

PAH NEWS PIX

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CALENDAR

- **Mining World Russia 2005**
April 5–8, 2005
World Trade Center
Moscow, Russia
email: oleg.netchaev@miningworld-russia.com
- **CIM Mining Industry Conference & Exhibition 2005: Mining Rocks!**
April 24–27, 2005
Metro Toronto Convention Centre
Toronto, Ontario, Canada
email: jdemers@cim.org
- **ARMINERA 2005 - V International Mining Exhibition**
May 4–6, 2005
Centro Costa Salguero
Buenos Aires, Argentina
email: info@caem.com.ar
- **National Coal Show 2005**
June 7–9, 2005
The David L. Lawrence Convention Center
Pittsburgh, Pennsylvania
www.mining-media.com

Optimization

Are optimists optimizers? Probably not. Is the contrary true: are pessimists optimizers? Maybe. The truth, no doubt, is somewhere in-between. Optimization of anything is a constantly elusive goal but one we are obligated to pursue, even though it is a Holy Grail we will never find. As Denis Waitley, the motivational guru of the 1930s, stated:

"Expect the best, plan for the worst, and prepare to be surprised."

Here at PAH we are often in the position of crusaders searching for this holy relic of optimization as we conduct feasibility studies of mining projects. As such, we find ourselves in different roles:

- ◆ Sometimes we are overall managers with several external consulting groups reporting to us, with PAH doing just a part of the work;
- ◆ Sometimes we conduct the full study with no external groups;
- ◆ Sometimes we do just a part of the work with some other group managing the study.

No matter what our role, optimization is a part of the work of any study. Optimization studies constitute a series of sub-studies to develop the optimum system for the project. The scope of these studies ranges widely,

from those of broad scope to those of narrow scope, that is:

- ◆ Those that encompass the entire project;
- ◆ Those that include a major component of the project;
- ◆ Those that cover some minor fraction of the project.

Ideally, the chronology of these optimization studies would proceed from those of broad scope to those of narrow scope but this is unrealistic; normally numerous studies of different breadth of scope are ongoing in parallel. The studies of broad scope obviously influence and take precedence over those of narrow scope, negating some of the narrow-scope studies at times. The battles occur on more than one front.

Ideally, a listing of optimization studies should be prepared at the start of a project with a hierarchy of importance, but usually the necessity for many of the optimization studies does not become apparent until the project is in progress. As these studies are undertaken, they can occasionally require significant changes in other components of the project, sometime negating large amounts of already completed work. Accordingly, there is often a reluctance to make changes that are beneficial to the project. This is often a serious concern, at

■ **CVRD IS THIRD-LARGEST MINING COMPANY**

Mining giant CVRD has become the third-largest miner in terms of market value. CVRD's market value of US\$38.2bn has surpassed Anglo-American, which now has a market value of US\$37.2bn. Melbourne-based BHP Billiton has the highest market value at US\$92.4bn, followed by UK-based Rio Tinto at US\$49.3bn. CVRD is the world's largest iron ore producer and has sought to diversify its mining mix, having recently signed agreements to explore and develop coal deposits in China, Mozambique and Venezuela, as well as phosphate deposits in Argentina.

■ **KYRGYZSTAN WELCOMES WESTERN-STYLE BUSINESS ENVIRONMENT**

Mineral-rich Kyrgyzstan believes that western-style mining technology, modern regulation, and equal rights for foreign mining investment is good for the nation. A member of the World Trade Organization since 1998, Kyrgyzstan enacted private land ownership and property rights legislation in 1998 and wants to enact and implement best practices in its mining sector. Kyrgyzstan has enjoyed a stable currency since 1993 and inflation has been less than 4% during the past 4 years. Their work force is educated and has experience in mining. According to the Vice Prime Minister, Kyrgyzstan has favorable geology for the discovery of large mineral deposits, and smaller deposits exist that may be economic under current commodity prices. Exploration licenses are granted for 2 years with an 8-year extension. Kyrgyzstan currently has 40 gold fields with commercial significance, and has granted 145 exploration licenses and 404 mining licenses.

■ **SUKHOI LOG GOLD FIELD MAY BE AUCTIONED IN SUMMER 2005**

Rights to the Sukhoi Log gold field could be auctioned in the summer of 2005. The subsurface resources agency, Russian Natural Resources Ministry and Rosnedra, has barred foreign companies from auctions for large mineral deposits, including Sukhoi Log, in 2005. Only companies that are at least 51% Russian owned will be allowed to bid. Russia's Norilsk Nickel, Alrosa Investment Group, Polymetal and Basic Element, Canada's Barrick Gold, Britain's Fleming Family & Partners, and Highland Gold Mining have expressed interest in mining Sukhoi Log. Still to be specified is when the gold field will go on stream, how much of it would be covered by the license, and how much gold the license-holder would be required to produce.

times leading to the completion of project studies that are non-viable and having to start the full study from scratch once more. Sometimes the campaign is lost; the troops must regroup for another charge with a different strategy.

