, coal transport and washing, coal products and marketing. Operating cost data was collected and compiled on a financial spreadsheet, along with capital replacement and construction capital costs. SRK used forecasts of future production, available reserves of coal and

related costs to arrive at a cashflow forecast for the coming years. A net present value (NPV) was then calculated to estimate the value of the mine and facilities.

The estimates SRK produced differed from Yanzhou management estimates in these areas:

1. the estimated time required to complete the construction of the washing plant
2. the total production capability of the installed facilities
3. the capital cost for replacement items

The washing plant construction was delayed, as SRK predicted, and the total production from the site has yet to reach the capacity forecast by Yanzhou. The Chinese methods tend to account for replacement capital in operating costs, where replacement capital is expensed in the year of expenditure.

When these differences were discussed with the client, the SRK data was used in the financial model, and produced a more conservative valuation of the assets. Based on the final report, the company and the investment bank sold the operating mine for 2.57 yuan or US\$310 million, with shareholders' approval.

Mike Warren: [mwarren@srk.com.au](mailto:mwarren@srk.com.au)



Jining 3 surface infrastructure

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## Assessing waste management (as part of due diligence)

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*Proposed tailings impoundment site in the Philippines*

**D**uring a typical due diligence review of a mining project, considerable emphasis is placed on evaluating the resource and reserves, the mine plan, and the mine process; however, the proper management of mine waste and tailings disposal, including the mine process water balance, may represent an even greater risk, not only financially, but from a regulatory liability and public relations standpoint.

SRK's approach to due diligence evaluations is to specifically address and, if possible, quantify the risks associated with mine waste management and tailings disposal, giving them a high priority. Properly assessing the engineering and environmental aspects of the system can help define and limit a company's long-term liabilities.

SRK has carried out many reviews in countries where mining regulation is still in its infancy. Therefore, SRK reviews projects to meet the standards not only of the host country, but of international mining norms. The process can include:

- Preparing a report that covers all techni-

cal aspects of tailings and waste disposal for the life of mine, including design, construction, operation and closure

- Providing technical input for tailings disposal, including associated working costs and capital costs
- Commenting on the achievability of implementing the new project; specifically, in allocating and scheduling capital and operating expenditures
- Commenting on its implementation potential considering the risks associated with tailings disposal.



*Dave Luppnow*

In general, recent SRK reviews show mining projects conform to the required standards or better. But some issues we have identified include: inappropriate design standards for tailings impoundments, such as upstream raise methodology in a seismic environment; incompatible plant and tailings water balances; and the improper use of equipment and technologies, such as warm-weather technology applied to waste management in cold regions, and vice versa.

Dave Luppnow: [dluppnow@srk.com](mailto:dluppnow@srk.com)

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## Bulgarian copper mine improvements

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**I**n February of 2002, SRK was commissioned to complete a feasibility study for the Assarel Medet JSC Copper Mine in Bulgaria. The feasibility study, funded by the US Trade and Development Agency, was designed to review the project and suggest improvements. SRK completed the review of the mine mill and operation in June, and subsequently developed the feasibility study, identifying and quantifying the improvements that could be made. The modifica-



*Don Beesley*

tions we proposed are grouped into two scenarios: one is based on production levels of 11 million tonnes of ore per year, the other is based on production levels of 12 million tonnes. The feasibility study identified areas in the operation that are bottlenecks and proposed alternatives. As well, it identified areas that represent opportunities for improvement in production. SRK found significant opportunity to increase the throughput and copper production of the mine and mill with a minimum relative investment of capital.

In preparing this report, SRK pointed out areas where improvements can be made, specifically in the areas of: Pit slopes; Mining fleet; Water management; Concentrator recovery improvements; Milling improvements; Power consumption improvements; Maintenance improvements; Laboratory improvements.

SRK's feasibility study identified potential savings of approximately 25% in operating costs, for a relatively minor amount of capital investment. SRK expects to identify funding sources for this investment. As well, we are prepared to provide ongoing support to Assarel Medet to implement the changes and modifications we suggested.

Don Beesley: [dbeesley@srk.com](mailto:dbeesley@srk.com)

## Neal Rigby Profile

In 1978 when Neal Rigby joined SRK in Johannesburg from Anglo American, the Group had a single office and a staff of 12. Today, with a staff of over 500, SRK operates from 25 offices in 9 countries on 6 continents.

Neal earned B.Sc. and Ph.D. degrees in Mining Engineering from the University of Wales in 1974 and 1977, respectively. His early projects in rock engineering and feasibility studies emphasized mineability assessment and mine design. He was among the founders of SRK UK in the late eighties. Since then his consulting work has focussed on project bankability and mining



Neal Rigby

finance as the senior participant on due diligence audits, competent person's and other reports, supporting the rationalization, merger, acquisition and disposal activities of international mining finance houses and mining finance institutions.

In this role Neal has certified the bankability of projects - their fundamental value, risks and opportunities - to boards, shareholders, stock exchanges and financial institutions. His most recent consulting work concerns the restructuring of mining assets and the scoping and implementation of business improvement strategies.

Neal serves on the boards of several Group companies; in 1995 he became chairman of the Group. He has recently returned to the UK practice after 6 years at SRK's Denver office, heading the North American mining group.

With nearly 30 years in the mining sector and 25 years with SRK, Neal's varied positions include production, academia, business and consulting on projects in over 50 countries throughout the world.

Neal Rigby: nrigby@srk.com

## Independent technical review for a copper oxide project



Dr. Brian Townley and Mr. Bernie Stannus examine Longacho Este core

During the austral summer of 2000-2001, Minera e Inmobiliaria Cascada S.A. (MICSA), owner of the Cascada Mine in northern Chile, asked SRK Consultores and local partner NCL Ingeniería y Construcción S.A. to prepare an independent technical review of the Longacho Este Sector to JORC reporting standards. The review would give purchasers additional confidence in the data provided.

An SRK-NCL team, led by Darryl Lindsay (SRK Chile) and Ricardo Palma (NCL) with William Crowl (SRK Denver) as the principal reviewer, was assembled to examine the geological model, verify the geochemical and density analyses, confirm the drilling results and resource classification.

