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NONFERROUS AND LIGHT METALS RESOURCES

8 November 1955

CONTENTS

Page

INTRODUCTION--Brigadier General F. E. Calhoun, USAF, Deputy Commandant, ICAF 1

SPEAKER--Mr. Simon D. Strauss, Vice President, American Smelting and Refining Company 1

GENERAL DISCUSSION 14

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Mr. Simon D. Strauss, Vice President of the American Smelting and Refining Company, was born in Lima, Peru, 24 July 1911. He was educated in the New York public schools and the College of the City of New York. In 1927, he became associated with the McGraw-Hill Publishing Company, assigned to the staff and subsequently Assistant Editor of the "Engineering and Mining Journal" of news, financial and markets (copper, lead and zinc). From 1932 to 1934 Mr. Strauss was Editor of the "Madison Eagle" of Madison, New Jersey. From 1934 to 1941, he was a member of the staff of Standard Statistics Company as Economist, specializing in the nonferrous mining, coal mining, and construction industries. In 1941 he was appointed Assistant to William L. Clayton, Deputy Federal Loan Administrator of the Federal Loan Agency and was particularly active in the Metal Reserve Company, subsidiary of the Reconstruction Finance Corporation. During the latter part of World War II he became Vice President of the Metals Reserve Company and Deputy Director. After the war he returned to industry, and in 1947 was elected Vice President and Sales Manager of the American Smelting and Refining Company, New York City. He now serves as a director of the American Smelting and Refining Company, the Revere Copper and Brass, the General Cable Corporation, and the New York Commodity Exchange. He has also served as a consultant to the Office of Defense Mobilization for several years. Mr. Strauss is the co-author of "Two Cycles of Corporation Profits," published in 1936 by Harper and Company, and has contributed to financial and industrial journals numerous articles on the economics of the nonferrous metals industry. From 1931 to 1942, he contributed the chapter "Zinc" to the "Mineral Industry, Annual Yearbook," McGraw-Hill.

NONFERROUS AND LIGHT METALS RESOURCES

8 November 1955

GENERAL CALHOUN: Gentlemen: This morning we have as our second lecture on natural resources the subject of Nonferrous and Light Metals Resources. As you know, these include copper, lead, and zinc.

Since it would be impossible to cover all of these metals in a single lecture, our speaker will confine his remarks to the nonferrous metals, touching only briefly on the light metals.

Our speaker is Mr. Simon D. Strauss, Vice President and Director of the American Smelting and Refining Company. For the benefit of those of you who daily peruse the financial pages of the "Wall Street Journal" and the local papers, I might add that he is a Director of the New York Commodity Exchange, and he also, somehow, has found time to serve as a consultant to the Office of Defense Mobilization for the past several years.

It is a privilege to have Mr. Strauss with us today. Mr. Strauss.

MR. STRAUSS: Thank you very much, General Calhoun. Gentlemen of the Industrial College of the Armed Forces: I had the privilege of appearing before this group some three years ago, and at that time I was asked to discuss the copper situation, which had been through some rather difficult times, due to the Korean situation. The questions that were asked of me at that time and the predictions that I made then really do not entitle me to a return visit, because I said quite flatly that it looked as if the copper situation was at last getting out of trouble, that there would be an adequate supply of copper available and at a reasonable price, and that any concern on the part of the Armed Forces about their ability to secure copper in the quantities and at the times needed could be dispensed with.

It is really very kind of you to give me a second chance to redeem myself, and I hope that what I am about to say will prove to be somewhat more accurate. I can assure you that my intentions then were of the best. My problem since then has been simply that the leaders of the diverse labor unions, the President of the Republic of Chile, and a number of other people just did not take my advice.

As a matter of fact, before I leave that particular subject, I might say that I have developed the unique Strauss formula for determining the future price of copper. While I know that copper is only an unimportant component in the total defense expenditures of the country, nevertheless it may help some of you, if you ever have to work on defense budgets, to use this formula: Take the height above sea level of the Denver offices of the mine, mill and smelter Worker's Union; take the current rate of exchange of the Chilean peso; take the number of black workers in northern Rhodesia, divide it by the number of white workers; find out the number of members of the London Metals Exchange; list all these items on a piece of paper. Then, tear the piece of paper in scraps and see that not more than two figures appear on any scrap. Drop the scraps of paper in a hat, shake well, reach in, pick out a number, and that will be the price of copper.

Well, to get down to the business at hand: There is one thing that the nonferrous metals and the light metals all have in common. I think it can be said with confidence that these are truly international commodities. It is not possible (however desirable it may seem to be) to look at the position of any one of these products on the basis of production, consumption, stocks, or domestic business conditions and chart the future course or the likely course of the economic status of these industries based solely on what we know in the United States.

We have to start with this basic assumption: that we have to look at the whole world for each and every one of them, starting with aluminum, and running right through to zinc.

This is somewhat different, I think, from the position of certain other industries. For instance, I would say one could largely gauge the position of the steel or of the coal industries as being based primarily on local conditions. Conditions abroad have some influence, but to a major extent the course of steel or the coal industry is determined by conditions in the United States.

This is not true of any nonferrous metal or light metal. So you must start off with the idea that you cannot afford to ignore what has happened in Northern Rhodesia, Southwest Africa, Peru, or Chile. This makes it more difficult to analyze the probable course of events in these industries, and it also makes more difficult the decision as to what is a wise defense policy for the United States.

Now, the second point on which I feel strongly about these materials (and it is a point on which I differ with a good many of my friends in the

industry, and perhaps some of the thinking here in Washington) is that, in assessing the true strategic position of the United States, the proper viewpoint to take is the continental viewpoint and not the national viewpoint.

