

SUMMARY AND CONCLUSIONS
OF THE
MINING ENVIRONMENTAL CONFERENCE

by

Thomas Ware
Business Consultant
Skokie, Illinois

When Dr. Scott said I was going to try to summarize this meeting he was right. It's been a stimulating experience to follow the convolutions of the many ideas that have been presented here. I shall not only try to summarize, but I find that I am moved to add a few personal observations to your program as well. However, in briefest summary, I believe there has been presented here a new aspect of mine management--its widening public responsibilities.

With the news media running as many stories seeking protection for our environment, it is obvious that the public has become quite concerned about the effect of mining on the environment. The public may not have had very much accurate information to go on, but it clearly senses the importance of giving serious attention to such problems, and it wants to assure itself that managements in mining are alert and are actively seeking improvements in this area.

There is an added awareness that increasing production in our society, in whatever field, is contributing to waste problems which adds seriously to social burdens. Government representatives find their task greater and their reaction quite naturally is one of inquiry, seeking specific information with which it can adequately plan to handle such difficulties. As Senator Randolph, of West Virginia, has observed, his senate committee of public works used to concern itself only with public roads and parks, today its work has become expanded, typically, into one of wide and searching inquiry into the effects of industry on our environment as it affects our water supplies and this is only one aspect of the change in his committees activities.

Mining Management on the other hand, is aware of the broad impingement of its activities on society and its various sensitivities. Most of these it readily acknowledges as real, and is attempting to find ways and paths for improvement. Others it, quite frankly, doesn't know how to accommodate within its product costs, yet it is seriously seeking practical answers to these, cooperating with universities, governmental departments and others. Especially does it wish to cooperate with those who have a responsible line of inquiry that would indicate promise.

Admittedly, mining companies find themselves in an increasingly paradoxical situation. They know that just about all human activity depends on mineral products, yet they know that they must intrude on the natural environment in order to provide vitally needed materials for human activity in industry. Also, the mere act of mining, while giving employment, exposes workers to hazards that can range from unsafe working procedures, to potential community disaster from unseen gas accumulations. Or hazards of the newer variety, exposures brought by science in its quest for more exotic minerals where there is little experience.

Moreover, forecast increase in world population makes it obvious, if we are to have adequate supplies of mineral products, greater production levels must be realized and we should expect intensified public response to increased accumulation levels of such problems.

Through government and university study with the cooperation of mining companies, fortunately there is now being developed a body of knowledge and skills that can be drawn on for mine planning to help minimize the undesirable effects of mining on the environment. It all starts of course with the ability to measure, quantify, and relate mining effects. Reporting at this meeting showed that if we can keep open minds and develop accurate, appropriate information, we can find improved solutions to the growing threat of waste and effluent disposal.

For example: Using advanced measuring techniques, careful study by investigators here at the University of Missouri were made on mines water discharges and they have shown stream ecology has, in fact, been changed by the mines in the new lead belt of Missouri. Growth of algae was represented as the principal observation, and it was suggested that these discharges had quite a toxic effect on the stream life in this area.

Analysis of river systems in the coal mining areas of Ohio's Appalachia has shown that mine drainage can affect stream pH for as far as 20 miles or more from the mine. Whereas public opinion has tended to place the blame on unreclaimed mine wastes, the real contributor to the acid flow in Ohio's Appalachia has shown that mine drainage can affect stream pH for as far as 20 miles or more from the mine. Whereas public opinion has tended to place the blame on unreclaimed mine wastes, the real contributor to the acid flow in Ohio's river system was traced to the drainage from abandoned mines which were found to contribute over 53% of this problem. Since there are 525 abandoned mines in Ohio, and sizably larger numbers of such mines in other states, the means for coping with this source of stream contamination are clearly indicated, but of course, we have the practical problem of the immense costs; these can be quite formidable.

There would appear to be many methods for blocking off and controlling acid mine waste water. Several of these were reviewed, however,

sludge formation with neutralization methods appears seriously awkward. More exotic methods such as electrolysis, reverse osmosis and other laboratory techniques are available, but they are prohibitably expensive at this time, even though they may point the way in some long term future sense. The Mine Drainage Pollution Control Activities group of Ohio is building a body of information on methods which should be useful to mining engineers for planning future mines. It would seem that there should be no reason for future closed mines to leave our states with drainage problems such as have been left in the past.

Deep well injection of waste effluent was illustrated showing how disposal can be made under deep lying cap rock formations. Popularity of this method has been increasing in recent years. Illustrations were given which showed typical design considerations, pointing to the necessity for care in filtering any solid materials to avoid plugging ground structures, or otherwise injuring porosity and permeability which would risk a rather sizable well investment.

In the concern for land reclamation following mining, there is a need to place this matter in perspective. The necessity for mineral production would appear to be of paramount importance to civilization in the long view. In many respects, it was pointed out there are worse abuses of land resources than that which appears to come from mining. It was suggested that the limits of mineral resources be taken into consideration when understanding the problems involved in establishing any standards for environmental control.