Because of the enormous influence of the optimization studies on the viability of a project, management of the early stages of a project is critical. It requires both flexibility and firmness, to allow innovation to flourish and to discard well-established plans when the necessity arises. Of course this also has to be done within pre-established constraints of time and budget.

Tracking and controlling optimization studies is often haphazard. It is not easy, particularly since the optimization studies occur concurrently with the regular progression of project work. Can it even be done? It can, but doing so requires recognition of the problem and setting up a system to delineate and track these studies with assigned time and budget, and documenting and filing of the studies as they are completed. It also requires that all project team members are aware of at least the major optimization studies that are in progress within other disciplines so that the work within their own disciplines may, if warranted, be delayed, slowed, or diverted to other areas, pending the result of an optimization study that could potentially impact their work. Keeping the troops informed minimizes confusion.

It may be argued that too much control of optimization studies stifles innovation. There is some substance to this argument, particularly where authorization to proceed is required and such authorization is reluctantly given. Nevertheless, it behooves the project to authorize, track, and document these

studies, especially so when it is necessary to establish, at the close of the study, that the project has been adequately investigated or to justify time and cost overruns should they occur. Discipline must be tempered by some measure of flexibility, for the morale of the warriors, if nothing else.

All projects are, to some degree, a reflection of the personnel involved in the study and especially so of the project manager whose influence is often as great as that of all the other participants combined. The choice of this individual is, consequently, critical. It requires someone who is familiar with the industry and who also has determination and enthusiasm for the project. The general's forbearance and perseverance can win the battle; lacking these qualities, retreat and surrender may ensue.

It is well to establish a separate part of a study budget allocated to optimization studies. Depending on the project this can range from about ten percent to perhaps as much as fifty percent of the cost. In preliminary studies the proportion of the cost allocated to optimization studies is naturally higher and in this regard it is pertinent to sound a warning of the danger of proceeding with a detailed final study of a project without preceding it with one or two preliminary studies to establish the principal outlines of the project. The buglers must be ready to sound the alert when danger looms.

The paramount optimization study is the throughput of the mine. Economics usually dictates a minimum life of about five to seven years, but there are other factors of concern, primarily the size and payback terms of the loan, the latter sometimes requiring an ore reserve/production 'tail' of the same time as the payback period, though it is occasionally

reduced to as little as 30 percent, depending on the perceived 'robustness' of the project. At times production rate hurdles become the guiding principal of project size, such as 100,000 ounces of gold per year. For all that, this particular optimization study is so critical, documentation to establish it is often unavailable. Much of the time it appears to have been made on the back of an envelope or on a napkin. Perhaps the lack of documentation is a consequence of this decision being made by the upper management of the property owners rather than by those conducting the study.

Other major optimization studies frequently encountered are as follows:

- ◆ Open pit or underground or both
- ◆ Contract mining or not
- ◆ Mill or heap-leach or combination
- ◆ Mill/heap-leach location
- ◆ Tailings location
- ◆ Tailings as slurry or filter cake
- ◆ Concentrate transportation system: overland or pipeline
- ◆ Power generation: on-site or grid supply
- ◆ Camp or no camp
- ◆ Water source
- ◆ Airstrip or not

Numerous minor optimization studies arise as those of major import are completed, some examples of which are as follows:

Open pit mine:

- ◆ Pit bench heights
- ◆ Catch bench intervals
- ◆ Push-back sequencing
- ◆ Ore loading systems: shovel or front-end loader or backhoe
- ◆ Shovel type: rope or hydraulic

Underground mine:

- ◆ Access method: ramp or shaft or both

- ◆ Backfill or not
- ◆ Source of backfill
- ◆ Major level interval
- ◆ Stopping method

Heap-leach ore processing:

- ◆ Rock size: run-of-mine or crush or both
- ◆ Crush size
- ◆ Pad type: on/off or permanent
- ◆ Heap height
- ◆ Multi-stage leaching or not

Mill:

- ◆ Comminution method
- ◆ Regrind mill type
- ◆ Merrill-Crowe or CIP
- ◆ High-rate or conventional thickeners
- ◆ SX adsorption and stripping stages

These are just a few examples. It is well to prepare a list of possible optimization studies at the start of a project study and then add or delete them as the study progresses. Each study should have a separate file to hold information relevant to it. These files are best kept as regular paper files, although there may also be electronic files in parallel with them. The status of the studies should be reported periodically as the study proceeds. The general needs to be aware of the progress of the battle.