Let me illustrate that by one or two specific cases. Lead and zinc are two commodities which are usually found together. We mine in the United States, as has been shown in the excellent advance material provided to you by the College, only 40 percent or 50 percent of the requirements of the United States. In other words, we are importing, or we are depending on scrap, for half or more of our supply. Therefore, one might conclude that the United States is peculiarly vulnerable in connection with lead and zinc to difficulties outside our own borders. However, the exportable surplus of lead and zinc produced in the neighboring countries of Mexico and Canada is greater than our imports.

It is true that we import lead and zinc from places like Peru, Australia, and Southeast Africa. It is also true that Canada and Mexico export lead and zinc to Europe as well as to the United States. In the event of all-out war, in the event that something happens to our sea lanes so that the Navy could not keep them open, obviously we face, as the worst of alternatives, being cut off from Peruvian lead and Australian zinc. Some might say that this would put us in a difficult and vulnerable spot with respect to these two metals.

I do not agree. If we were cut off from our overseas sources of supply, then it would also be true that the Mexican and Canadian exporters of lead and zinc would be cut off from their overseas markets. And if all the metal they now ship abroad is diverted here, our supplies plus our stockpiles should be adequate for our needs.

That is why I say we must look not at the national but at the continental position of these materials. I am talking now in terms of assessing our vulnerability. I am not talking, naturally, in terms of the political consequences. From a political standpoint it often becomes necessary to judge the importance of keeping alive the domestic mining industry. A good deal has been said on that score. I am not saying we do not need an alive and active domestic mining industry. We do; but we cannot afford to ignore the fact that we have in Canada and in Mexico two reliable sources of supply which will be available to us under any conditions of emergency. The fact, therefore, that our own production of some of these metals and minerals does not completely meet all our needs is not necessarily cause for alarm if we can foresee

as I believe we can, a healthy production by our two immediate neighbors, both of which serve our markets by rail and not by water transportation.

In other words, I am trying to bring you a word of cheer. I find, in looking through the documents which I understand provide the basis for this course, a certain tendency to feel that our dependence on overseas sources is tending to increase. That is true in some materials, but it is not true in others. I think there is a great distinction to be made between the overseas source and the foreign source which is not overseas at all.

By the same token, in considering the aluminum position, the fact that there has been developed within the last ten years a substantial mining industry for bauxite in Jamaica, an area which is almost invulnerable, has greatly strengthened our aluminum position.

So, as we go down the list of the really significant nonferrous metals, we find, I think, that the only one in which this country is truly vulnerable is tin. As to tin, you gentlemen are perhaps aware of the very large stockpile that has already been accumulated.

I am not trying to argue for a position of complacency with respect to the nonferrous metals; I am simply saying I think we occupy an excellent strategic position with respect to our nonferrous metals, in view of the stockpiles we have already accumulated and the fact that for almost every one of the really major nonferrous metals--copper, lead, zinc, aluminum, magnesium, and antimony--we have available to us foreign sources of supply that can be served by railway or by extremely short water hauls.

What is the strategic position of some of our allies and of our potential enemies? The position of Western Europe, in contrast to ours, is one of great weakness. In the first place, there has been no stockpiling program. In the second place, the bulk of their supplies of these metals must be imported by water, with the sole exception of aluminum.

The aluminum industry of Western Europe, excluding the United Kingdom, is more or less self-supporting, in terms of bauxite reserves in France, in Italy, and in other places on the Continent. For copper, for lead, and for zinc, the nearest available sources, other than the rather meager resources of Europe itself, are those in North Africa,

and the position there politically seems to be somewhat insecure. Europe must look to Canada, Southern Africa, Australia, South America, and Mexico.

The British are particularly vulnerable. They have no bauxite of their own, and their aluminum production is small in relation to their requirements. What bauxite they use to make aluminum in the United Kingdom must be imported by water. The aluminum they use that is not produced in the United Kingdom comes almost entirely from Canada. Therefore, all aluminum depends on an overseas source.

It is rather surprising to me, actually, that, in the United States, which, relatively speaking, has a secure position in these materials, we should be so much more concerned with the stockpiling program than the British, whose position is extremely insecure.

What is the strategic position in Russia? The difficulty in trying to analyze that situation, of course, is that the Russians give you virtually no information to go by. Some educated guesses are made by people who are familiar with conditions in Russia. It is fairly clear, even including all the satellite areas of Eastern Europe and of Asia, that the Russians have nothing like the metal production of the Western World.

The copper production, for instance, of the Western World, is three million tons annually at present. It would surprise me if the Russian production, that is, the current production of the Iron Curtain group, is 500 thousand tons a year. I suspect it is more like 400 thousand tons.

In the case of zinc, the Western World production is 2 to 2-1/2 million tons a year. There the Russians are better off in comparison with our own position. They are producing 600 thousand tons a year.

In lead the conditions are similar to those of zinc. In tin the only resources within the present Russian orbit that amount to anything are those of China. The overland transport problems in connection with that were serious in World War II and presumably would be serious in an emergency today.

In aluminum their position is strong. Large bauxite resources in Hungary have a high potentiality, presumably, for these people to develop a substantial aluminum industry. Figures are not available, but I would estimate the production to be 700 or 800 thousand tons of aluminum a year.

All told, therefore, while the potential in the Russian area may be very great, due to lack of exploration and the lack of capital equipment, they have not developed their potential to anything like the degree that we have. Of course we use nonferrous metals for things that are undreamed of in the Russian sphere--all kinds of consumer luxuries. Our total production of these goods is in the order of 50 to 1 against the Russians.

