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Fernando Fuentes

Chile's US$1.3 billion Los Pelambres copper project to be on line by year-end, 1999

Latin American Development

Latin America is still booming, with inflows of capital, estimated at well over US$10 billion between 1995 and 2000, for new projects and expansions into the region. Beyond the massive sums being spent on development of projects, an estimated US$500 million a year is going towards exploration. Chile, Peru, Venezuela, Brazil and Argentina are the main centres of activity.

The rosy outlook is somewhat sullied by the disproportionately high percentage of projects awaiting go-ahead for construction, compared to total exploration activity. This is due mainly to lingering uncertainties about the economic stability of some countries in the region, as well as specific problems with local taxation levels.

"However," says Fernando Fuentes, managing director of SRK (South America), "in general the future looks promising. Most Latin American countries continue to improve their economic situation and strongly encourage capital investment in mining. Therefore we perceive excellent business opportunities for engineering and environmental consulting in the region."

Work environments and cultures, though different to North America and Europe, do not represent an obstacle for foreign companies that wish to participate in the region. Strong globalisation of the mining industry has raised standards in Latin America and created a conducive environment for exchanging best professional practices.

Well educated and experienced engineers, scientists and technicians can be found in countries such as Chile, Peru, Brazil and Argentina. These professionals can integrate well with teams of foreign specialists and provide the necessary knowledge of the local culture, language and customs. Some local professionals have already gained extensive practical experience, and are capable of performing leading roles in projects and operations management.

"We recognised the immense potential of the region some years ago and set about positioning our company accordingly," Fernando continues. "With the formation of SRK SudAmerica in Chile in 1994 and SRK Peru in 1996, we strengthened our participation in Latin America after more than 10 years of activity through the South African, North American and UK offices.

"We will be expanding our presence further by enhancing the existing offices and opening of new practices in countries where mining activity is increasing, such as Brazil and Argentina. The strategy to integrate the extensive experience and strong technical capabilities of SRK world-wide with the most competent local partners and staff has proved to be successful. We will apply this winning formula in the next few years as we expand further into Latin America."

Due Diligence Audit in Mexico

As a part of a larger due diligence audit performed for Standard New York, Inc., SRK evaluated the Mexican properties of Consolidated Nevada Goldfields (CNGC) of Denver, Colorado, that were acquired in the 1996 merger with Grupo Real del Monte S.A.

SRK's study consisted of a complete audit of resources/reserves, mining, process and environmental conditions as they related to CNGC's Five Year Plan.

Bill Crowl

The review started with a four person team travelling to Mexico to examine CNGC's Pachuca and El Baztan operations. The Pachuca operations have been actively mining silver, with some gold, zinc and lead, for over 465 years.

Total historic silver production from Pachuca is about 40.8 million kg (1.3 billion troy ounces). Annual silver production will be increased, according to CNGC's plans, through mine expansions, modernisation of mine planning efforts and close attention to environmental requirements.

Bill Crowl, Principal Mining Geologist at SRK, comments: "Our audit resulted in a number of recommendations for enhancing production at Pachuca.

In addition, the visit to the remote El Baztan mining operations revealed a copper mine/mill complex that will benefit substantially from investment in state-of-the-art mine planning and environmental awareness. We recommended a number of improvements that could be made."

(CNGC has recently changed it's name to Real del Monte Mining Corporation)

The Right Environment for Peruvian Privatisation

SRK was part of a multi-disciplinary team of specialists which travelled to Perú during early 1997 to undertake an evaluation of the San Cristóbal, Andaychagua and Carahuacra mines east of Lima on behalf of a confidential client.

Two of the three properties are owned by the state-owned mining company, Empresa Minera Del Centro Del Perú, which is in the process of privatising its exploration, mining, smelting and refining business units. The third property is close to the others, but is owned by a Peruvian company public, Compañía Minera Volcan S.A.

SRK was responsible for the environmental component of the assessment. Information related to the local environmental regulations and conditions was provided by SVS S.A. of Lima.

One of the old tailings impoundments near the mill and concentrator facilities which serve the San Cristóbal Mine

Cam Scott, Principal Engineer at SRK, comments: "Extensive changes to the environmental legal framework recently occurred in Peru. These have a significant impact on both new and existing mines.