Optimization studies usually have operating and capital cost estimates associated with them and often cost is the only criterion for deciding the optimum alternative. In some cases other factors require consideration such as reliability and safety, and this is always so for tailing containment locations. They may be even more important than cost.

Where rigorous evaluation of alternatives factors other than cost need to be included, they need to be weighted and evaluated to determine the best alternative. In such cases factors other than cost can seldom be quantified

■ **FEDERAL HELP NEEDED TO ADVANCE COAL**

Although coal is available domestically, is relatively inexpensive compared with natural gas, and is getting cleaner, it will need major federal help to remain attractive to investors, the public, and policy makers over the next several decades. Twenty-five groups presented their views to the Senate Energy and Natural Resources Committee stating that the industry's main challenge is to make coal cleaner and allow the growth needed for it to remain the United States' chief electricity source. The group stressed that coal is abundant, domestic, and getting cleaner, while natural gas will become increasingly foreign, expensive, and remain subject to terrorism and local opposition. They indicated that if coal generation does not grow substantially and reduce gas demand, the United States will lock in higher electricity rates. Clean coal development could allow the United States to export the technology and create jobs.

Minerals Corner—

Peridot (Mg,Fe)₂SiO₄, variety of Olivine

Peridot (pronounced pair-a-doe) is the best-known gem variety of olivine, a species named for a series of magnesium-iron rich silicate minerals. Olivine, which is actually not an official mineral, is composed of two minerals: fayalite and forsterite. Peridot is usually closer to forsterite than fayalite in composition although iron is the coloring agent, yellow-green to green. Because of its color, peridot is often mistaken for emerald. The earliest recorded production of peridot was in approximately 70 A.D. from St. Johns Island in the Red Sea, about 54 kilometers off the coast of Egypt. Today the United States is the basic supplier of peridot to the world gemstone industry. Deposits of peridot can be found in Mogok, Myanmar (formerly known as Burma); Kohistan, Pakistan; Minas Gerais, Brazil; Eifel, Germany; Chihauhua, Mexico; Ethiopia; Australia; Peridot Mesa, San Carlos Apache Reservation, Gila County, Arizona and Salt Lake Crater, Oahu, Hawaii, United States. Peridot is currently being recognized as the birthstone for August and it is supposed to bring success, peace and good luck to those who wear it.

directly, so the values used are necessarily subjective. An example of an alternative evaluation is illustrated in Table 1.

Most of the time, once an optimization study is complete, it is done and can be left as such. There are times, however, when a study needs to be revisited, especially when different disciplines are connected and changes of plan in one area affect another, such as mine ore delivery and primary crushing, or tailings containment and mine backfill. Where plans are changed they can result in

domino changes in other areas. Accordingly, it is well to focus on areas of interconnecting disciplines early on in a project so as to minimize later disruptions.

Optimization studies can sometimes seem never ending, especially if data related to it is in the process of being delivered, such as that from continuing exploration drilling or laboratory testwork or geotechnical investigations. There needs to be a time when a cut-off of information is dictated and study is

concluded with the available data. However, should radically different information be subsequently received, it may be pertinent to reopen the optimization study and modify it, even though this might cause serious disruption in other areas of the study.

It is evident that the subject of optimization studies is more complex than many people realize. It is well to take cognizance of the subject well ahead of time and control it, to ensure that appropriate optimization studies are conducted, that they are conducted in a timely manner, and that they do not get out of hand and unduly disrupt the progress of the project study. With these factors in mind, we're ready for battle, keeping in mind General Eisenhower's statement:

"In preparing for battle I have always found that plans are useless, but planning is indispensable."

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TABLE 1
Example of Optimization Study Table

	Weighting Factor Value	Option 1	Option 2	Option 3	Option 4	Option 5
Parameter	(percent)	RANKING				
Capital cost	30	1	2	3	4	5
Operating cost	40	5	1	2	3	4
Reliability	20	4	5	1	2	3
Safety	10	3	4	5	1	2
SCORE (WEIGHTING FACTOR X RANKING)						
Capital cost		30	60	90	120	150
Operating cost		200	40	80	120	160
Reliability		80	100	20	40	60
Safety		30	40	50	10	20
Total Score		340	240	240	290	390
Conclusion:		Proceed with Option 5				