SRK supervised the confirmation drilling from twin-hole collar selection through drill core transport, logging, sample preparation and storage; it supported the MICSA's earlier geological model. SRK introduced the concepts of confidence ranges in modelling the structurally controlled, litho-stratigraphic mineral deposits. Analytical verification of sample rejects and pulps, as

well as a check of SRK's drill samples, confirmed the procedures.

SRK identified minor erratic sample analyses but reported that they resulted from client procedures; the sealed humid samples were stored in a desert environment. SRK recommended that MICSA re-evaluate tonnage figures, examine the effects of outliers, and consider moving some resources from the Indicated to the Inferred category, pending new drilling.

Based on SRK's recommendations, MICSA requested a project proposal for in-fill drilling and resource estimation. This project was not undertaken because MICSA succeeded in selling the project to Haldeman Mining Company (Minera Haldeman). At the beginning of 2002, Minera Haldeman announced an investment of US\$24M to bring the Cascada Mine into production by Q1 2004. SRK is presently providing the project with geotechnical and hydrogeological work.

Darryl Lindsay: dlindsay@srk.cl



Darryl Lindsay



## Julietta – European Mining Finance Deal of the Year in 2000



*Foreground: man camp, left foreground: tailing impoundments, centre: process plant, background: mine portal*

**E**uromoney's Project Finance magazine awarded their 2000 European Mining Deal of the Year to the Julietta gold mine project in Magadan, Russia. Standard Bank London Limited was the facility agent and, with Bayerische HypoVereinsbank A.G. underwrote the commercial bank finance package totaling US\$29 million including a US\$4 million overrun facility. The International Finance Corporation, a division of the World Bank, provided an additional US\$10 million.

SRK engineers and geologists have been involved for over 6 years, first as the Due Diligence reviewer and subsequently as the Independent Engineer for the project finance lenders. Initially, Standard Bank

London commissioned SRK to carry out a Due Diligence Review, after Davy International studied the mine's feasibility on behalf of Arian Resources. SRK's Bill Crowl and Bill Tanaka visited the frigid site in January, followed by specialist reviews of the data.

Bema Gold purchased their 79% interest in the Julietta mine from Arian Resources in 1998. A re-assessment of the project resulted in a new Development Plan that SRK audited. The process flowsheet now included conventional flotation concentration with cyanide leach of the concentrate and Merrill Crowe precipitation. The new flowsheet saved considerable capital compared to the Davy version.

During the summer of 1999, Bema began constructing concrete footings and improved the access road. This forward planning and execution helped bring the project to commercial production in December of 2001 at a total capital cost of US\$51.4 million. SRK certified Mechanical Completion in March 2002.

Bill Crowl, Principal Geologist and Project Manager, says, "Early on, Bema optimized the process flowsheet and with careful planning got a jump on the severe Siberian winters. With our help, the lenders gained the confidence necessary to fund the project – the first to be funded in Russia in over 4 years."

Bill Crowl: [wcrowl@srk.com](mailto:wcrowl@srk.com)

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## Spotlight on Mike Warren

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**M**ike Warren heads up the due diligence practice within SRK Australasia, which services mining companies and major banks in the mining industry. Mike provided similar services to Barclays Bank (BZW Australia) and WestLB, a German owned bank for nearly five years on their Global Project Finance teams. A mining engineer with over 28 years of industry experience in underground and open cut mines, Mike has been involved in technical, supervisory, financial and head office roles.

Beginning with 8 years at Broken Hill with CRA, Mike moved to the coal mining industry where he says the “toys were bigger,” spending 5 years at the Goonyella coal mine in the Bowen Basin of Queensland. Moving his family to Sydney in 1987, he worked in head office roles at Elders Resources and Exxon Coal and Minerals. While there, Mike completed a part-time MBA at Macquarie University leading to his move into investment banking.

At the investment banks, Mike carried out due diligence for world class mines, including Lihir, Argyle, Bengalla and Alubrera, as well as mining projects in gold, nickel, copper and coal, including the financing of the Nimary gold mine in WA for Eagle Mining and the Coppabella PCI coal mine in Queensland for Australian Premium Coal.

In 2000, Mike assisted SRK by leading a due diligence team at a coal mine in China. Subsequently, he joined SRK as a principal consultant and the business unit manager of the Sydney office of SRK Australasia. In the last two years Mike has consulted or led due diligence teams on projects in Western Australia, Queensland, Victoria, and New Zealand, plus coal, iron ore and gold mines in China.

Mike Warren: mwarren@srk.com.au



Mike Warren

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## SRK due diligence in China

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Imported Caterpillar scraper and dozer

**SRK** Australasia has completed several due diligence projects in China recently. Since then, we have established an office in Beijing and closer links to the Chinese mining industry.

For the Aluminum Corporation of China Limited (“Chalco”), SRK prepared an Independent Expert Report for a prospectus for listing on the New York and Hong Kong stock exchanges. The SRK team of four mining specialists and associates from Worley Engineers visited Chalco’s mines and processing plants, accompanied by experts from the Beijing Institute of Geology for Mineral Resources and Chalco representatives.

Chalco owns and operates an integrated aluminum business in China through province-based processing plants. Each plant consists of at least one bauxite mine, an aluminum refinery and an aluminum smelter (except for Shanxi), workshops and infrastructure. SRK examined the geology of the Chinese bauxite deposits, which is quite different from the standard Australian laterite type deposits; deposits ranged from eluvial to hard rock, with interesting deposit geometry. SRK reviewed Chalco’s bauxite deposits and converted the A to D deposit categories used in China to the JORC & SME categories, on a deposit by deposit basis. At several mines the equipment was in poor repair but at

*Underground  
at Guizhou*



## Profile of Mike Armitage

**D**r. Mike Armitage is the managing director of SRK (UK) Ltd. and a principal mining geologist with twenty years' experience in the industry. Mike graduated from Cardiff University in 1983, then spent four years working as a mine geologist in South Africa and Zimbabwe. He completed a Ph.D. in resource estimation and structural modelling at Bristol University before joining SRK in 1991.



Mike Armitage

Having recently handed over the reigns of the Geology/Resource Estimation Group at SRK (UK) to Martin Pittuck, Mike is now primarily responsible for managing feasibility studies and stock exchange expert reports on behalf of mining companies, and for audits and due diligence studies on behalf of investment institutions or in support of mergers and acquisitions.