Our telephone operation, which is an enormous user of nonferrous metals, is perhaps 100 to 1 against the Russians. From this very fact alone, the residual quantities of metals available to the Russians for truly defense or military needs are undoubtedly a greater proportion of their production. Nevertheless, we saw during World War II that under the stress of military necessity we can and do divert nonferrous metals away from civilian products to military requirements. As a matter of fact, the manpower situation alone would make it necessary, even if we had sufficient nonferrous metals available, to supply civilian industry and the military alike.

So my own conclusion in this area is that the position of the Western World is stronger than that of the Iron Curtain countries, and the position of the United States in particular is much stronger.

Now, in spite of this predominant position that we occupy, it is nevertheless true that, with our highly developed civilization, our rising standard of living, and increased mechanization, the requirements for nonferrous metals have been increasing. The requirement for aluminum has increased more rapidly than that for any other metal, but almost every metal has shared in the upward tendency.

The problem that arises in the event of a crises is: How rapidly can production be expanded still further? It is a very serious problem. We have had enough experience now with World War II and with the Korean crisis, and with the general development of atomic energy, to see some of the results of government programs in this area to stimulate and increase production. I had a talk perhaps two weeks ago with an official of the Atomic Energy Commission who is concerned with this problem of raw materials, and he made the statement, the important and quite categorical statement which I accept and agree with, that there are no scarce materials. That may come as something of a shock to you. He said that in the light of what the Atomic Energy Commission has done in stimulating the production of uranium. The production of uranium has expanded at an astronomic rate. Why has it expanded?

Primarily because the Government has set up what appears to be a very high price, without any reservations, for a long period of time.

That is the surest way of developing additional resources--to guarantee a long-term market at a remunerative price. The financial cost to the Government of such a program can, of course, be very great. I am not recommending that this program be adopted, for other metals, but I am saying that when the occasion seems to warrant the expense, this method can be highly effective.

Uranium is not the only example. I recall that right after the end of World War II there was a great deal of talk about columbium. Columbium is a steel alloying element. Therefore, it is perhaps a little outside of my field; but it does throw some light on this problem of how to increase production of a metal. Columbium is a very desirable additive in connection with jet engines, and it seemed desirable to expand the production of columbium. During World War II the production of columbium for the Western World was predominantly as a byproduct of tin-mining in Nigeria. There seemed to be no other columbium deposits of consequence elsewhere in the world. The result was, as I understand it, that, when it became necessary to plan for a much larger production of jet engines, people came to the conclusion that there was not going to be much columbium available and they had better design away from columbium. I remember seeing advertisements on the part of one of our leading aircraft engine producers to the effect that their aircraft engines required little or no columbium, which seemed to be a talking point for them.

Nevertheless, when the Korean difficulties broke out, the Government offered a bonus of 100 percent for columbium production. The results have been truly remarkable so far, although actual production has not been very great. New major sources of columbium have been found in Canada and in several parts of Africa. It is clear now that, if we want columbium and are willing to pay the price, we can get the quantity needed to produce almost any conceivable number of jet engines.

So that is one way of expanding production. It takes time. But the assurance, the knowledge, of a market at a fixed price for a clearly defined period of time is a terrific incentive to the mining industry to go out and develop a raw material.

Now, in industries that reach the size and scope of the aluminum and copper industries, such a program of pegged prices for long periods

of time is usually too burdensome financially to be considered by the Government. As an example, today's price of copper is 43 cents a pound; that is 860 dollars a ton. When you are talking about 3 million tons of copper a year in the Western World, you are talking about 2 billion or 3 billion dollars. If you take a period of ten years, as we have done in our uranium program, you are talking about 25 billion dollars. That is a great deal of money. Furthermore, if you say you are going to pay a certain price over that period of time, you have to be prepared to take larger quantities as they come forward. Production could increase very sharply. The quantities might swamp the Government and be a serious financial drain. So I don't believe that in any of these older, big tonnage, established industries we can think seriously in terms of pegged prices for long periods of time.

Actually, the industry itself has a responsibility to plan for expanding production. It has that responsibility because, unless it is prepared to take care of its consumers in times when the material is hard to get, the consumers may switch to other materials and the markets will not be there when supplies become easy. So the copper industry, the aluminum industry, and others do plan for expansion as they see the markets grow.

There is a great deal of difference in the rate at which these expansions occur. Those of us in the copper industry have been the recipients of many remarks, most of them not too congratulatory, about our inability to supply sufficient copper. They contrast our progress with that of the aluminum industry. I should like to take a minute to try to analyze why this is so. There is a sound basic reason for the difference.

To make a ton of aluminum, the aluminum producer uses four tons of bauxite, which he converts to two tons of alumina. He then takes the two tons of alumina and makes one ton of aluminum. So he uses four tons of raw material per ton of aluminum. A ton of aluminum is worth at today's price 470 dollars. Four tons of bauxite are worth 50 dollars. The ratio is about 10 to 1. In other words, the mining component in aluminum production is only 1/10 of the value of the finished product.

In the case of copper today in the United States. the bulk of ore being mined is material running about .8 percent, in other words, about 16 pounds of copper per ton. To make a ton of copper, you have to mine 125 tons of ore. If you are mining in an open pit--and I

understand you gentlemen have seen a moving picture of an open-pit operation--you may have to mine 125, 150, or 175 tons of waste rock and throw it over a dump somewhere in order to get out 125 tons of copper ore, so you may be moving 250 tons of raw material to get one ton of copper, instead of 4 tons to get one ton of aluminum. The mining component in copper is roughly 60 percent to 70 percent of the value of the finished product. Transportation costs, power, and selling costs are a small part of the price. The mining element is the biggest element in the cost of producing copper.