"For operating mines, such as the ones considered by this study, the most significant changes involve Environmental Compliance and Management Programs (PAMA) as well as new effluent discharge criteria that will come into effect in 2001.

"Environmental liabilities, and associated capital and operating costs, are significant imposts on all of these properties. Our report provided the value and timing of necessary environmental expenditures."

Environmental Study Puts the Focus on People

Inundation area of the proposed Corrales reservoir

In the first EIS of its type under the new regulations, SRK is assessing the impact of the proposed Corrales Reservoir located in the IV Region of Chile, a transitional zone between the extremely arid Atacama Desert and the Mediterranean climate of central Chile.

Ivonne Stade

The aim of the project is to expand the agriculture system of the Choapa River basin, a high-potential region with rich soils and a benign climate. At present development is constrained by poor irrigation supply, which is dependent upon the seasonal flow.

The project planners envisage the construction of a 50 million m^3 capacity reservoir and distribution canals. This modification of the current agricultural system, based on the proposed distribution of the water resource to direct and indirect areas, will increase the irrigation certainty for about 10,000 ha from 50% to 85%.

Ivonne Stade, Senior Environmental Engineer at SRK elaborates: "The main scope of the study is to assess and mitigate the impacts to the physical, biological and human components in the inundation and irrigation areas.

"Major issues to be considered include the resettlement of people, archaeological rescue and the development of a training process for the farmers to help ensure that the new water resource will produce an increase in not just production, but also the quality of life."

Impact of New Environmental Regulations Felt In Chile

New regulations for the enforcement of the Chilean Environmental Impact Assessment System came into effect in April 1997.

The regulations, promulgated for the application of Law 19.300 of 1994, require that all new projects obtain an environmental permit (EP). This can be obtained through two routes, depending upon the scale of the project.

Developments that may cause significant environmental impacts – much greater than the established standards – should present an environmental impact study (EIS). This should clearly establish all contemplated mitigation measures including monitoring plans, environmental risk prevention, contingencies and involvement with the community.

Projects with environmental impacts less than the standards in force should present an environmental impact declaration (EID). This technically guarantees the absence of relevant environmental impacts, and enumerates any additional voluntary mitigation measures.

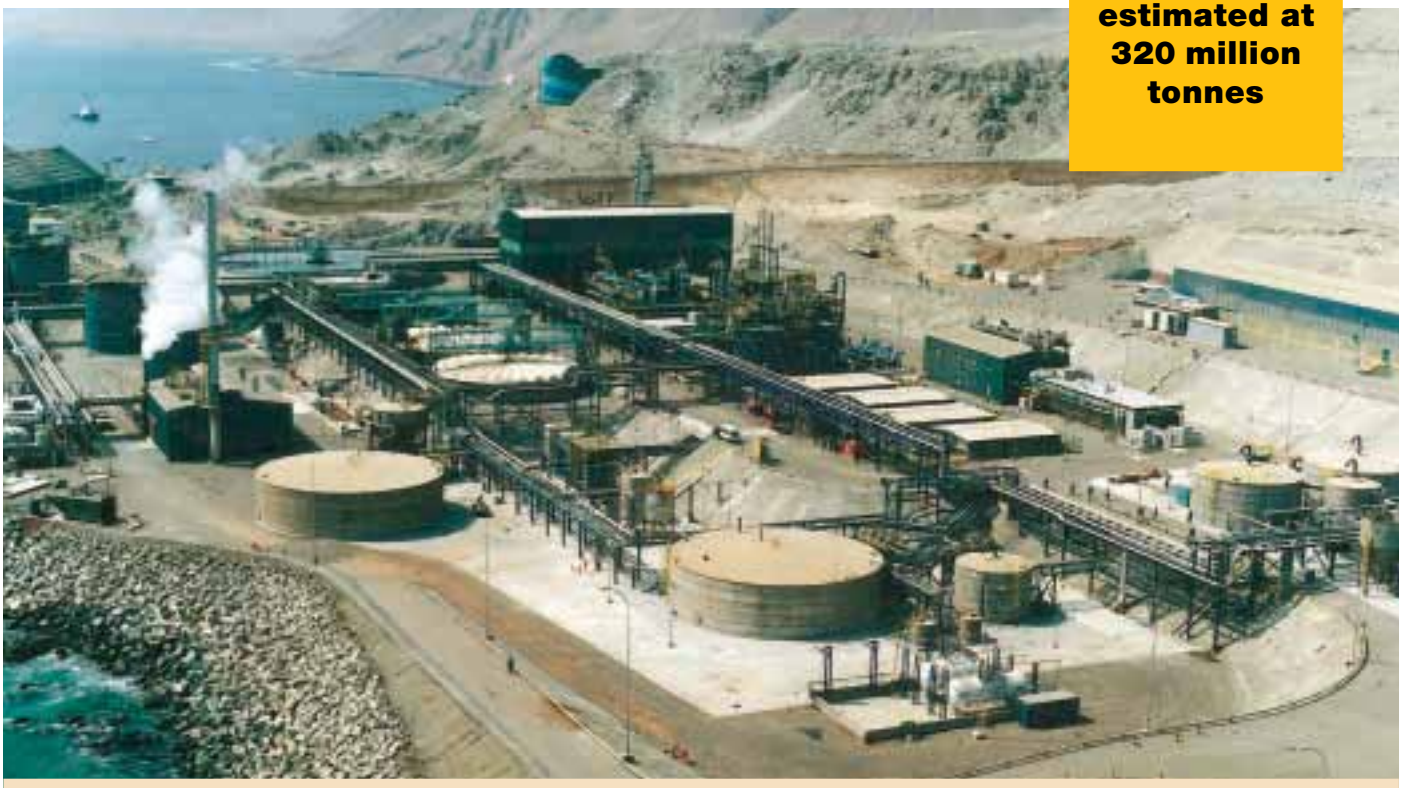
In practice, mining exploration projects must present an EID declaring the mitigation measures for their low level impacts. Exploitation projects, by contrast, must present an EIS ensuring that all the phases of the project (construction, operation and closure) will comply with the environmental legislation by means of an adequate environmental management plan.