He has written several papers and given many presentations on resource and reserve estimation methodology and classification, and on the due diligence process in general. Until recently, Mike was joint course coordinator of the M.Sc. degree program in Mineral Resources at Cardiff University.

In preparing due diligence studies and audits, his principal aim – in addition to highlighting risks, uncertainties and opportunities – is to make sure the resulting report gives the potential investor a clear indication of the impacts of these on the cash flows assumed by the sponsor's feasibility study or Life of Mine Plan. If SRK is requested to produce a report, we must be as definitive in our opinions as possible. Our findings must be quantified in order to clearly explain the level of risk and its impact on the project's potential.

Mike Armitage: [marmitage@srk.co.uk](mailto:marmitage@srk.co.uk)

others it was first class. While environmental monitoring met local standards, some monitoring programs were considered insufficient. In general, safety performance appeared to be a high priority with good management attention but its level was below international standards.

SRK evaluated risks in these categories: geology, ore quality, environmental risk,

financial risk and social risk. At the completion of the project, Chalco was successfully listed and raised over US\$457 million. At least some of this capital was earmarked for improvements.

Mike Warren: [mwarren@srk.com.au](mailto:mwarren@srk.com.au)



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## USTDA-funded feasibility study completed for Ambaji Project, India

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In 2001, the U.S. Trade and Development Agency awarded R.B.W. Minerals Industries Limited (RBW) a grant to prepare a detailed feasibility study for the Ambaji Group of Mines. The mines, comprised of the Ambaji, Deri, and Basantgarh Cu, Pb and Zn deposits, are situated in the states of Rajasthan and Gujarat, India.

The majority partner of the RBW joint venture wishes to bring about the backward integration of its smelting operations into mining. Its immediate intent was to develop the Ambaji Group of Mines to mine and process copper/lead/zinc ore to produce concentrates and, subsequently, to explore new areas to augment the project's production over a 13-year life.

RBW contracted with SRK Consulting in Denver to prepare the feasibility study. RBW's staff in Udaipur provided strong support in the areas of geology, cost estimation, procurement, scheduling and financial modelling. Indian sub-contractors designed the tailings dam, the water storage dam and completed environmental impact assessments of the three mining areas.

In developing the feasibility study, SRK complied with RBW's desire to more tightly constrain capital and operating cost estimates, by requesting and receiving early fixed-price bids for the engineering and construction of the



process plant and for contract mining of the Ambaji open pit.

Bill Crowl, Principal Geologist and Project Manager, says, "The optimal use of contractors during mine operations and the very low labor costs in India led to a financially attractive project, even at today's depressed

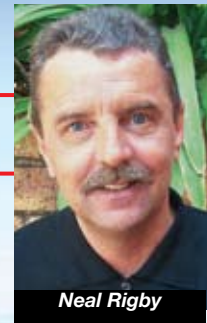
base metal prices. SRK will provide additional help to RBW as they seek project financing. This multi-mine project can be a real boost to the local economy, and will provide the local populace with a new, sustainable, fresh water supply."

Bill Crowl: [wcrowl@srk.com](mailto:wcrowl@srk.com)

*Blessing of the drill at the start of the Ambaji drilling campaign*



# Restructuring of Konkola Copper Mines Plc



Subsequent to the announcement in January 2002 by Anglo American Plc of its decision to exit its investment in Konkola Copper Mines Plc (“KCM”) SRK was commissioned by the Government of the Republic of Zambia (“GRZ”) and Zambia Consolidated Copper Mines-Investment Holdings (“ZCCM-IH”) with World Bank support, as Technical Advisor to the restructuring of KCM. KCM had incurred substantial operating losses exacerbated by copper prices languishing in the mid 60 cents per pound range and, with little further imminent funding, was experiencing severe working capital problems. Working alongside Standard Bank London as Financial Advisor and Clifford Chance as Legal Advisor, SRK completed numerous assignments ranging from an initial diagnostic health check of the assets, providing technical support during the somewhat protracted exit and restructuring negotiations with Anglo American Plc, the formulation, in collaboration with KCM management, of alternative life of mine exploitation strategies through to presentations to and negotiations with prospective new investors. All this with regular communication and briefing sessions with the principal clients GRZ and ZCCM-IH.

The demeanour of all stakeholders in the KCM assets was extremely depressed when SRK’s multidisciplinary technical team first arrived on site at the beginning of March 2002. The assets comprised the Nchanga open pit and underground mines and concentrators, the Tailings Leach Plant, the Konkola underground mine and concentrator, the Nampundwe pyrite mine and concentrator and the Nkana smelter and refinery. SRK’s first task was to conduct a high level due diligence to assess whether the assets could be rendered economically viable or whether a closure scenario should be pursued. SRK concluded that the potential to leverage the considerable financial and human capital invested in the assets since vesting two years earlier together with the strategic