The consequences of this are very serious in terms of the ability of the copper industry to expand rapidly. To increase the domestic production of aluminum from a million tons of aluminum a year to 2 million tons a year it was necessary to make preparations to mine four million tons of additional bauxite. To expand the domestic production of copper from 900 thousand tons a year to 1 million 200 thousand tons a year it was necessary to make preparations to mine roughly 75 million tons of raw material. This is the reason why the copper industry seems to be so slow about expanding.

When the good Lord decided where to put copper deposits, He seemed to decide to put them in very inaccessible and difficult locations. I don't think He did it deliberately to harass the copper industry, unless we are like Job, being plagued to find out how good our character is.

Most copper deposits are in areas far from centers of population and with no easily accessible water, power or transportation. The result has been that, in opening up new copper mines, we have had to provide all these facilities. I don't want to seem unfair to the aluminum producers. I think they have done a magnificent job. They have gone to Jamaica, where a fellow usually goes to take a swim, and they have found bauxite lying right there at the surface. All they have to do is carry it over the water to an attractive city like New Orleans or Corpus Christi and make aluminum. They don't have to build towns for the workers. They use existing centers of population. One exception is the Aluminum Company of Canada in its new project in British Columbia. The domestic aluminum producers build their facilities where there is plenty of labor, where power is provided by someone else, and where transportation facilities are readily available. Naturally, in a job of that kind, you can do it pretty fast. What you are doing is building a manufacturing plant near a good power outlet.

Our company is engaged in a new venture for the production of copper in southern Peru. We have hung this map on the wall, so I think in all fairness we ought to use it once. I will show you where our mine is. It is down here in this southeastern corner of Peru, at an altitude of about 10,000 feet. It is 56 miles as the crow flies from the sea coast. I don't believe they have many crows there. There is nothing for them to live on. The railroad which will eventually connect the mine with the port will have a distance of about 100 miles.

These deposits were really first developed, though not intensively so, immediately after the end of World War II. Due to the difficulties of getting into the place and the problems of getting diamond-drill operators and so on, it took 4 to 5 years to determine the nature and extent of the deposits. You can't plan a mining program until you know where the ore body lies, how much overburden has to be removed, and until you survey the water situation. There is no water there. It will have to be piped vast distances over rugged terrain. You have to figure where you are going to do the smelting and milling, and what kind of power you have to provide. So it was not really until the Korean War broke out that the project was ready for serious consideration. We had done enough engineering work to estimate on the one hand the investment required and on the other hand the amount of production and the cost of production. It soon became apparent that the capital required would be very large and that we would have to secure some of this capital from outside sources.

Well, the Government was interested in new copper projects and showed great interest when we brought this one to them. However, there were certain aspects that needed to be considered. One was the one I brought out in my original statement about our policy being continental rather than national. Some people in the Government questioned whether the project was as desirable as a project in Arizona or some place near. The question of a government loan involved many considerations.

By one of those chances which always occur, there was a change of administration while some of these things were being considered, so the considerations had to be considered all over again. I am not being critical. It is logical when someone new has the responsibility to want to make the determination independently of his predecessor. At any rate, from the time we applied to the United States Government for financial assistance until we actually got it, 3-1/2 years elapsed. I am not being critical. It was simply caution on the part of the government people involved. They were considering the many angles concerned. But it did take from 1952 until late 1955.

As the project stands today, we are going forward with it. The investment involved will be a little over 200 million dollars. The Government is putting up 100 million dollars. My own company and the other companies associated with us in this enterprise are putting up the balance. In addition to the first deposit, which is the basis on which we approached the Government originally, two other deposits have been brought into the overall picture. There are three large copper deposits with an aggregate reserve of a billion tons of ore, running a little over one percent of copper. Production will start at about 120,000 tons of copper a year. It is about 4 percent of the total present Western World production of copper. It is about 8 percent of the present rate of consumption in the United States. So it is a sizable project.

We hope now that we are actually under way. We are building a new seaport because there is none there at present. We expect to build a railroad. We will have a powerplant on the coast. The smelter will be on the coast. There will be a mill and a town site up at the mine. We hope to get into production by 1960. In other words, it will have taken 14 years from the time exploration began. I don't think we have been slow about the matter. We have been prosecuting it diligently. This will be an economic copper producer. The project is not simply a problem of defense. It is something needed to provide copper to keep the wheels turning in peacetime as well as in wartime.

The condition in the United States is not much more favorable. A great deal of time is involved in equipping a new copper producer. The San Manuel Mine in Arizona was drilled by the Bureau of Mines at the end of the war. It will get into production for the first time early next year, 1956--11 years involved in a domestic project.

All I am trying to do is point out to you that the bigger the tonnage involved, the longer the time involved in bringing new mineral resources into play. It is for this reason, and because of the enormous investment required, that the copper industry does not maintain a substantial excess capacity. The communities in which we operate, for the most part, have only one industry--copper mining. If we operated those on a starting-up-today and shutting-down-tomorrow basis, we would have very serious and severe consequences from suspension in our relationships with the local communities. If an aluminum plant in New Orleans or Corpus Christi cuts off one-half or one-third of its production it would not paralyze the community, as would be the case with a copper mine in the wilderness.

So much for that. Expansion is possible in these industries. The resources are there. I do not subscribe to the theory that we are living on the fringe of the last remaining mineral resources of the world. On the contrary, this period since the end of World War II has developed far larger tonnages of all these basic nonferrous metals than have been used in this same period. I would say the known ore reserves of every one of the basic metals is larger today than in 1945, in spite of the heavy consumption in the last 11 years.

