For the past five years, environmental costs imposed upon our industry have given foreign producers a substantial but temporary advantage. There is no question that, in time, all world production will be under environmental control and the present advantages in foreign production lost.

Last, but not least, the U.S. ferroalloy industry has been seriously disadvantaged in the world market in that duties on ferroalloys into the United States are lower than into the other ferroalloy consuming areas of the world, such as Japan and the EEC.

The United States is the most attractive market in the world for both developing and developed countries whether resource-rich or resource-poor. The current round of Multilateral Trade Negotiations under the General Agreement of Tariffs and Trade has as its key objective the reduction, if not the elimination, of current disparities in national tariffs and other trade costs which will tend to decrease the current disadvantage imposed on the domestic industry.

**SUMMARY**

In summary, the domestic ferroalloy industry is in serious trouble today from increasing imports which come in because of a lack of certain resources, of high power and labor costs, environmental control costs and the lowest average duty rate of any country in the world. All of these factors are changing rapidly and when the dust settles, we may find ourselves in an advantageous position for the first time in many years.

Our future depends upon how these factors change, how well we adapt to them and how strongly our country and our customers feel about the need for a healthy domestic industry to produce and supply essential ferroalloys.

**DISCUSSION**

**Session VI**

Discussion of Mr. Peters' paper

**Dr. Koul:** I think Tony Peters and Bill Brown have presented an excellent discussion of steel industry use of ferroalloys. But I should come to the defense of the ferroalloy industry. We've looked at the problem critically but it is not easy to determine whether melting point or dissolution rate is the controlling factor. It is important to remember that melting point is an equilibrium phenomenon while dissolution rate is a kinetic phenomenon. When solid material is added to a liquid bath kinetic factors dominate. We have to remember, too, that dissolution rate should be considered in conjunction with recovery; there are cases where high dissolution rate may not lead to higher recovery.

Many excellent experiments have been performed to study dissolution phenomena utilizing rotating discs and cylinders in liquid baths, not only for steel, but also for aluminum, titanium and iron. But the results of these experiments do not correlate well with observed effects at the pouring ladele for open hearth, electric furnace, or BOF. The recovery for each of these is different, and each must be separately studied. In the open hearth and electric furnace practices we find a great deal of turbulence in the ladle, so that a large fraction of the steel interfaces with air and slag, as might be expected, there is great variability in recovery depending on density and amount of slag present. A second point which should be mentioned is that if an element is added at a level of about 0.5% we should look to a third decimal place. That is, 1/10 of 1/100 of the weight of an element. We normally move the BOF ladle back and forth in the surface. I think this is a very important quality aspect that one has to keep in mind. Reoxidation in the mold, is very often a reoxidation of the ferroalloy that you put in the mold and not reoxidation of the steel. I think this is something that is often overlooked. Now, I have a question to Tony and Bill about the future. What do you feel about injection of ferroalloy in ladle, its feasibility and the scope of usage in the next 10 years?

**Mr. Peters:** Well, Leon, I don't know whether you speak any German but there's a German saying. (He now speaks in German) In free translation, why to make it simple if it can be nicely complicated? If we will have to put into the steel something that oxidizes readily and we want to avoid the products of oxidation, we will do it if the price of the product warrants, otherwise not.

**W. W. Brown:** We have considered this in the past but we don't know what the future is going to bring, Leon. It could be a possibility, but it would have to be thor-
Discussion of Mr. Cumbo's and Mr. Porter's papers

Tony Peters: I wanted to ask whether it's possible, as is frequently done with refractories, to avoid problems of microsegregation by sequential grinding. Grind for a minute or two, screen out the hundred fraction. Grind the remainder for a minute or two, screen it out and so on and so on in order to avoid overgrinding. Is it a recognized procedure; is it a useful procedure?

We have never tried it exactly as you suggest. We have only taken to a certain size screen and in the case of a standard, we can reject the fines because there are differences in analysis. Of course, if this is a shipment, then this cannot be done. It's a part of the shipment and consequently has to be part of the sample. I don't know. You raise an interesting point but I don't have a good answer.

Perry Weston: I'd like to make one comment upon the dual paper presented here this morning. Maybe perhaps you may not realize that in the early part of 1976 the Bureau of Standards was out of 64-B, which meant there was no ferrochrome standard in the United States. Within about 9 or 10 months, the cooperation of the Bureau of Standards and of the industry produced a material, processed it and made it relatively available for certification. I think that this is probably the first time in the history of the Bureau of Standards it's been accomplished in such a short time. And this was only possible through the cooperation of all the industries involved, all the laboratories, and the government agencies. This is commendable and I'm very proud to be part of it—a very small part, I grant you but still a part of this necessary task.

Chairman supplementing Mr. Weston's remarks: I would like to call your attention to the fact that the Bureau of Standards is de-emphasizing its basic standards activities in so far as the metals industry is concerned. You will find increasingly less manpower available at the Bureau for the production for analytical standards of the type we discussed here and industry will have to pick up the ball as this group has done here. This will also be true of the calibration of mechanical equipment—for example, the equipment used in connection with calibrating tensile machines. This whole section has been done away with at the Bureau of Standards so that these people can be assigned to checking the design of bicycle frames, home vacuum cleaners, and so forth. Apparently the people at the Bureau of Standards that are behind these decisions, which have not yet been announced in public, are unaware of the important roles that they play in furnishing standards and calibrations standards to industry I think, and this is all off the record—they're waiting to see how much trouble the lack of this activity causes before they reallocate personnel to resume activities which industry has taken for granted for decades. So you might talk this over with your people at home and have them check into what the potentialities are as far as your companies are concerned.

Jim Klein: I feel compelled to make one other comment with regard to these two well-presented papers. We appreciate the work done. I want to say this because there are several companies here today who are supporting this research associate. It is a good example of what can be accomplished when industry wants to get something done. It was on the 28th of January that we became aware that there was no high carbon ferrochrome standard available. By February 18th that the material had been cast and the process on the way. That speaks well for the industry that saw the need, the meeting at Pittsburgh and the work of the research associate and the committee that was immediately established to get this done. This work has been progressing well and I just want to say thank you to those companies who are supporting the work being done at the MBS and to each of these cooperating members who is working on this committee.

Discussion of Mr. Waller's paper

James Klein: I was wondering, John, how long it takes from the time a sample arrives at the laboratory until you have the analysis printed out.

Mr. Waller: That time can vary anywhere from four to five minutes to 15 to 20 minutes. We have number of furnaces running and samples go in on a priority basis; strictly controlled furnace samples get first run. Some furnaces have priority over others, so it depends upon which furnace it came from and the kind of sample.

Discussion of Mr. Watson's paper

Joe Brown: That was very fine, George. One quick question: you alluded to a prognostication that there were 300 years supply of manganese available; is that only terrestrial or does it also include ocean bed.

Mr. Watson: The work resources and reserves and supply are difficult to deal with. If we talk about resources, this may include material which is not necessarily economically mineable today. But the Bureau of Mines which has the best data available in the world defines resources as exploitable at current market prices; in those terms they have given manganese a figure that, against any projection of steel growth, would probably last our steel industry for 200 years. This does not include manganese nodules from the ocean. It only includes known deposits of manganese such as in Australia, Ghana, South Africa, Russia and so on. In chromium the estimated reserves mineable at today's costs is probably around 200 years against any projection of stainless steel production. So we really have no shortage of resources, now. The problem is the supply—whether the material will be mined to produce ferrochrome, to ship to the market is another story and that's the one where we have found ourselves in trouble in times past.