A call for creative solutions for anticipating public pressures was suggested from the mineral economist point of view. Cost-benefit analysis was pointed to as a means for evaluating and making choices when selecting among alternative methods for achieving land rehabilitation. The view expressed at this conference is an approach at optimal decision making, and it was a very fresh and vigorous contribution. It shows promise at pointing the way for getting some "economic handles" on this type of problem and Lord knows we need them. I believe this warrents further development as providing a structural approach for handling many mine waste disposal situations.

Specific solutions for land rehabilitation were cited by Peabody Coal and the Florida Phosphate Council who have dealt with strip mining operations. Both presentations emphasized restoration of plant life after reshaping over-burdened piles and ponds. The most striking feature appeared to be the effort to plan rehabilitation taking advantage of community needs, offering quite imaginative and meaningful ties for the companies involved and their people. Such lands were made into park areas, fishing ponds, beaches, wild life preserves and they were turned into attractively planned home communities, interspersed with lake fronts which had formerly served as effluent circulation basins. Both Peabody Coal and the phosphate mining industry have converted extensive overburdened acreage to agricultural use, developing cattle

ranges, and tree farms. These thoughtful, practical applications of mined out properties constantly remind the public that the mining company is conscientious about its responsibility toward its community.

In the case of White Pine Copper, when faced with developing an unusually large above ground storage area for pines, and stabilizing these materials to keep them from becoming wind blown, this company turned to available government agencies and university life science teams for advice and assistance. It tapped a very important political response tie. It not only succeeded in establishing vegetation to cover these tailings, but made the unique contribution of a wild life sanctuary for migrating birds to the ecology of this area of Michigan.

Great care and thoroughly intelligent investigation was suggested for handling environmental problems that stem from stack and dust emissions. This was also suggested by approaches used to handle entirely new and unfamiliar mining tasks that have been brought on by our new branches of science in its quest in particular for uranium ores with resultant exposure of miners to the hazards of the two radon daughters.

Where cause and effect are less visible, idle speculation can fan public emotion to irrational response, and the danger of misleading the public to its detriment through economic loss. It was pointed out, for example, that it took quite some time to identify the automobile population as the principal contributor to city and air pollution. In the matter of urban concentration, of population, air pollution easily becomes the focus of public interest. Not too much is known about it yet except that the concentration of air pollution does correlate with the population size of our cities, with New York at the top of the list. Studies on particulate concentrations show that the aggregate of our city pollution appears to be on its way to improvement, but it is pointed out that the shear volume of air around us is so large that it is very difficult if not impossible to perceive such a trend with any certainty, let alone discerning the factors for its amelioration.

In the paper on SO_2 emission, we had an example of a very responsible and thorough inquiry. The need for power generation by coal is irrefutable yet our principal coal reserves do contain sulfur with the greater portion of these being in higher concentrations. Here again, through investigation, questions on smoke stack height are left with yesterday. R and D analysis of the original coal makeup and burning, gas scrubbing, and extensive processing technique are being examined. It was reported that many large power companies are making whole plant investments in quite different schemes, after the most rigorous study and pilot investigations, trying to achieve certainty in minimizing SO_2 affluent emission. These efforts can result effectively in major cost additions of as much as 50¢ to \$2.00 per ton of coal burned. The final proof will hopefully come from full scale prototypes.

Taken all together, the papers presented at this conference are impressive in the range of material presented as well as the depth of study that is evident by their content. The evidence of buffeting that is shown in the response of the mining profession to public concern can be gleaned by the immense amount of work that is now being carried on by this industry to find facts with which it can be certain of its future course.

Achievements in mining being what they are, born of risk-taking to serve the public with the products it requires, it would simply seem to me that management, government and the universities are being pushed to a point of vexation where it is also reasonable to question the source of public pressures that are now impinging on the mining effort. It would seem all too glib to assume that the mere outlet for these pressures is to be higher product costs to the public. Rather, I would be so bold as to suggest that we stand back to see if we can not see the source of pressure causing the public to respond the way it has. I don't mean to say that present mining practices are perfect, and I hope I have not implied that in my summation to this point. Clearly this conference shows the way for such improvement. The course which has been outlined as one of intelligent, assiduous investigation and research into all matters relating to public concern for the protection of our environment, is born of long term careful and proper consideration. We should always follow such a course. But somewhere there is indicated, at this time, a flexibility that is required. Perhaps you can glean some of what I should like to add to your conference, by suggesting that more attention to the nature of the public's response - what it wants, what it needs, the force which establishes its tenor - should be looked at.

As we look to forces which emanate from the public to shape the widening responsibilities of mining management, it seems to me that there are other forces far greater than some of those that have been mentioned in this conference. For example, population growth pressures, domestic as well as world wide:

Population growth is at an exponential rate. Its demands are greatest in the developing countries where its rapid growth creates widespread disorder, seeking and forcing ways to be included as a part of the world economic circuitry. These developing countries not only possess the largest portion of the world's population but they are so underdeveloped as to require massive capital formation. This can only be realized at primary capital forming levels, through both agricultural development and mining.