There is another group of nonferrous metals which I have not dealt with. I will touch on them briefly. These are the materials we refer to as byproducts. These are the most difficult, both for you and for us. They are materials such as cadmium, bismuth, selenium, and germanium. Some of them are becoming increasingly important in the complicated defense setup of the present day. Selenium is a good example. It is a basic item for the rectifiers that go into all of the electronic equipment used by the defense services and used by peacetime industry as well. I think it is not unfair to say that our company, which is the largest selenium producer in the country, is approached on the average of once a month by somebody in Washington who asks, "What are you doing to increase the production of selenium?" We are doing what we can. These elements rarely occur in nature by themselves. There is no present production of selenium by itself. There is a report of a selenium deposit in Wyoming, and I assume it has been followed up. If it is a source, it will be the first source as such.

In the production of cadmium and the other elements I mentioned, they are obtained as byproducts of bigger tonnage metals, such as copper, lead, and so on.

It is important to note that the critical and strategic list omits one material which is of increasing importance to industry and to the defense effort, and of which our consumption today is approximately three times our domestic production--yet it has been overlooked.

This element is silver, which is also a nonferrous metal. There are political angles to the silver problem with which I do not propose to deal. They are very controversial. People have rather violent and strong views on the question with which I do not think the Defense Department concerns itself. But I do think some serious thought ought to

be given by the Defense Department and the ODM and other interested agencies to the fact that the use of silver by industry today (exclusive of coinage) is roughly three times our domestic production. In other words, we are producing one-third of what we need.

Some of this use of silver, of course, is in goods which are not essential. They are pleasant luxuries, but not essential. You would be surprised, if you examined actual statistics, to find how small a portion of silver today is going into silverware. I am not talking about some of these military insignia, either, when I talk of silver as a defense item. The actual major use of silver today is in key industrial uses of great importance to the defense effort. Photographic film is an obvious example which will occur to all of you. Electrical equipment is another. Silver is often a better conductor of electricity than copper. When economies are not of importance, it will pay to use silver as a substitute for copper if necessary. Another use is in desalination kits which were used to advantage by people who were shot down at sea during World War II.

I do believe this is a problem that should concern the defense agencies of the Government, for the reason that the silver production of the world is tending to decline. Because silver deposits can be readily identified, silver was an element which the early explorers and prospectors and the conquerors of the Western Hemisphere did very well by. I was talking last week to one of our geologists who has spent all his professional lifetime in Mexico. He said that there is not a major silver deposit in Mexico which had not been found by the Aztecs or by the Spaniards 400 years ago.

As to these known deposits of silver, people have found that, as they go down deep into the mines, the character of the ore changes, the silver content declines, and the lead or zinc content increases. The result is that although the production of the base metals is rising the production of silver is declining.

I believe it is of first importance that we be sure in connection with our stockpiling program that the stockpile of silver be an adequate one. During World War II good use was made of silver. The Treasury lent it for the purpose of having it take the place of copper in bus bars. I think an examination of the Treasury's position will show that a repetition of that might be difficult under today's conditions. That is, the quantity of silver the Treasury has on hand is less than it was at that time.

Well, to summarize: My attitude toward the relationship of the Defense Department to the nonferrous industry is that on the whole, in spite of the record of shortages, in spite of the alarm which exists in some quarters that our resources are being depleted at a rapid rate, actually, our position with respect to nonferrous metals is a sound one. We need not be too concerned that essential defense needs cannot be met, because, should we again enter an emergency situation, I, for one, am convinced that the civilian controls on the use of metal-consuming products will be so stringent, not because of the lack of raw materials, necessarily, but simply because of the lack of manpower, that there will be adequate supplies available to be diverted to the military.

Thank you.

COLONEL ECKLES: Mr. Strauss is ready for your questions.

QUESTION: Mr. Strauss, is there any industrial need for gold?

MR. STRAUSS: There is some industrial need for gold. It is not comparable with the need for silver. Gold is soft. It is not a good conductor and, generally speaking, it is not an important element at all in any defense consideration that I know of, other than perhaps for certain of the decorations of the military.

QUESTION: Mr. Strauss, I wonder if there is anything done, or should anything be done, in the area of high temperature chemistry or metallurgy to utilize some of the stockpile that we are now developing, which is normally called slag?

MR. STRAUSS: Well, yes, a lot of work has been done on that score, both by industry and by the Government--the Bureau of Mines. The problem really separates into so many different fields that it is hard to give a cogent answer. The American Cyanamid Company has developed a process which they consider properly applicable to the separation of cobalt and nickel. The process has been put into operation at a plant at Salt Lake City, which is treating material mined in the United States. So far it is not entirely successful. The chemistry is fine, but the equipment has not stood up under the acid conditions and the extreme temperatures involved. (Note: About one month after the date of the lecture, announcement was made that the process is at last in successful operation.)

A lot of work is being done in every field of metallurgy. The best example I can give is the astonishing increase in the percentage of recoveries of the metals as compared with what used to be recovered 50 years ago, when the copper recovery from low-grade ore was only 60 percent. Today it has gone to over 90 percent.

QUESTION: In previous lectures, and then again today in your lecture, there have been several references to the part the Bureau of Mines is playing in the development of technical advancement in the metallurgy industry. I am extremely surprised that, for instance, the steel industry can't do its own researching. I wonder if you would comment on just what the relationship is between the Government and industry.

MR. STRAUSS: Yes; I think that is a very good question. I am answering now for the Bureau of Mines as someone in private industry sees its work. The fields the Bureau of Mines occupies--and occupies preeminently well--are the fields where the economic return is highly questionable. An example of that is a process for the treatment of the low-grade manganese resources of the West. They have done a great deal of work on that. If they did not do it, it is questionable whether it would be done at all. The owners of these deposits are not large organizations. In all probability, most metallurgists, I think, would agree that the cost of treating this low-grade material will always be such that it will not be a truly commercial undertaking. It will be of interest to us primarily at such times as access to low-cost foreign manganese is cut off. In other words, it is difficult to visualize a result no matter how good the treatment process, at a cost comparable with the cost of the product abroad.