From 1994 to March 1997 more than 60 mining projects presented EIS voluntarily to the environmental authorities. SRK participated in approximately 10% of these studies.

Ivonne Stade, Senior Environmental Scientist at SRK, states: "We anticipate that the 'Regulation for the Environmental Impact Assessment System' will promote environmentally sustainable projects in Chile. We hope the system will not become a bureaucratic rule tending to delay the execution of projects in development."

Long Term Studies for Escondida

Reserves are estimated at 320 million tonnes



The facilities at Punta Coloso were part of the extensive list of projects components considered by the recently completed Escondida closure plan.

SRK, as part of its on-going involvement with Mineral Escondida Limitada's (MEL) copper operations in Chile, recently completed two major projects.

For the first project, SRK provided feasibility studies, engineering design and construction quality assurance for a new copper heap leaching facility. Copper will be leached from low-grade oxide ores and recovered using solvent extraction/electrowinning (SX/EW) technology.

Troy Meyer

Troy Meyer, Project Engineer at SRK, comments: "Reserves are estimated at 320 million tonnes, and will be produced at a nominal daily rate of some 58,000 tonnes for leaching under an irrigation rate of 15 l/hr/m^2."

SRK reviewed available metallurgical, geotechnical and related data to assess the viability of several alternative design concepts. The preferred option was an HDPE-lined pad which would be expanded vertically in 6 meter lifts to a total height of 90 meters.

Troy at SRK, says: "Solution control and high seismic risk were key considerations. The design incorporates inter-lift solution collection systems using compacted spent ore for solution control on each lift. This reduces the potential for disruption of the solution collection system components by seismic induced heap slope failures."

The pad will be constructed in four phases with an ultimate footprint of over 4 square kilometres. SRK prepared technical specifications and quality assurance procedures for facilities construction and will assist in construction quality assurance monitoring. Construction is scheduled to begin in the summer of 1997 and up to 9 field monitors will be required at peak construction.

For the other project, SRK provided the first comprehensive decommissioning plan for the Escondida site.

"Because MEL expects operations to continue for 50 or more years, the plan was preliminary in nature," explains Cam Scott, Principal Engineer. "Nevertheless, the study was comprehensive in scope and included all existing project elements as well as those currently on the drawing board."

Boost for SRK's Exploration Geology Expertise

Assessing exploration properties is not usually the most dangerous work, but the unknowns involved in old artesinal workings have been a challenge for one of SRK Santiago's newest exploration geologists, Deborah Lord.