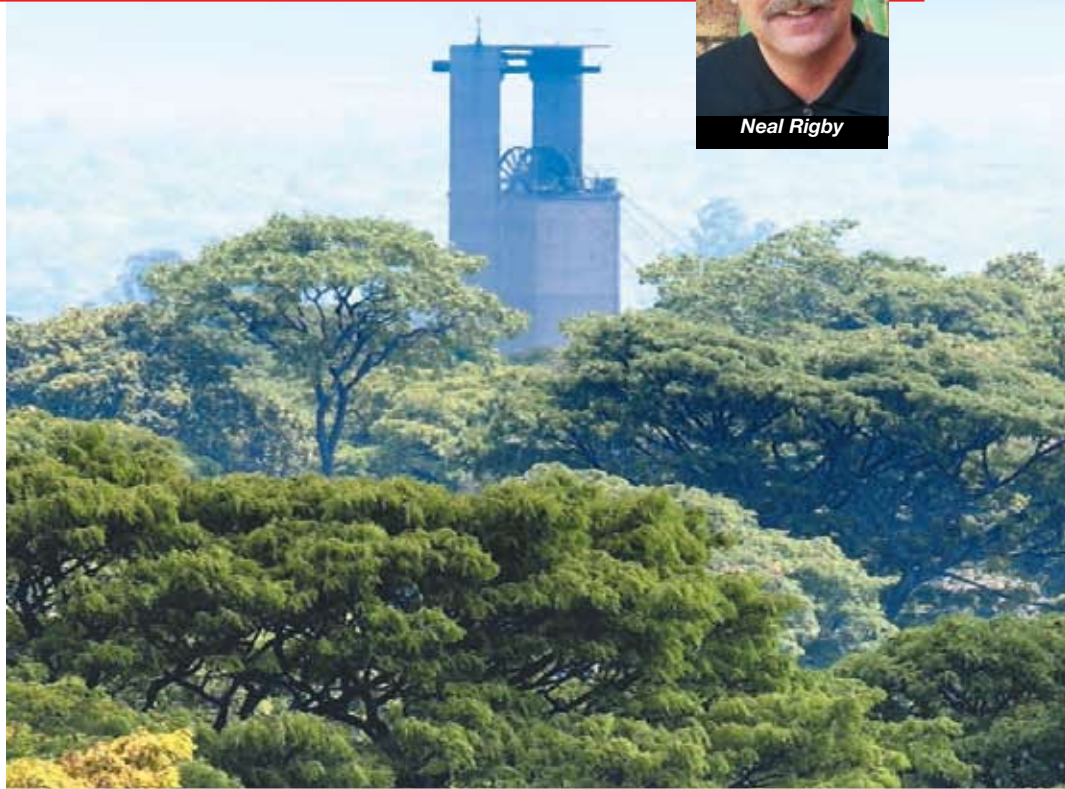
importance of the very substantial, 32Bib of contained copper and 220Mib of contained cobalt resources at KCM’s Konkola mine necessitated the continued operation of these assets. However in order to support this, further funding would be required, operational improvements had to be maintained and extended and the potential from certain upside opportunities would have to be realized.

The focus of the previous board and management on the development of the capital intensive Konkola Deep Mining Project had subordinated the many areas of opportunity and optimisation with the existing asset base which soon became evident to SRK. It would be contravening confidentiality obligations to go into detail in this article, suffice it to say that KCM management in collaboration with the SRK team are presently re-evaluating the Konkola Deep Options and are working hard to prioritise, formally adopt and

implement plans to realise these opportunities. Similarly, the bottom line benefits from the substantial “stay in business” and “refurbishment capital” invested over the two years since vesting has yet to be fully realised.

Eighteen months on and although by no means out of the woods yet, KCM is a different place. A new management team, concentrated at the business units demonstrates a new determination and self belief in its ability to sustain the viability of KCM and, going forward, to leverage the copper price. The support of the workforce and the Mineworkers Union of Zambia has also played a major part in this belief.

Neal Rigby: nrigby@srk.co.uk



No. 1 Shaft at Konkola Mine

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## Proactive mine evaluation in South Africa

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In South Africa SRK Consulting is helping to transform the old, reactive approach to mining authorization (regulatory compliance and minimal community support) to a positive, proactive one that supports global concerns with sustainability. The recently enacted Mineral and Petroleum Resources Development Act and regulations that are soon to be promulgated impose broad responsibilities on mining operations, from the bio-physical to the socio-economic environment.

At the application stage, mines now must submit a social and labour plan, along with an environmental management plan. SRK has been drafting management plans since before 1992 that seek to mitigate bio-physical and socio-economic impacts, but this focus has seldom been required at the operational and closure stages, in auditing, closure planning and costing.



**Ally Burger-Pinter**

The Act will require an emphasis on sustainability issues throughout the life of mines, by considering social and economic as well as environmental impacts. The financial provisions for closure will require a social and labour fund to ensure that surrounding communities, including ex-employees, are not adversely affected.

A key principle underpinning the plan is not only to minimize potential damage associated with proposed developments but also to enhance the positive impacts and opportunities for durable net gains in economic and social well-being. As potential partners in local economic development, mining companies will have to demonstrate – to shareholders and stakeholders alike – that sustainable development is good business.

SRK's historical strengths in socio-economic and, more recently, organizational

management position us well to help mining clients with compliance. Under the new legislation we can use impact assessment as a dynamic development tool, rather than a one-off exercise to obtain permitting. Forward thinking mining clients have commissioned us to develop comprehensive social and labour plans for their operations. These plans help create opportunities for local socio-economic development, and mining operations, as responsible community members, integrate stakeholder concerns, local needs and aspirations, into plans for the complete life cycle of the mine.

Nic Boersema: [nboersema@srk.co.za](mailto:nboersema@srk.co.za)  
Allison Burger-Pinter: [aburger@srk.co.za](mailto:aburger@srk.co.za)



**Nic Boersema**

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## Due diligence workshop

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Each year the SRK Group sponsors an internal workshop on a particular facet of the Group's consulting business.

SRK recently conducted a due diligence workshop in Toronto, Canada. This location was selected given that many major, mid-tier and junior mining companies and financial institutions are headquartered in Toronto, and that SRK's newest North American office is located in the heart of the city. The venue for the workshop, the Toronto Stock Exchange was particularly poignant given the theme.

The due diligence focus reflects the increasing importance of this type of work to Group business and Group clients over the past fifteen years or so.

Twenty senior SRK professionals representing SRK's offices in South Africa, Australia, the United Kingdom, the United States, and Canada attended the workshop. The objective of the workshop was two-fold; it provided an opportunity for interaction between the various offices, an exchange of ideas and experiences and case studies and, to debate at length the management of due diligence mandates and the inter office consistency of process and high quality deliverables.

The results of three days of intense internal meetings were presented in "Mind Manager" format to mining and mining finance clients in the main auditorium of the Toronto Stock Exchange with full and frank discussion on a range of burning issues and anecdotal evidence. Most notable of

these were the implications of increasing disclosure requirements by regulatory bodies, internal v external qualified person, collective and independent sign-off and accountability, real and perceived conflict of interest, formal quantitative risk assessments and the dangers of limited or restricted due diligence.

Nick Michael: [nmichael@srk.com](mailto:nmichael@srk.com)  
Neal Rigby: [nrigby@srk.co.uk](mailto:nrigby@srk.co.uk)



**Nick Michael**

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## Determining fair market value: Magistral

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Magistral project area

**SRK** recently provided a professional opinion on the “Fair Market Value” of Anaconda Peru’s 51% interest in the copper-molybdenum Magistral Project, located at 4,300m in central Peru. While Anaconda had requested a valuation report for internal purposes only, the valuation methodology we used followed the guidelines of the Special Committee of the Canadian Institute of Mining, Metallurgy and Petroleum on Valuation of Mineral Properties (CIMVAL).