I think that is, practically speaking, the field the Bureau of Mines has followed. They have gone into some more or less abstract research on the development of new materials; like, for instance, the processing of certain aluminum-bearing clays. This is not of immediate concern to the aluminum companies, in view of the large quantities of bauxite available. It is theoretical to a degree; but it is also highly useful.

QUESTION: Mr. Strauss, I wonder if there is any future to the retreating of the miles and miles of tailing dumps that one passes when he drives along through a mining community and realizes that some years ago our recovery methods were not as good as they are today, and also that there may be some of these new metals that we were not interested in years ago.

MR. STRAUSS: Yes, there is, of course, a lot of that work that has been done. One of the most interesting ventures of that kind is one our own company undertook in Arabia. We found a deposit there which we believed to be the original site of the mines of King Solomon. There were movies made in Central Africa about such mines. That was a more picturesque site; but actually we believe the mines in Arabia are the source of Solomon's gold.

The problem of the retreating of this material was complicated by the fact that these mines were located in an oasis area, and over the last 2500 years a large number of caravans have stopped off there, and they have had camels with them. The result has been that the tailings have become mixed with a great quantity of organic material. This was a new problem in gold matallurgy that our metallurgists succeeded in solving. Actually, the gold content per ton of this material was higher than the content of any large gold mine in operation anywhere in the world. It ran 1-1/2 ounces of gold per ton. That is an extreme example of the thing you are talking about.

Another good example, one more likely to be of use in a defense effort, is retreatment of lead slags from old smelter operations. In the old days the separation of zinc from lead was extremely difficult until the selective flotation process was developed. The result was that the slag at the lead smelters contained a large amount of zinc.

Today we have slag retreatment units in operation at three of our lead smelters producing large quantities of zinc. Other companies do likewise. A lot of the zinc is also recovered from current slag. There is a large potential zinc supply here. It is a question of price. mostly.

Another outstanding example was in the Michigan Copper District, where old tailings were dumped in portions of Lake Superior by the early miners. Those sands contained about 5 to 10 pounds of copper per ton. The Calument Company, as early as 1915, worked out a process for retreating that material. It is all retreated now. Many thousands of tons of copper were recovered at very low cost. Every mining company is alert to the possibility. There is a lot of work done in this field.

QUESTION: Mr. Strauss, would you care to discuss a little more fully the compelling reasons that determined you to locate in Peru rather than in the United States where the situation would be a little less vulnerable geographically?

MR. STRAUSS: Yes. I would use an old Welsh miner's expression, which is, "Ore is where you find it." We look for it in the United States also. We have found some. We have brought into production a copper mine in Arizona, 37 miles from Tucson. We made a contract with the Government in 1951 and we brought that mine into production in 1954. It took us three years to equip it. The development work had been done many years before that; so it took us only three years. We did not need to build a smelter. The power was available. We had to build about 15 miles of access road, put up a mill, and get going.

We would prefer to find a mine in the United States or Canada. But if an economic deposit is elsewhere, we will go after it. We look for them everywhere. If a mine is of high enough grade or large enough tonnage, the economic factors may offset political or transportation risks that are involved.

QUESTION: Mr. Strauss, some 20-odd years ago, I was down in Peru in a big copper mining town there. It was the Cerro de Pasco Company. Have they fallen from grace now?

MR. STRAUSS: No; Cerro de Pasco is very active, actually. The copper portions of their deposits are not so important in the overall picture as they used to be. Today they are a much larger producer of zinc and lead than of copper. Cerro de Pasco is also in partnership with us in the project I described, in southern Peru. They have 16 percent interest.

QUESTION: What restriction has the Peruvian Government placed on your operation in Peru regarding the employment of nationals, taking out profits, and that sort of thing?

MR. STRAUSS: We have negotiated these maters with the Peruvian Government. I might say the Peruvian mining code is the most liberal to foreign capital of any country in South America. The present Peruvian Administration is interested in getting foreign capital in. They have succeeded. As a result, in addition to our venture, the Marcona Mining Company has opened up large deposits of iron ore in Peru. I understand a lot of Peruvian capital is going into lead and zinc mining, and the program has been successful.

It is a matter of policy with us always to give the greatest possible opportunity to local technicians and people of advanced education to rise in a professional way in our organization.

As far as taking out profits is concerned, the Peruvian Government places no restriction at present, and under this agreement there will be no restriction. We have an understanding with respect to taxes, not only with respect to income taxes--there is a ceiling placed on those--but also with respect to taxes on imported machinery.

One of the easy ways for a Latin American country today to collect money is to put high taxes on the import of capital equipment; not for the purpose of stimulating the local production of bulldozers or transformers, but simply because it is an easy way to collect money.

At the same time, the existence of the tax is obviously a serious deterrent to going ahead with capital investments. It adds greatly to the amount of money required. The Peruvian Government has agreed to reduce these taxes in the case of this particular project. They are receptive to making that kind of arrangement when anybody comes with something that looks bona fide.

QUESTION: Mr. Strauss, I am from the Bureau of Mines. I would like to thank you for your good word.

MR. STRAUSS: I hope it was reasonably accurate.

STUDENT: It was very good, sir. I would like to ask if you don't think that, when the supply of any metal becomes sufficiently critical, there is a good chance of finding a substitute? I am thinking of recent methods where they substitute aluminum for copper in electrical equipment.