Deborah Lord

Deborah established the Etheridge Henley Williams (EHW) practice in Santiago before the geoscience firm merged with SRK. Her work recently took her on exploration property assessments from Northern Chile to as far as Brazil.

In both countries, she faced the problem of assessing properties previously worked by artesinal miners. "The *garimpeiro* workings we covered in Brazil were relatively straight forward," said Deborah. "But in northern Chile, there were a number of underground shafts that were clearly unsafe. Fortunately excellent surface exposure and numerous surface pits and trenches allowed us to comprehensively survey the property without venturing underground."

Deborah has many years of experience in exploration geology across Australasia, Canada and China, and now South America. She is one of the few geologists who has been fully involved in a deposit from discovery through to mine development, not once but twice. She previously worked for Western Mining and Placer Dome as exploration geologist and director of research.

The addition of EHW's considerable exploration geology expertise is a fillip for SRK as it enables the group to assist a client from grass roots exploration through to mine closure.

A recent study by EHW of Archean greenstones around the world is the premium global synthesis of information about these environments, which produce about 40% of the world's gold. This multi-client study covers South America, Australia, Canada, Scandinavia, India and Africa, and enables a client to rapidly delineate exploration targets using successful exploration concepts.

A number of underground shafts were clearly unsafe

Exploration geologist Deborah Lord views the morphology of the basaltic Tarawera Volcano.

Overcoming Steep Honduran Terrain

Roman Jaurequi

Typical decommissioned on-off leach pads at San Andrés Mine

SRK has been extensively involved in the expansion of Greenstone Resources' gold mining and processing operation, San Andrés, in the Department of Copán, western Honduras.

Historic mining has occurred in the 4 square kilometres concession area, including a 500 tonne per day open pit mine and cyanide heap leach operation. This was recently phased out by Greenstone.

To evaluate the environmental impacts of the prior operations and proposed development, SRK in conjunction with a Honduran sub-consultant conducted a series of environmental baseline studies. These included soils and mine wastes, surface and ground water resources, aquatic and terrestrial flora and fauna, socio-economic, cultural resources, air quality and noise.

SRK was also commissioned to design the new heap leach facility. This consists of a dedicated 45 ha leach pad with a storage capacity of 20 million tonnes of ore.

Roman Jauregui, Project Engineer at SRK, says: "The design took account of relatively steep terrain and clayey subgrade, as well as flood flows in an adjacent river, high regional seismicity and high annual precipitation.

The solution ponds accommodate process solution throughput of 2,000 m^3 per hour, as well as high runoff anticipated during the rainy season."

Construction has begun on the proposed 2.1 million tonnes per year project, which further consists of an open pit mine and townsite relocation. Patricia Acker, Senior Project Scientist at SRK says: "SRK is currently preparing an Environmental Impact Assessment (EIA) for the project in accordance with Honduran environmental policy and World Bank guidelines."

Design of Peru's Quellaveco Pit

Innovative geotechnical and hydrogeological evaluations provided the basis for recommendations by SRK to the mine planning engineers of the Quellaveco project in southern Perú regarding slope stability and slope dewatering aspects for each of the design sectors.

William Gibson

Located at an altitude of approximately 4,000 m, the extensive copper porphyry orebody is disected by the Rio Asana. This will require divertion works prior to the start of mining.

William Gibson, Senior Engineer at SRK says: "Complex geometry with many materials and sophisticated failure models made conventional slope stability evaluations unsuitable for this project.

Instead, we used a finite difference program together with a probabilistic analysis tool to obtain more realistic answers.

These relationships were used to prepare design curves for up to 12 sectors within the final pit shell at Quellaveco. When the design was completed, the final pit architecture was subjected to simulations of earthquake events typical of the southern Perú region to determine the final performance of the slopes.

In addition, mine closure aspects related to the formation of a pit lake were included in the final evaluation. The impact on the pit and rising ground water levels were modelled in order to determine their impact on slope stability.

Asana Valley, the area of the proposed Quellaveco open pit mine.

SRK Opens Office in Lima

SRK has opened a practice in Lima, Perú, to capitalise on important development opportunities in the country, particularly in the fields of geotechnics, environmental studies, tailings design and mine planning.