One of the challenges SRK faced was to determine which appraisal approach to use: Income, Market or Cost. Although some work on the project met the requirements of a pre-feasibility study, the project was not a Development Property according to CIMVAL definitions, and was at the Preliminary Assessment stage. Therefore, Magistral was insufficiently advanced to apply the Income Approach with any confidence. As a result, we followed the Market Approach and the Cost Approach.

The Market Approach was used to review past transactions involving the asset, and compared Magistral’s attributes to

other South American copper deposit transactions involving similar-type assets. A comparison of Magistral’s current resources with other South American copper deposit transactions revealed an appropriate project value indicator, expressed in US dollars per pound of attributable contained copper. Multiplying the value indicator by the pounds of copper equivalent to Anaconda’s 51% interest suggested a Fair Market Value.



Mike Michaud

The Cost Approach was used to determine the current value of past expenditures. It accounted for their contributions to the technical understanding of the project and its anticipated economics.

According to Mike Michaud of SRK’s Toronto office, when these two approaches resulted in almost identical numbers, the analysis provided confidence in determining the Fair Market Value.

Mike Michaud: [mmichaud@srk.com](mailto:mmichaud@srk.com)

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## SRK’s AIM

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**B**efore the London Stock Exchange established the Alternative Investment Market (AIM), it was not possible for exploration and mining companies without reserves, and therefore without completed mining feasibility studies or operating mines, to list in London. Since its establishment, this market has become increasingly attractive to small-medium sized companies. In fact, in 2002 alone, fourteen such companies listed on AIM, raising nearly £50 million; several more are currently in the pipeline. The companies listed have assets all over world, in South America and Russia, and in areas better known to UK-based investors, in Europe and Africa. Though some companies already have operating mines, AIM has re-kindled the junior sector in the UK; several forums have been set up to help them benefit from their experiences, and there is an enthusiasm that has not been seen for a significant time.

Listing on AIM does not require the Independent Competent Persons/Expert/Technical Report that most other equity markets require. Still, including independent reports in the offer documents has become the norm rather than the exception. There is no set format for reports, so the documents produced vary widely. SRK has developed a format that reflects the nature of this market and gives investors confidence that the activities proposed are technically achievable and economically justifiable and that the budgets allocated are sufficient for the purpose. SRK works with the listing companies to develop viable work programs and budgets. Our standing in the London mining and investor community and our experience in exploration and mining disciplines means we can provide help beyond technical reports and work with these companies after they complete the listing process. In due course, SRK expects that some of these companies may well obtain listings on the full exchange.

Mike Armitage: [marmitage@srk.co.uk](mailto:marmitage@srk.co.uk)

# Reconciliation study for Geita's completion test:

## Proof of the pudding is in the pouring

The Geita Gold Mine lies in the Victoria Greenstone Belt gold district of northern Tanzania. The mine, operated by Geita Gold Mining Ltd (GGML), was opened in August 2000 and poured its millionth ounce of gold in June 2002.

N M Rothschild & Sons led a syndicate of banks that provided US\$135 million in senior credit to finance the project. SRK Consulting undertook a technical audit before Rothschilds' financing, subsequently audited the revised Life of Mine (LoM) Plan and most recently monitored its 3-month technical completion test.

Passing the completion test was a very important milestone, demonstrating that the operation had reached a steady-state

of production, that planned cash flows were being achieved and that the Ore Reserves covered the loan repayment and the syndicate's insurance requirements.

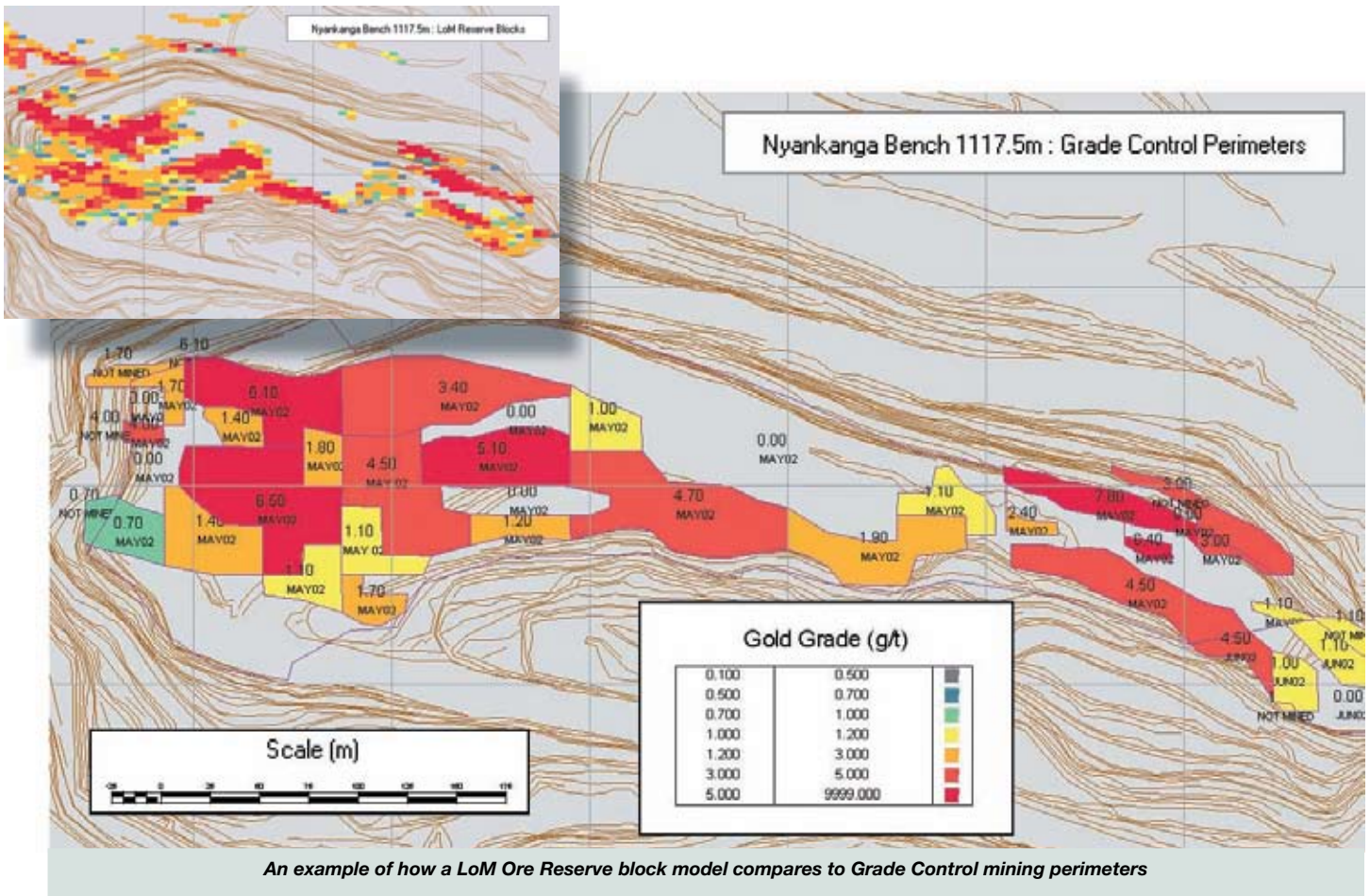
LoM cash flow relies heavily on an accurate estimate of ore tonnage and grade in the Ore Reserve. The LoM Mineral Resource had to be verified as part of the study. To reconcile back from the mill feed tonnage and grade, we verified stockpile loading and depletion records, ore and waste production figures for each pit and made a detailed comparison of the grade control resource estimates that ore mining perimeters were based on and the LoM reserve estimate in the volume of ground mined.