MR. STRAUSS: That is true. Substitution is something we are all alive to. There are few uses in which one material is indispensable. There are many uses where one material is preferable. We choose to think copper is the best material for conducting electricity. It is true that at a price aluminum becomes more attractive.

Another example is the sheathing of a cable by lead, which has been the accepted way--sheathing by lead. More recently the aluminum and plastic people have gone into that field.

We find under certain conditions that a substitute material may be economically better. In this situation I would say that, if the price of copper today were 25 to 30 cents, you would hear very little talk of substitution; but at 43 cents it is a very sensitive product of substitution.

One big utility company's West Coast office recently advised its cable supplier that they were going to switch in such a way that they would cut their copper requirements from maybe 1500 tons a month to 500 tons a month and would not be interested in resuming the use of copper until the price of copper got down to 26 or 27 cents. There is a lot of leeway there of movement back and forth.

QUESTION: Sir, I wonder if any significant contribution to the war effort was made at all in the recovery of old toothpaste tubes, tin cans, and so on, collected during the span of the war.

MR. STRAUSS: I think the most significant contribution was from a morale standpoint. I think it make a lot of people feel awfully good to contribute scrap. I think from the standpoint of actual war use it was questionable. As a matter of fact, the whole scrap problem is the most difficult one you face under conditions of stress.

The reason is the price factor. The position of the scrap dealer is quite different from that of the primary producer. His scrap is really his capital asset. If he sells a ton of scrap today there is no guarantee he is going to get another ton tomorrow. Naturally he looks at it a little bit like you might feel if you owned five shares of Anaconda. The more people say they want to buy Anaconda, the more you expect to sell it at a high price. The more hoop-de-do there is about how we need scrap, the more the scrap dealer creeps into his shell.

Actually, the cost of these scrap salvage campaigns is terrific. You have a lot of ladies running around with badges across their chests, and so on. I can not really say that there is a significant contribution made by them.

QUESTION: Mr. Strauss, we read that unknown ores might be hidden pretty deep in the ground and we have not discovered them. Is any attempt being made to take advantage of these ores from oil drilling operations? Would this be practical?

MR. STRAUSS: Yes, it would be practical. There was some drilling of oil in Mexico which resulted in finding sulphur down in the Tehuantepec Peninsula. That is the only one that occurs to me. There are different techniques. The technique that the mining industry is using now to find material which does not outcrop at the surface is one by which they determine by magnetic surveys whether the ground may be metal bearing. Then they do the drilling.

QUESTION: Mr. Strauss, you mentioned numerous places all over the globe where you find information on various minerals. Can you tell us something about the methods that you use in finding minerals all over the world?

MR. STRAUSS: Well, that is properly the field of our Exploration Department. We are organized in this way: We have a mining engineer or a geologist stationed in what we consider to be a critical area, where there are likely to be discoveries, or where somebody else has already made a discovery. We feel that if we are on the spot, maybe we can find something, too. Frequently deposits are not isolated.

A good deal is gained by studying the documents of geological surveys put out by some governments, particularly areas not too carefully explored, on which geological information to date is fragmentary. We may get suggestions because of a report of conditions in a particular part of the world which indicate there may be deposits there.

In a place like our own West, which has been fairly well pawed over, and where competition is very keen, we have to be very much alive. On this whole uranium campaign, every major mining company has had teams of geologists. The minute a strike is made they stake the ground in all directions and take a good look at it. There is not any one method.

QUESTION: In that new Peruvian job you mentioned that your smelting operation is very close to your ore deposits. I am thinking of a case on aluminum where actually the bauxite was in Canada and was actually delivered to a plant some distance away. What is involved in the location of the smelting operation?

MR. STRAUSS: It varies. In the case of aluminum, the major determinants are power, transportation, and labor. Ore supply is not too important. The cost of some Canadian power is under one mil per kw. hr. It takes 10 kilowatts to produce a pound of aluminum. If your power rate is 1 mil, your power cost is 1 cent; if it is 4 mils, the cost is 4 cents. With 1 mil power you have 3 cents to play with or spend on transportation.

Now, in the case of copper and lead smelting, the fuel cost or power cost is a much smaller component, and therefore a smelter is more likely to be located close to the mineral deposit, provided--and this is a very important provision--that the ore resources are large

enough to justify the capital invested. There are many mineral deposits which are not large enough to support an independent smelting plant, where the available or potential production is small.

We have at Tacoma, Washington, a copper smelter which probably treats more copper ores from diverse parts of the world than any other plant does. It gets a good deal of ore from British Columbia, and from northern Peru, from southern Bolivia, from Australia, from the Island of Cyprus, and from a mine in Newfoundland that we operate, but where we produce only 4,000 to 5,000 tons of copper a year. We could not justify a smelting plant for so small a tonnage. This plant is on tidewater and so can attract ores from many areas. To locate a smelter near the ore deposits, we have to be sure we have enough ore to put through the smelter to amortize the cost of the smelter.

QUESTION: Mr. Strauss, I wonder if you care to give us some more details regarding the financing of those new properties in Peru. Two hundred million dollars is a lot of dough, even from the Army standpoint. You mentioned that the Government put up 100 million dollars. I assume that was RFC.

MR. STRAUSS: No, it was the Export-Import Bank.

STUDENT: How did you amortize and how did you finance your 100 million dollars?

MR. STRAUSS: On this 100 million dollars that the Government has put up, the interest rate is 5-1/8 percent. The money will be drawn down during the period of construction, as we need it. Assuming on an average that it is outstanding for two years before we go into production, you can see that the accumulated interest is going to be 10 million dollars before we turn out a pound of copper. The time lag after we start mining the ore and before we have something to sell is another six months. How fast our customers will pay us, we don't know. Usually in the copper business they pay fast. Otherwise they may not get copper when they want it.