The new operation started in May 1997, with Lionel Ocampo as General Manager and Aldo Brigneti as Head of Environmental Engineering.

Lionel comes from the SRK practice in Santiago and will be sharing his time between both offices. Aldo has broad experience in environmental impact assessments for mining projects in conformity with Peruvian environmental legislation, as well as in other technical studies for mining operations.

Lionel comments: "The exploration boom in Perú, coupled to the development of several major mines and the generally favourable conditions for steady growth in the mining sector, make the future look promising for the new office."

Aldo Brigneti

Aldo continues: "In the environmental field, we foresee growing demand for consulting services for environmental impact studies for new projects, implementation of mitigation and reclamation measures for existing operations, and environmental audits. We also envision opportunities for non-mining environmental work in the near future."

Other growth areas include geotechnics related to tailings dam investigations and design, and other aspects of mine infrastructure.

SRK recently completed activities on the open pit design at Quellaveco in southern Perú. This project involves an in-depth evaluation of all geological, geotechnical and hydrogeological aspects related to slope stability.

Pelambres production increase to 85,000 tonnes/day.

Pelambres Expansion Design Challenges

Test pit in the Pelambres valley for the study of the future waste dumps location

SRK has been involved with the Pelambres open pit copper porphyry mine which is planning to increase the planned production to 85,000 tonnes per day.

SRK's involvement with the technically challenging project, situated in the central Andes of Chile on the border with Argentina, has taken many forms. These include stability studies, hydrogeological assessments, and evaluations of mineral conveyor tunnels, portals and foundations.

Allan Haines

Allan Haines, SRK Director, comments: "Through the years SRK has provided a strong scientific and engineering group to support the Pelambres project team in Santiago and at the mine site. This close working relationship has proved successful partly because of SRK's ability to provide innovative and practical solutions to the technically challenging design aspects of the project."

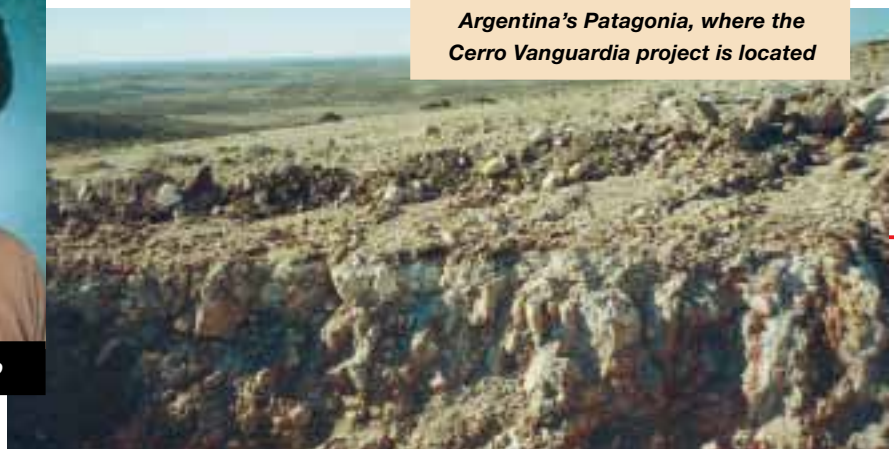
SRK has been in charge of the geotechnical study for the approximately 10.5 km long ore conveyor tunnel.

At the present time, SRK is carrying out a groundwater and surface study which considers the future open pit and waste dumps and a water management plan for these facilities in the upper part of Los Pelambres Valley.

The project is expected to start production late in 1999.

Slope Stability Studies In Patagonia

Lionel Ocampo



Typical panoramic view of Argentina's Patagonia, where the Cerro Vanguardia project is located

Cerro Vanguardia in Argentina's southern region of Patagonia was the site of a recent SRK project for Anglo American South America.

The geology of the property was characterised by an ignimbrite rock mass, typical of the area, with an inclined hydrothermal vein structure containing gold deposits.

Lionel Ocampo, Director and Rock Mechanics Engineer at SRK says: "We were commissioned to undertake a pre-feasibility study of slope stability aspects for a series of open pit mines on the site.

"The project included field studies aimed at determining the influence of large scale structures on the ultimate slope performance, as well as modelling exercises to determine optimum slope geometries."