Following the test period, SRK worked on site on the production analysis. The mine had exceeded all of its targets for the three month period, milling 7% more tonnes at a 30% higher grade, and pouring over 40% more gold than planned. SRK also found that the tonnage and grade depleted since mining began compared favourably with the material processed by the mill. The excess was due to overly conservative adjustments for supergene gold depletion, and efficient management that led to upgrading the mined material.



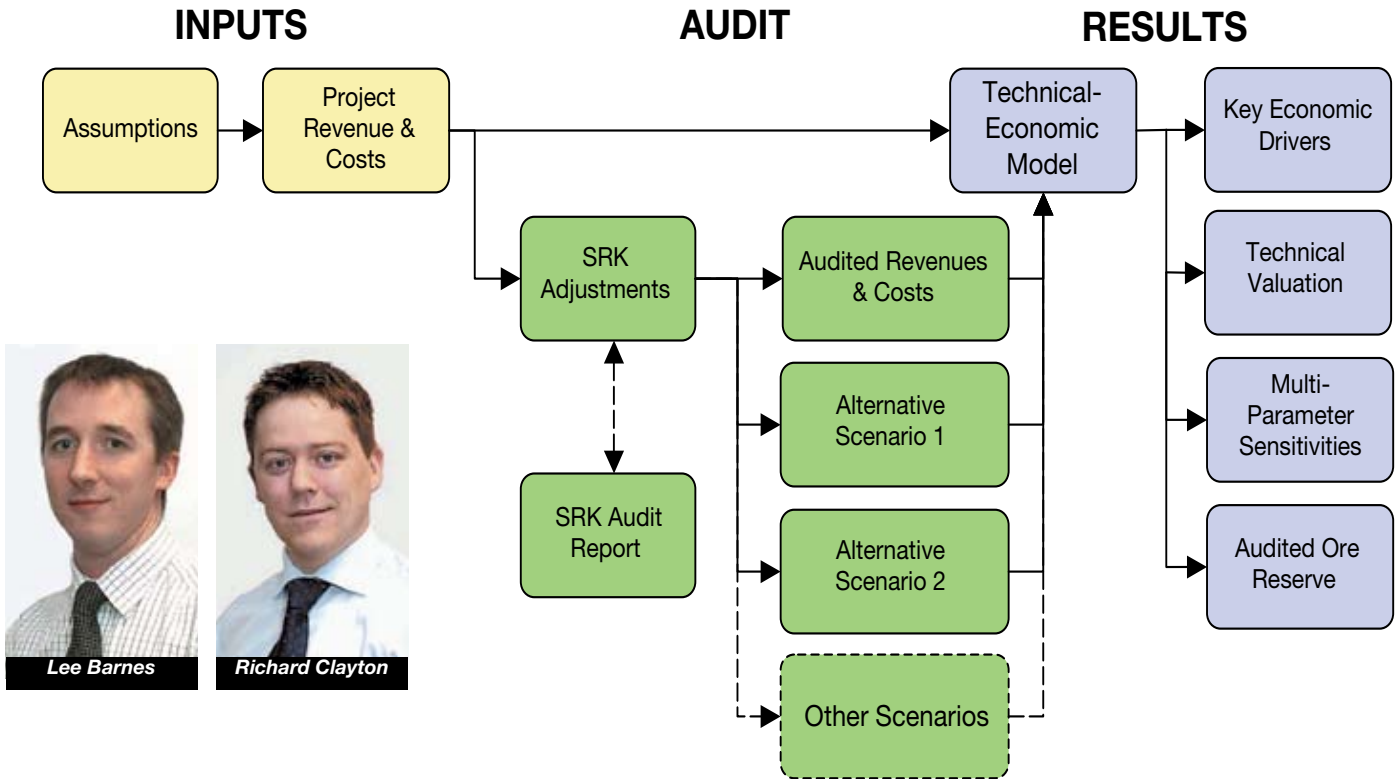
Martin Pittuck

Martin Pittuck: mpittuck@srk.co.uk





# Technical-economic modelling for due diligence



**A**t SRK, quantifying the impact of the conclusions presented in an audit report is key to ensuring the audit meets our clients needs. This is why producing technical-economic models is an integral part of our approach to due diligence. Using these models, SRK can assess negative and positive economic impacts of our conclusions and focus on the key technical and economic assumptions to ensure the robustness of the audit. Over the last ten years an SRK core team has developed the technology and skill base to analyze the whole value chain from technical inputs to post-tax pre-financing cashflows.

SRK obtains detailed production, operating cost and capital expenditure projections and uses them to develop the technical-economic model. A modelling engineer identifies the key issues, checks for material omissions, and verifies the calculations used to derive revenue and

cost projections. The model can then be adjusted to reflect the audit findings.