The government loan has to be repaid in 15 years after production begins. There is a schedule of amortization over that period. However, in the event earnings exceed the estimates we have made, we can retire the bonds more rapidly, and will do so, in view of the interest rate.

So far as the private part of the financing is concerned, the great bulk will be drawn out of the working-capital resources of the four parent companies, all of which are in a fairly strong financial position. We have been a little stingy with our stockholders in recent years; knowing that we had this ahead, we had some cash already put aside. Our three partners are Cerro de Pasco, Phelps Dodge, and Newmont Mining. All are in an excellent position to carry the burden.

QUESTION: We have been told there is a distinct shortage in the younger generation of developing scientists and engineers. Does your industry feel that pinch also?

MR. STRAUSS: Yes, we do. As a matter of fact, I would say that that is a much more critical factor, perhaps, than just the availability of the raw-material deposits. The life of a mining engineer or a metallurgist, living in remote locations, at high altitudes, or under unfavorable climatic conditions, or working with people of much lower educational and cultural backgrounds, makes it hard to get people to work in that field. We feel it is a real challenge to make it sufficiently attractive to draw the required number of people.

Actually, I think mining is a fascinating business. But it is a lot easier for some people to live in large cities, where all the comforts of home are available, than it is to live in isolated mining camps.

QUESTION: The lead and zinc industry seems to be one which is always in a position of feast or famine. We have always had trouble, no matter how good the industry looks. Before we get into war we find we are up against a shortage of lead. After the war period the shortage may still exist, but pretty soon we get into a position of surpluses. Would you comment on the characteristics of this industry that make it so temperamental?

MR. STRAUSS: One of the characteristics is that we have panicky customers. Actually a shortage of five percent looks to our customers as though it could never be solved. Among our customers are the governments. I recall in 1951 when Clement Attlee came over to see President Truman he asked Mr. Truman for two things. One was 10,000 tons of zinc; the other was sulphur. The zinc was taken from our stockpile or maybe diverted from metal coming into the stockpile; but at any rate the British did get zinc.

In 1951 they thought they had a critical zinc shortage. About 16 months later the British Minister of Supply called together the

representatives of all the leading Empire zinc producers and sellers for assistance on how to deal with an unmanageable surplus of zinc. Thus in exactly 16 months the unsolvable shortage became the overburdensome surplus.

Actually it has been my experience that a difference of five percent is enough to make people swing into these rapid extremes. The problem of the producers is that they do not have the financial resources to accumulate stockpiles on their own. They need the help of the consumers, who are more numerous, and some of them stronger financially. If the consumers were prepared to take the longer view, that is to carry larger stocks when the metal is in plentiful supply, and to draw on stocks when the shortages arrived, we would not be having these swings. I don't know how to inculcate this thought on the part of the consumers. As soon as they see a surplus developing they stop buying in the hope they can buy much cheaper.

I am afraid we are going to have recurring chills and fevers in the lead and zinc industry. It will help a great deal if, as a result of the large stockpile the Government has accumulated, the next time we get in trouble our Government puts less pressure on the producers to expand production, or in some way calms down the excitement that the consumers are bound to go through.

When a crisis develops, the typical automobile driver thinks he will feel better if he has one more battery in the garage because lead is going to be short. As soon as he is convinced the crisis is over, he uses that one plus the one he has in his car, and he does not come back to buy a battery for 3 or 4 years, instead of 2 or 3 years, the way he should.

COLONEL CONNER: Mr. Strauss, you started off by apologizing for your dire prediction on copper. We have a shortage of copper now. Industry is not getting all it needs. I don't know whether it is your fault or not. I would like to ask you if you would like to comment on why we have this shortage. Then maybe you can come back again.

MR. STRAUSS: The Western World capacity to produce copper is 3 million short tons a year. Since 1 July 1954, a matter of 16 or 17 months, we have had 5 different strikes in 3 different areas--Chile, the United States, and northern Rhodesia. These strikes have cut off, in my opinion, about a quarter million tons of copper. That is, one-twelfth of a year's supply, about a month's supply, has been lost through intermittent strikes. In my opinion this is the cause of the present copper shortage.

During the second quarter of 1955, the only quarter in the last five during which we had a normal rate of operation, there was not a single strike; and during that quarter the rate of copper production actually hit this 3 million-ton rate I am talking about. The maximum production in the Western World in any previous year had been 2-1/2 million tons. Actually, therefore, during the second quarter, the copper production rate was 20 percent higher than at any previous time.

In my opinion, that is enough to supply all requirements. What we need is freedom from interruptions in supply. The difficulty is that, having had interruptions, and having seen the price of copper rise as a result of them, the temptation is going to be very great for a country like Chile, which relies so heavily on copper for its economic life, to say to itself, "If the copper should turn easier, why don't we have a little cost ailment of output now to keep the market where we would like to see it--up around 40 cents a pound?" To overcome this temptation to cut output, I hope the Chilean Government can be persuaded to see, however, that in restricting supplies they might endanger the long-run stability of the copper industry.

We were talking about substitutions. There is no question that today's high price copper is losing some of its market. The loss is gradual. Substitutions take time. People can't switch one day from copper to aluminum the next day. People could not switch from coal one day to oil the next day. Over a period of years, with a steady rise in the cost of coal, however, a lot of people have been convinced that they need to use oil. The coal industry has lost much of its market. The same thing could happen to the copper industry.

COLONEL ECKLES: I regret that our time is up. On behalf of all of us here, Mr. Strauss, I thank you for a most informative lecture and an excellent question period. Thank you very much.

(17 Jan 1955--250)O/ljt