First Permitted Mining Operation in Nicaragua

Crushing and heap leach facilities under construction at Cerro Mojon

SRK has completed a series of environmental studies for the proposed Cerro Mojón gold project in south-central Nicaragua, which subsequently became the first mining operation to be permitted in accordance with that country's emerging environmental policy.

Cerro Mojón is being developed as a 4,000 tonnes per day open pit mine and reusable heap leach facility by MINISA, a subsidiary of Greenstone Resources Ltd. The project is the first of many promising gold deposits that MINISA is planning to develop within its 120 square kilometres La Libertad concession area.

Patricia Acker

Gold deposits in the zone have been mined historically. Processing activities have included small scale arrastras and stamp mills with mercury amalgamation, and more conventional milling with cyanide leaching. In most cases tailings were discharged directly into streams.

SRK was commissioned to conduct an environmental baseline study and evaluate the historic impacts for the entire concession area. SRK also prepared an Environmental Viability Report (EVR) and a waste rock management plan for the Cerro Mojón Project.

The investigation included soils and mine wastes, surface and ground water resources, aquatic and terrestrial flora and fauna, socio-economics, cultural resources, air quality and noise. Baseline data collection was performed by a Nicaraguan sub-consultant.

Patricia Acker, Senior Project Scientist at SRK, reports: "All work was aimed at meeting the requirements of emerging Nicaraguan environmental policy and World Bank guidelines. After reviewing and approving the EVR, the Ministry of the Environment and Natural Resources awarded MINISA an operating permit for Cerro Mojón, the first permitted mining operation in Nicaragua."

The Power of Local Partners

The recent opening of an SRK practice in Lima, Perú, is a further milestone in the on-going partnership between SRK and NCL S.A.

The successful team has already undertaken joint projects in Chile, including El Teniente, Chuquicamata, Andina and Salvador (divisions of Codelco), Anaconda, Lince, Anglo American, Placer Dome, Escondida, Altamira, Homestake and Amax.

This fruitful alliance gained fresh impetus in 1994, when the organisations joined forces to open SRK Sud América in Santiago, Chile. Through this office, and the new one in Lima, SRK is able to provide services related to mining engineering, geomechanics, tailings disposal and the environment throughout South America.

NCL, a Chilean company established in 1985, has worked with SRK since 1986. NCL specialises in all the main aspects of mining engineering, ore reserve estimation, mine design and planning of open pit and underground mines, cost estimation and project evaluation.

NCL professionals have worked with their SRK colleagues on projects in several countries such as South Africa, Namibia, Australia and Chile, to name a few.

Further afield, major collaborative projects were carried out in Perú, Bolivia, Ecuador, Greece and Russia.

Outsourcing at Codelco's Andina Mine

Since early 1996, SRK has been providing on-going support to the Environmental Management Unit of Codelco's Andina Mine in Chile for a wide spectrum of tasks.

Andrés Benítez

The SRK staff on site at the mine cover the co-ordination of environmental studies, coordination with environmental authorities and development of a Water Quality Monitoring Program.

A major activity has been support for the initiation of an environmental management system (EMS). SRK was responsible for the technical support for the Divisional Environmental Declaration and for the environmental commitments of the Environmental Unit at Andina.

Other activities included preparation of the structure for the Environmental Administration, identification of the most relevant environmental aspects and the definition of Environmental Programs for the next two years.

SRK has also been involved in the environmental aspects of various projects at the Andina mine. The most important of these were the Ovejería tailings dam and Cordillera tailings projects.

SRK's participation in the Ovejería project involved technical support to fulfilling the commitments for the Environmental Impact Study, such as analysis of the monitoring plan results, and support for the technical management of the project to the satisfaction of the environmental authorities.

Andrés Benítez, Manager of the SRK Saladillo office comments: "For the Cordillera tailings project, we assisted with the supervision of the reforestation on areas near the Piuquenes and Los Leones tailings dams, as well as with hydrochemical and piezometric monitoring and management of the technical aspects of the project to the satisfaction of the environmental authorities.

Blanco river valley, where the Andina Mine activities take place.

"The relationship between Andina Mine and ourselves has proved extremely successful. It represents a very good example of outsourcing by large mining organisations in Chile."

Interactive Mine Scheduling in Bolivia

Tapping its considerable expertise in mineable reserve/production scheduling, SRK recently developed an innovative model for a confidential client to enable interactive, real time production scheduling for the company's deposit in Bolivia.

