

Bureau of Mines in Situ Mining Research Program An Overview

by
William C. Larson
U.S. Bureau of Mines

ABSTRACT

The U.S. Bureau of Mines is conducting research on technology that will allow mining companies to develop methods of extraction which will keep them competitive on world mineral markets into the 21st century. The goal is to develop advanced mining methods which maintain or increase productivity levels, with lower costs than conventional techniques, and still meet stringent environmental protection requirements.

One research effort is the Advanced Mining System program. This program is investigating long-term, high risk research projects-which cannot be supported entirely by industry because of high financial risk.

A major focus of the Bureau's research of advanced mining systems is the development of in-situ leach mining methods. In-situ mining involves the injection of a leach solution through wells completed from the surface or underground working into an otherwise undisturbed ore zone; dissolution of mineralization as the solution moves through fractures, pores, or diffuses through the ore; recovery of metal-bearing leach solution through recovery wells, and solution processing at a surface plant.

In-situ mining has been commercially practiced since the mid-1970's to produce uranium from porous sandstone deposits in Texas and Wyoming. Successful extraction of uranium using in-situ methods, coupled with the demonstrated leachability of copper-oxide ores using in situ-mining methods in shattered ore (block-caved zones and backfilled stopes), suggested the possibility of leaching copper-oxide ores in place.

In 1986, the Bureau began a research project to develop an in-situ mining methods for shallow to moderately deep copper-oxide ores using a dilute sulphuric acid leach solution. An important goal of this research is to provide the U.S. mining industry with the means to design a commercial-scale in-situ operation for any specific copper-oxide deposit. Copper-oxides were selected as the target of the research project, because they represent an easier leaching target than sulphide ores. The emphasis of the current research is on the control, collection, and detection of leach solutions; gangue-minerals relationships; copper recovery and acid consumption; and engineering design.

This paper highlights three areas of the in situ mining research program, namely the field experiment which is used as an example of a large governmental/industry cost sharing program; the use

of geophysical techniques to detect leach solutions; and the use of drilling additives to enhance drilling performance to reduce overall drilling costs.