The exposure of mining management to the pressures of population growth comes into focus when we realize the enormous role which the economy of our country plays in the world economic structure. In terms of Gross National Product the United States is an economy of over \$900 billion, accounting for just about 1/2 of the world economy. We also consume just about half of the world's mineral production in

achieving this level of activity.

We operate on a free, competitive philosophy, seeking lowest costs, but as we do this we place extraordinary responsibilities with enterprising mining management. This makes for unusual political angles in both the domestic and world scene. In such circumstances mining is no longer separable from world markets. Minerals shipped into this country come into competition with minerals produced here, and minerals we produce and ship go into competition with minerals produced elsewhere.

Where the economies of newer nations are principally dependent on one or two minerals, a change in price as a result of new prospecting, or new technology, can be harsh, i.e. 10 to 20% off can mean a particularly difficult cut back to that country's total economic complex, it's no flea bite such as we may shake off here in our country.

Moreover, where corporate structures, in order to be efficient, often must direct mining activities that are remote, this separation can make for considerable misunderstanding i.e. New York management can become "Yankee absentee" ownership to southern communities, but escalate this to the French point of view these days where the Frenchman talks about domination of his nation's economy by foreign owned companies, purportedly serving the political interests of the foreign (U.S.) nation, and you are in global politics.

The exposure of mining management to the pressures of population growth becomes particularly strained when we realize the interdependent relationship which must exist between agriculture and industry: Modern farming is not successful in our terms without the tractor, without the mines to produce the minerals that are used to make the tractor, and so on. Nor do we ship the "inputs" that the farmer needs such as fertilizers, seeds, and chemical pesticides without constructing highways and all that this way entail, from cement manufacture to the education that provides us with engineers who design and manufacture. Nor do we get our products to the market place without myriad services from an interdependent industrial and social structure.

My experience in the agricultural field reminds me that some 100 million people outside the U.S. depend on surplus farm commodities from this country. On the other hand, one third of our food production which feeds our 200 million, plus these outside dependents, depends upon mining and manufacture of fertilizer materials. This brings us back to mining of phosphates, potash, and oil wells.

I think we ought to be aware of the fact that only 3% of the world's surface is available for producing food. Since the drive in world unrest is really coming from massive increases in population, we need really to look beyond, to future food production resources. These are not unlimited. Most countries do not have sufficient soil or skill to produce their food needs indigenously. There is not really the opportunity to increase the amounts of arable soils to match the re-

quirements of present rates of population increase. This is bound to present a source of difficulty for mining management even though it is apparently an activity quite removed from mining. Management of mining in Peru, Chile, and many other countries are tending to confirm the breadth of this view, as does the current emphasis on mineral development here at home in a safer economic climate.

In short, it would seem to me that the breadth of mine management now requires the broadest span of political comprehension and skill. It would seem that a third criteria has been introduced into the management process, beyond what might be termed, by comparison, the more technical industrial decisions of the past.

The two primary criteria of return on investment and share of market are now joined by the new consideration of the public's need to know, understand, and accept mining. Enterprising mine management has the responsibility to communicate in meaningful terms with the communities in which it works, its leadership may currently require handling of air and stream pollution problems, but it should also look ahead to those problems which will come with requirements for even greater mineral market demands.

Finally, I would like to suggest that this conference was timely. I believe it has provided an initial focus of viewpoints on environmental problems in mining which require flexibility on the part of mining management. One could describe this conference as the creation of "a new instrument for communication" and it wouldn't miss the point. In the final analysis the quality of a society depends on its ability to communicate effectively.

Dr. Scott: At this time I'd like to thank all the conferees and speakers for participating in this first Mining Environmental Conference. Your active interest and discussion of the topics before this meeting increase my conviction that the problems associated with environmental processes has become the new dimension that the mineral's engineer must face up to.

At this time I would like to pose a question for all to consider: "Where do we go from here?" "Should this conference be conducted at the University of Missouri-Rolla yearly?" "Should the scope of the conference be limited to specific problems rather than the broad coverage which was attempted in this one?" "Should the conference, perhaps, be international and should foreigners who have been dealing with these problems for many years be asked to participate?" "Should the conference, perhaps, be rotated between several schools across the nation so that specific problems in different geographic areas could be explored?" *

I pose these questions without answers at this time and I would like the conferees to communicate their thoughts to me so that the most effective and worthwhile conference can be set up for the future. This I do know, that to have any impact at all upon environmental conditions, the people attending this and other conferences will have to take the ideas put forth back to their jobs and associates and assume the role of leaders to face and solve these problems. I thank you for your attendance. This meeting stands adjourned.

* At the time of printing, a conference is being planned for March 23-25, 1970 at the University of Arizona. This meeting will be publicized in the near future.