Bill Tanaka

SRK's solution allows the results of production scheduling to update the mine cash flow model immediately, enabling mine management to make faster, more informed decisions.

Bill Tanaka, Project Engineer at SRK says: "Traditional mining simulation packages were insufficient for this project, because they would have produced a grade-targeted schedule that required mining from several small pits within any given year. This was at odds with what would more likely occur during the actual mining.

"Also, the client wished to schedule production interactively in real time so that the results of scheduling could be input into the cash flow model. This process involved outlining annual production blocks on a grade contour plan of the deposit, querying the model tonnes and grade within that outline, and downloading the results to examine the impact on net present value (NPV)."

SRK's solution consisted of the creation of a 2-D gridded model with values for grade and thickness. This model was derived from a 3-D block model based on 2 m composites of the drill holes. By rigorously developing the tonnes and grade of the 3-D source, SRK was able to increase the accuracy of the 2-D model and attain an acceptable level of confidence.

2.6 million tonne Tomi gold mining operation

State-of-the-Art Mining

Geotechnical investigation site, Tomi Project, Venezuela

SRK recently completed a third party technical audit of the development and financing plans for the proposed 2.6 million tonne Tomi gold mining operation in central Bolivar State, Venezuela.

Tomi is one of the first mining operations in the region that will employ state-of-the-art bulk mining and processing methods. It is also one of the first Venezuelan mining projects for which international bank financing arrangements are being made, hence the requirement for an audit to assure the lending institutions of the technical viability of the mine.

Bill Crowl, Principal Mining Geologist at SRK, says: "We were retained to review the geological model and ore reserves, as well as the proposed mining and processing technologies. Other responsibilities included an audit of capital and operating cost estimates, and evaluation of the proposed development and production plans."

Beyond mining and geotechnical work, SRK also completed a review of the project Environmental Impact Study and baseline studies, and evaluated the environmental management plans.

Eugene Muller

Eugene Muller, SRK Senior Engineer, states "assessments were carried out in conjunction with a review of the suitability of the geotechnical designs for open pit, process facilities, tailings impoundment and waste rock disposal facilities at the site, and in overall compliance with international practices."

Deep Roots in the Desert

At the request of a confidential client, SRK has completed environmental studies for a proposed non-metallic mining project in the Atacama desert of northern Chile.

Maria-Inés Vidal

Indigenous tree in one of the groundwater supply alternative areas for the project

The environmental studies included the assessment of two groundwater supply alternatives, one of which sustains an ecosystem whose main vegetation is a rare indigenous tree which survives in the world's driest desert because of its deep root system.

María Inés Vidal, Senior Environmental Scientist comments: "The project will not have a significant impact on the desert environment. However, because of the shortage and competition for groundwater in the north of Chile, it was critical that the Environmental Impact Study (EIS) assess the water source proposed for the project. In the case of the supply which sustains a small forest of this indigenous tree, it was equally important to study the impact of groundwater use on this forest. Due to the sensitivity of this species, the study presented mitigation measures and an extensive monitoring plan to be implemented when groundwater extraction commences."

The EIS was approved by the environmental regional authorities in early 1997.

The study for the alternative water source will be presented to the authorities in the format of an Environmental Impact Declaration (EID), consistent with the new Chilean environmental regulations of April 1997.

Welcome Moises Maravi

Moises Maravi

SRK has a wealth of Latin American talent and experience, but not all of it is in Latin America. Peruvian-born Moises E. Maravi recently joined the SRK Denver office as Senior Mining Engineer based in the Denver office.

Moises is an experienced mining engineer whose particular areas of research/expertise include economic risk analysis and the application of geostatistics to resource and mineable reserve estimation. Moises is currently completing a Ph.D. at Michigan Tech.

Prior to joining SRK, Moises worked as a mining engineer for several Peruvian mining companies. He also worked for Redpath Engineering and Echo Bay Mines at their Round Mountain gold operation in the US.

Dr. Neal Rigby, Corporate Mining Consultant at SRK says: "We recognize the importance of Latin America to the international mining community, and are dedicated to improve our ability to provide the highest level of support to our Latin American clients.

"The addition of talented individuals such as Moises, who have considerable 'hands-on' mining experience in Latin America, is an important part of that dedication."

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