The SRK model includes these broad components:

1. Logic review – how are revenues, operating costs and capital expenditures derived?
2. Integrity review – do individual elements of the model tie together? For example, does the processing schedule flow from the mining schedule; does it include stockpile movements?
3. Multi-option analysis – rapidly compares the project case with the audit case and adds in “what-if” scenarios.
4. Sensitivity analysis – updates multi-parameter sensitivity analysis instantly in response to model adjustments.
5. Project financing – uses financing ratios to assess the impact of the audit on the project covenants.

SRK’s knowledge of the key economic performance criteria for mining projects adds value to the due diligence process over the whole range of financing options. SRK has recently applied this approach to mergers and acquisitions, in project and corporate financing, to regulatory valuations and documentation for securities and stock exchanges, in brownfield expansions, privatization and internally funded projects.

With these models, we can link technical and financial aspects of due diligence and assist clients in making more informed financial decisions.

Richard Clayton: [rclayton@srk.co.uk](mailto:rclayton@srk.co.uk)  
Lee Barnes: [lbarnes@srk.co.uk](mailto:lbarnes@srk.co.uk)

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## Profile: Iestyn Humphreys

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Iestyn Humphreys

Iestyn Humphreys heads up the due diligence arm of the SRK mining group in Johannesburg. After completing his doctoral thesis, based on his experience working at South Deep Gold Mine, South Africa from 1990-93, Iestyn joined SRK Consulting in 1994.

From 1994 to 1997 he was responsible for all aspects of mine design and for planning software applications as part of scoping, pre-feasibility, and feasibility studies in West Africa, Eastern Europe and former countries of the CIS.

With merger activity in the global mining industry expanding, Iestyn has been formalizing SRK's in-house expertise in mining economics and the management of multi-disciplinary due diligence. He undertakes due diligence mandates for internal and external financing, information memoranda, and competent persons reports on expansion programs, divestment, acquisition and mergers, scoping studies, pre-feasibility and feasibility studies.

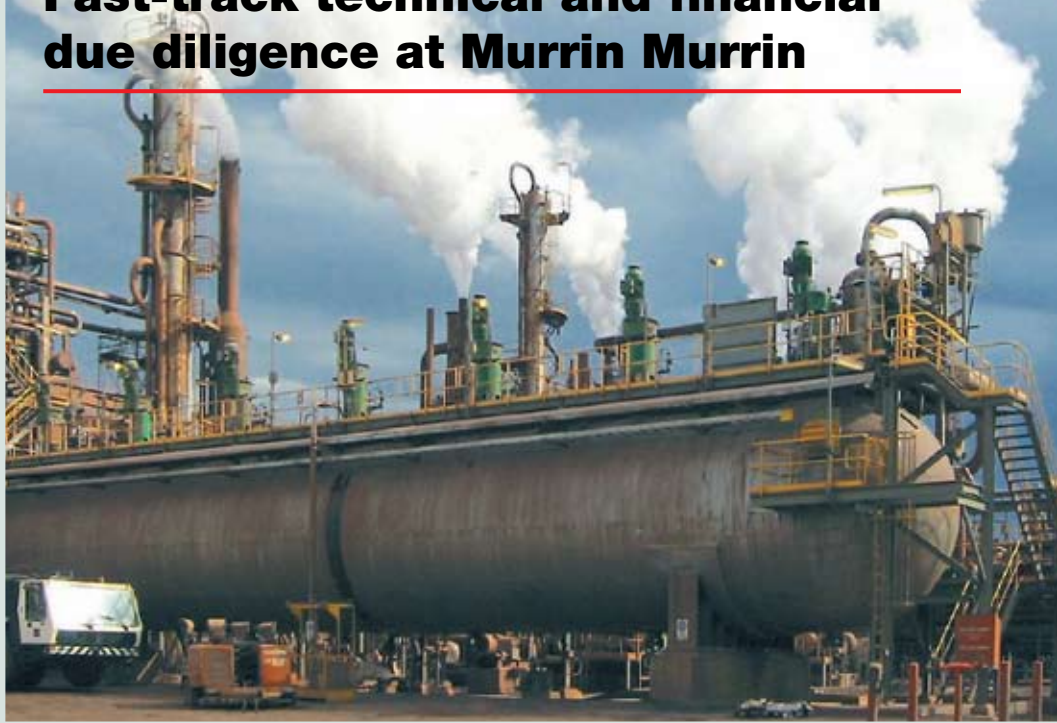
To assess both technical and financial viability as an integral part of the due-diligence process, Iestyn is developing a focus that moves beyond post-tax pre-finance cashflows to full analysis for both equity and debt financing structures. He believes that the mergers, acquisitions and restructuring currently taking place in the global mining industry will continue and that the SRK Group is ideally positioned to provide the services and expertise that such work requires.

Iestyn Humphreys: [ihumphreys@srk.co.za](mailto:ihumphreys@srk.co.za)

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## Fast-track technical and financial due diligence at Murrin Murrin

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Ferric sulphate arsenic precipitation plant

**SRK** recently completed an ultra-fast-track review of the current position and future options on behalf of Rothschild & Sons for the Murrin Murrin nickel laterite project in Western Australia, a joint venture between Anaconda Nickel and Glencore.

Murrin Murrin is a large and trail-blazing technical project that has been pioneering new technology since its inception in May 1997. To assure the continuity of its operations, the project financiers and owners required a thorough technical review of all aspects of the operations.

In view of the size and complexity of the project, the assessment had to be provided by specialists of international standard, hence the involvement of an SRK review team made up of permanent staff and senior associates from the various Australian offices, with Mike Waren as project manager, all of whom were under considerable pressure to meet the very tight project deadlines.

Among SRK's proposals were additional

and advanced risk analyses to support the likelihood that sufficient high-grade resources are available near current pits. Additionally, the SRK team constructed a number of global resource models for key areas and quantified the risks associated with increased selective mining.



Tony Wesson

Tony Wesson, SRK principal geostatistician based in Perth, comments: "The full project, including the technical review of resources, reserves, mining schedule, plant maintenance, cost predictions, the options study and financial modelling, a workshop with the bank and a draft report, was completed within the two-week timeframe!

"We are happy to have delivered quality results to the client, and thankfully acknowledge the teamwork with the client and site personnel – a shining example of close partnership between technical and financial experts."

