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$$2NO_{2\,(aq)} + 2NO_{(aq)} + 4H^+ \rightarrow 4NO^+_{(aq)} + 2H_2O \quad (7)$$

Since the nitrogen species is continuously regenerated, its role in the overall reaction as the actual oxidizer is not obvious. The net overall reaction has the sulfide mineral reacting with the acid solution and oxygen to solubilize the metal value into the sulfate solution and form some elemental sulfur.

$$2MeS_{(g)} + 4H^+ + O_{2\,(g)} \rightarrow 2Me^{2+}_{(aq)} + 2S° + 2H_2O \quad (8)$$

Of course, at higher temperatures and/or nitrous acid concentrations the sulfide would be fully oxidized to sulfate.

Overall, the nitrogen intermediates serve as an expedient means to transport oxygen to the surface of the solid particle and allow the resulting reaction to take place at a heightened redox potential. This inherent asset of the unique novel NSC system eliminates the need for the use of high temperatures and high pressures, which lead to higher costs in other pressure leach processes. For example, commonl available stainless steel can be used for the reactor vessel. And, comple oxidation of sulfide to sulfate can be achieved without the excessive conditions found in other pressure leach systems. Thus, the rapid kinetics of the system leads to smaller reactor volumes and higher unit throughputs. Finally, 99.9% of the nitrogen species utilized in the leach system report to the gas phase when the pressure vessel is flashed an they are readily destroyed and contained by commercially available scrubber systems. So, environmental impacts are minimized and the NSC leach plant solutions contain little or no nitrogen species. In summary, NSC was first used industrially from 1984 until 1995 on silver bearing copper concentrates. It has also been found to be applicable to and effective in the treatment of zinc, gold, lead, nickel, cobalt, copper PGM and molybdenum concentrates.

Copper and molybdenum flotation considerations

Traditional treatment of copper porphyry ores bearing molybdenum consists of differential flotation to produce two concentrates. As illustrated in Figure 1 after comminution, a bulk copper and molybdenum concentrate is produced and then cleaned

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The testing was carried out and solids and liquids were analyzed by ICP for Re, Cu and Mo. Recoveries were then calculated and the data inserted into the Stat Ease program for optimization. The recovery data is also shown in Table 5.

Nsc Confirmatory Testing Results and Discussion

Figures 3, 4 and 5 summarize the Stat Ease optimization of modelling of the confirmatory NSC testing. In essence, the model fit for Mo, Cu and Re pressure leaching with NSC was excellent. For good molydenum recovery, grinding, higher temperatures and longer reaction times help at low molybdenum solids content. This is probably a function of molybdenum solubility limits. For good copper recovery, higher temperatuess and longer reaction times lead to better recoveries Finally for rhenium, lower slurry solids densities and longer reaction

- Gangue acid consumption is estimated at 17 kg/t between samples and needs to be modeled across the orebody as a component of the mine schedule.

During testing of the vat leaching, an agitated leaching test of the 38 micron thickener underflow material was undertaken to identify why there were unleached fines. The testing of the material identified the material leached well at a pH of 1.9 for 48 hours and obtained a total extraction of approximately 73% of unleached fines.

Solvent extraction

Solvent extraction testwork was completed on resource material for the development of the vat leaching. The SX circuit consisted of two-stage extraction and two-stage stripping. The organic phase employed in this circuit was 25% v/v ACORGA® M5774 (Cytec) extractant in Exxsol® D80 (Exxon Mobil aliphatic solvent) diluents matrix. Prior to

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molybdenum recovery, the PLS will pass through an industrial EcoTec acid purification unit to recover free acid from the PLS. The recovered sulfuric acid solution product will be recycled back to the NSC pressure oxidation system. The resultant PLS free acidity will be dropped from about 30 g/L to approximately 5 g/L. This molybdenum-free PLS solution is then sent to the PLS pond where the copper is recovered through a conventional SX/EW circuit. Upon loading the carbon with molybdenum, the carbon is transferred to an atmospheric strip vessel. The pH is raised with ammonium hydroxide to strip the molybdenum from the carbon, and a concentrated solution of ammonium molybdate is then formed. The ammonium molybdate solution is treated by pH adjustment to 2.0 using sulfuric acid, and then solid ammonium molybdate precipitates. The ammonium molybdate slurry is then filtered in a 3.7 m^2 filter, dewatered, and fed to a dryer heated to 550°. The ammonium molybdate is calcined to form molybdenum trioxide. The ammonia driven off in the calcining process is captured in a water scrubber and reused in the process. The molybdenum trioxide product is dried, bagged and sold.

