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CIRCULAR NO. 1

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LEAVE A CLEAN CAMP:

NEUTRALIZE CYANIDE

by

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In cooperation with the:

Arizona Department of Mineral Resources
John H. Jett, Director

Because of rising prices of gold and silver, many small mines and old dumps in Arizona are becoming economically attractive to work on a limited scale. The use of either sodium or potassium cyanide solutions to extract gold and/or silver is a time-proven method and can be an efficient and economic process for some ores; not all, but some.

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Anyone who uses cyanide should be aware of the fact that it is very poisonous; 0.1 grams of CN^- (cyanide) is lethal if ingested, inhaled, or absorbed, as it can be, through intact skin. Exposure to concentrations as low as 100 ppm for 30 minutes can cause death. Tailings pulps carrying only traces of cyanide and even so called "barren" solutions in many cases constitute a real hazard to both humans and animals. Under some conditions, as little as 0.1 ppm has proved fatal to fish.

The situation today is much more serious than most people realize. It would be extremely damaging to the mineral industry as a whole if some young children (as a worst-possible-case) were to be allowed access to a can of raw unused cyanide at an operation carelessly abandoned (as was an actual case) or went swimming in an unguarded pond of cyanide tailing water which had not been rendered harmless and free from all cyanide. No dollars of insurance could ever pay for this kind of stupidity. It's up to the mining industry to educate and police its members or else we are inviting disaster. So: be warned, help control and avoid accidents.

In any case it is MOST IMPORTANT that the user realize the dangers involved. Read and study the subject. Know the procedures involved and follow safety rules. Take all precautions. Properly store and safeguard raw cyanide. Get the official permits before starting any leaching. It is further advisable to talk to experienced operators and experts and follow

their advice. Finally, dispose of all leached tailings and barren solutions properly. It is this last item that we wish to discuss at this time.

In the early days of Western mining, "Metallurgical cattle raising" was a common social problem which netted certain irresponsible characters a considerable profit at the mining company's expense because a cow died from drinking water near a cyanide plant. Courts usually awarded the damages claimed and the men who operated the cyanide plant were blamed regardless of facts.

One way of ensuring zero free-cyanide out of one old-time CCD cyanide plant was to hang a 50-pound pack of ferrous sulphate over the "barren" solution discharge and allow for a constant drip-drip of tap water into the sack. At that time sheep and cattle were watering a mile or two downstream and not only was no trace of cyanide ever detected in the water but there were never any metallurgical sheep or cattle purchased by the mining company.

For years various investigators have sought a satisfactory method of treating cyanide wastes. Among the methods tested were:

1. Acidification with dilution and removal of resulting HCN gas by Blowing large quantities of air.
2. Reaction with "lime sulphur" or with sodium sulphide.
3. Treatment with ferrous sulphate.
4. Oxidation with potassium permanganate.

5. Aeration to cause atmospheric decomposition of the cyanide.

All of the above methods have been used commercially for the reduction of cyanide content of solutions but they all tend to leave substantial objectionable cyanide residues. This residue can be dangerous unless extremely diluted. Another objection is that, by the first four methods, the pollution load is increased by the addition of objectionable chemicals.

The one treatment method now generally accepted is chlorination of solutions at a pH above 8.5. It is the only economical and, <u>if done properly</u>, satisfactory method for treatment. The source of chlorine can be commercial bleach solutions, any alkaline hypochlorite, or gaseous chlorine applied in the manner of a common water treatment plant. The reaction, $NaCN + NaOH + Cl_2$, going to inactive sodium cyanate and table salt, is practically instantaneous and complete in seconds. No cyanide radical can exist in the presence of free available chlorine at a pH of 8.5 or higher.

All cyanide tailings before being abandoned should be flushed with fresh water and then treated with chlorine water (such as we maintain in much-used swimming pools) until there is free chlorine in the OFF solution. The standard orthotoludine test (swimming pool chlorine test) is simple, easy to perform, and definitive and understandable by any thinking person.

The Bureau of Geology and Mineral Technology at the University of

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Arizona and the Department of Mineral Resources in Phoenix are available to advise and help in any way. The Bureau's phone is (602) 626-1943, ask for Dave Rabb; the Department's phone is (602) 271-3791, ask for an engineer.

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