Tony Wesson: [awesson@srk.com.au](mailto:awesson@srk.com.au)

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## Environmental due process in fast-tracked mine evaluations

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Since 1998, the South African mining industry has been dominated by renewed interest in platinum group metals (PGMs). Factors contributing to the platinum industry's rapid development include:

- getting minerals to market while platinum prices remain high
- perceptions around the “use it or lose it” principle in the Minerals and Petroleum Resources Development Bill

Whatever the factors, it appears that once a mining house decides to get mineral resources to market, the process moves at a rapid rate – often to the exclusion of strategic planning or due consideration of environmental and social issues. But the consequences of fast-tracked planning rarely result in fast-tracked decision mak-

ing by the regulatory authorities.

On the contrary, in some cases, it appears that decision making is hampered by the absence of detailed information and concerns over environmental due process. Where fast-tracked planning has led to fast-tracked decision making by regulators, it is often because of a creative collaboration:

- environmental scientists are involved in conceptualizing the project to assist in defining procedural requirements, environmental fatal flaws and key material issues
- all project stakeholders are involved at the earliest stage in developing project concepts
- long-term relationships with stakehold-



Ally Burger-Pinter

ers are established from the outset

- the integrity of environmental due process is maintained by declaring values and objectives, and establishing principles for accountability and transparency

SRK recognizes the program constraints placed on project teams and continues to partner with clients in finding solutions that work. Fast-tracked planning must involve the collaboration of key people if it is to lead to authority approvals and sustainable projects.

Briony Liber and Allison Burger-Pinter:  
aburger@srk.co.za

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## Resource auditing for due diligence

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As experienced technical auditors, SRK takes on due diligence studies all over the world. The client who commissions an SRK study can expect an independent assessment of a mining project, a report on its potential to generate revenue as set out in a business plan, and its ability to fulfill specific requirements.

As the building block of any feasibility study or Life of Mine Plan, the resource is always a primary object of study.

1. The orebody model is the basis of the resource. Particularly important are the continuity of mineralization and the nature of the contacts between the modelled orebody and the host rock. Together these help determine the model's validity and the appropriateness of the assay extrapolation procedures.

2. The quality of sampling information is critical. Studying quality assurance and quality control procedures, reviewing

laboratory reports, repeat assay studies and production reconciliation studies are fundamental. Not only must these studies have been done but appropriate followup actions should have been taken based on the results. As auditors, we need to understand why data was excluded from any analysis as much as why data was included.

3. The quantity of samples, and in particular the density and spacing of these within the orebody allied with the statistical distributions and geostatistical ranges of the variables measured, impacts significantly on the confidence in the resulting estimates and should therefore be reviewed.

4. The extrapolation procedures used to create area or block grades from borehole data can, in particular, affect the degree of smoothing in the resulting grades. Though not as critical as some of the other issues where there is very little variation in grade,



Mike Armitage



Martin Pittuck

this is most important where selective mining is envisaged or where grades vary significantly across a deposit.

5. Classifying the resource by assigning tonnes and grade to different categories is a critical step; it determines the proportion that can be used in feasibility study based cash flow projections. The key issue is the distinction between what is classed as Indicated and what is classed as Inferred. Auditing this aspect is a key part of any resource audit.

Mike Armitage: marmitage@srk.co.uk  
Martin Pittuck: mpittuck@srk.co.uk

# Technical due diligence for the Cerro Matoso expansion project, Colombia

**SRK** was retained by Barclays Capital to undertake a technical due diligence of the existing operations and planned expansion of BHP Billiton's Cerro Matoso S.A. (CMSA) ferronickel production facility at Montelibano, Colombia. The existing (Line 1) facilities, which began operating in 1982, included a conventional open-pit laterite mine with ore crushing and blending facilities, a rotary dryer, a rotary kiln used for calcining, an electric smelter, and a refinery. The expansion added a second metallurgical processing line (Line 2) to increase production capacity to 120 million pounds of nickel per year.

The principal objective of the due diligence was to verify that the expansion plans were based on adequate data and formulated according to sound mining, smelting and engineering principles and good environmental practice. SRK analyzed the ore reserves and mining, smelting and refining, environment, EPCM process, infrastructure, management, and capital and operating costs.

The participating lending institutions used the results of the study in evaluating the US\$240 million loan for the facility's expansion; the Export Development Corpo-



Line 1 and 2 smelters, shortly after expansion. Open pit can be seen in the left background.

ration of Canada for providing political risk insurance. The loan was approved in 1999 and production on Line 2 began in January 2001.

In its role as Independent Engineer for the banks, SRK reviewed and assessed the project for the lending institutions and assisted CMSA in meeting the requirements of the loan agreement. In addition, SRK provided a series of environmental programs and testing procedures that were initially designed for the Completion Test and have subsequently been adopted by CMSA's environ-

mental department as a means of meeting BHP Billiton's commitment to achieve and exceed the World Bank's environmental standards and good practice. CMSA's environmental department has made significant improvements in overall site environmental management, and has developed a quality monitoring program to provide the data required to verify compliance during the Completion Test.



Nick Michael

Nick Michael: nmichael@srk.com

## For more information, contact us at: [www.srk.com](http://www.srk.com)

	Telephone		Fax		E mail
Australia	(+61)	(8) 9288-2000	(+61)	(8) 9288-2001	perth@srk.com.au
Canada	(+1)	(604) 681-4196	(+1)	(604) 687-5532	vancouver@srk.com
Chile	(+56)	(2) 269-0353	(+56)	(2) 269-0322	santiago@srk.cl
China	(+86)	(10) 6834-4198	(+86)	(10) 6834-4198	beijing@srk.com
South Africa	(+27)	(11) 441-1111	(+27)	(11) 880-8086	johannesburg@srk.co.za
Turkey	(+90)	(312) 266-1800	(+90)	(312) 266-0697	ankara@srk.com
United Kingdom	(+44)	(29) 2034-8150	(+44)	(29) 2034-8199	enquiries@srk.co.uk
USA	(+1)	(303) 985-1333	(+1)	(303) 985-9947	denver@srk.com
Zimbabwe	(+263)	(4) 49-6182	(+263)	(4) 49-0144	harare@srk.co.za

Issue No. 32