NSC POX leached residue sulfur recovery system: Due to the high cost of sulfur based products, another POX system will be implemented to recover sulfur from the NSC leached residue. The NSC POX residue is settled in a 35 m thickener and the underflow is filtered in a Larox filter. The POX material is stored until ready for sulfur recovery. During sulfur recovery, the POX residue is fed into a leach vessel and ultimately pressure leached with sodium hydroxide and oxygen. The sulfur is converted to sodium sulfate and a sulfur free POX residue is formed. The POX residue is thickened and approximately 50% of this residue is recycled back to NSC, with the remaining 50% of the material going to final tails. The sodium sulfate solution is filtered and polished, and then fed to a relic molybdenum recovery circuit similar to that discussed above. The clarified and purified sodium sulfate solution is then fed into an Electrodialysis Unit (EDU) and evaporator system. The EDU will convert approximately 50 t/d of sodium sulfate into about 25 t/d of caustic. The caustic grade will be 100 g/L of sodium hydroxide. Also, 35 t/d of sulfuric acid will be produced at a concentration of 70% sulfuric acid. These by-product solutions will be recycled and utilized in the process where required for leaching, sulfur recovery, and neutralization. Excess sodium sulfate solution from this process will also be treated in a conventional crystallizer system and solid sodium sulfate will be produced, bagged, and sold based on market prices and demand.

Order of magnitude operating and capital cost estimate: Annual production is based on mining activities operating at assumed 90% efficiency. The pre-production stripping numbers are also assumed and will be defined when the final geologic and mine reserve models have been completed. Haul road distances are also assumed and will be determined once a location for the processing plant has been selected and waste rock storage areas designated. The development and operational key process indicators are:

- Pre-production Stripping (North Pit) 300 ktonnes
- Pre-production Stripping (South Pit) 200 ktonnes
- Haul Road Construction (North Pit) 2.5 km
- Haul Road Construction (South Pit) 2.5 km

Initial Production:

Ore Production	25 ktonne/d
Waste Production	50 ktonne/d
Concentration Production	325 tonne/d
Annual Production- Ore	8.75 million tonnes
Annual Production- Waste	17.5 million tonnes

The milling plan estimates capital and operating costs assume a nominal 25 kt/d mining operation. The milling plan includes:

- All labor, material, supply and equipment operating costs for the mill and associated concentrate leach plant.
- Supervision, administration and on-site management.
- Benefits and employment taxes.
- All on-site development for start-up and production.
- Mill equipment and facilities purchase and installation or construction.
- Engineering and construction management fees.

Pre-production development, installation and construction of all equipment and facilities necessary to operate the mill at a nominal 25 kt/d are included. Costs associated with the following facilities and operations are included. However final locations and design details are pending:

- Crushing and conveyance of ore to the grinding circuit.
- Grinding and flotation.
- Flotation Tails leaching.
- Copper and molybdenum concentrate pressure leaching.
- Molybdenum trioxide recovery.
- Copper solvent extraction and copper cathode electrowinning.
- Eco Tec APU sulfuric acid recovery.
- Sodium sulfate production.
- Electrodialysis salt splitting of sodium sulfate for caustic and sulfuric acid production.
- Tailings facility.
- Basic access roads, power lines, and pipelines.

COST SUMMARY	
Category	$/tonne
Mine	$ 1.21
Process Plant	$ 11.10
Administration	$ 0.46
Total Operating Cost	$ 12.66

Table 10: Updated Operating Cost Estimate US$ +/- 30%.

- Construction, installation and operation of facilities and equipment necessary for equipment maintenance and repair,