



## NON-FERROUS AND LIGHT METALS RESOURCES

Mr. Simon D. Strauss

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Reviewed by: Col Ingmire      Date: 7 Feb 63

**INDUSTRIAL COLLEGE OF THE ARMED FORCES  
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~~NONFERROUS AND LIGHT METALS RESOURCES~~

19 November 1962

CONTENTS

	<u>Page</u>
INTRODUCTION--Lt. Colonel Daniel W. McElwee, USA, Member of the Faculty, ICAF.....	1
SPEAKER--Mr. Simon D. Strauss, Vice President, American Smelting and Refining Company.....	1
GENERAL DISCUSSION.....	25

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INDUSTRIAL COLLEGE OF THE ARMED FORCES

Washington 25, D. C.

## NONFERROUS AND LIGHT METALS RESOURCES

19 November 1962

COLONEL Mc ELWEE: Gentlemen:

This morning we focus our attention on Nonferrous and Light Metals Resources.

We have with us Mr. Simon D. Strauss, Vice President of the American Smelting and Refining Company.

Welcome back here, Sir, for your eighth lecture.

MR. STRAUSS: Gentlemen of the Industrial College:

I am very pleased to be back once again to discuss the problems of the nonferrous metals industry with you. I am particularly pleased to be afforded this opportunity this year, because our industry seems to have had focused on it a rather unusual amount of attention in the course of the last few months, thanks to the stockpiling and to other factors. As I was saying before I came in here, I have the feeling sometimes that perhaps we have not put our best foot forward as far as public relations are concerned, and a certain number of misconceptions have arisen with regard to the operations of our industry. I believe that you gentlemen, representing as you do a broad crosssection of the defense efforts of our country, need to have our side of the story told to you. Whether I can convince you or not I will leave to you.

Actually, if you look at the periodic table, almost all of the elements in the periodic table can be classified as nonferrous metals. I do not propose to try to

tell you about each and every one, because, if I did that, I would barely have time to enumerate them. Instead of that, my remarks will be addressed primarily to those four nonferrous metals that are the major elements in modern industrial life, not only in the United States but on a worldwide basis.

These four are those which are consumed in refined metal form in tonnages of one million or more on a worldwide basis. I am sure that you know what four elements I am referring to--aluminum, copper, lead, and zinc. There are many things that these four elements have in common. There are many respects in which they differ from each other. But perhaps the most important aspect which must be considered in studying any one of the four is the fact that these are international commodities, international in a way that applies to very few other major industrial groups. You cannot consider the problems of any one of these four in terms of the United States market alone. If you do you will have a false picture.

All four of these products are minerals. All four of them enter into international trade in a rather unusual way, in that there is no major industrial country, no major consuming country, that is self-sufficient with respect to any one of the four. By self-sufficient I mean with regard to the true origin of the material. It is true that in the case of aluminum our internal production of aluminum could, under certain circumstances, satisfy our demand, but this production must be obtained from the treatment of a raw material, bauxite, which must be imported.

So all major consumers of these four metals are importers, and all major

producers of these four elements are exporters with the single exception of the United States. The United States is an important miner of copper, lead, and zinc, and it is not a substantial exporter of these three metals. But all the other major producers, which is to say Canada, Mexico, Australia, Peru, Chile, Northern Rhodesia, the Belgian Congo, and so forth, are exporters. So you have a pattern here of international trade that is not readily duplicated in other commodities.

I understand that this morning you have already had a discussion of the petroleum situation. Petroleum I would say is one of the commodities that also fall into this classification. But when you talk of steel or coal or plastics or some of the other major industrial raw materials, you have a rather different picture than you do in nonferrous metals. So let's agree in the first place that we cannot ignore the international aspects of these four elements.

I would like to begin the discussion by considering the matter of aluminum. Aluminum is the one of the four metals which **has** shown the greatest growth in the post-World-War-II period. It is the metal that people think of as the metal of the future. It also at present ranks first in consumption in the United States, although this is not true on a worldwide basis. Taking the free world as a whole, the consumption of copper is still somewhat in excess of the consumption of aluminum, but in the United States alone aluminum ranks No. 1.

Aluminum is obtained from a raw material, an ore, called bauxite. There is work being done now on the processing of other aluminum-bearing raw materials, various clays, but for all practical purposes, today's aluminum production is

obtained from bauxite. Bauxite is a rather abundant raw material. At one time this was not believed to be the case. The deposits in Guiana, in South America, were considered to be the major source of bauxite in the world, plus some deposits in France and Hungary, and elsewhere in Europe. But in recent years there has been an enormous expansion in the known reserves of bauxite. As a single example, in Northern Queensland, in Australia, there has been developed a bauxite field which alone probably contains more bauxite than has been extracted from all the deposits in the world today. This is the so-called Weepa Field.

One of the interesting things about bauxite is that with the exception of the Hungarian deposits and those in Southern France virtually all the important sources of bauxite available to the free world are in the tropical zone, and for the most part in countries that are so underdeveloped that perhaps they don't even merit the name of being underdeveloped. Here again Australia is the exception. I am speaking of the Guianas, Jamaica, the Dominican Republic, and some of the countries in West Africa.

At present the conversion of this bauxite originating in these underdeveloped areas is carried on for the most part in the industrialized countries--in the United States, in Canada, in Western Europe, and in Japan. The reason that the reduction of the bauxite ore to the metal form is carried on in a country where the aluminum is consumed is, in the first place, the most important element in the cost of producing aluminum is the cost of power. It is not the cost of the raw material. Bauxite can be shipped at as low an expense as iron ore can to almost any part of the world. What you need is cheap power and a market.

Therefore at present the bulk of the production of aluminum occurs not in the country where the bauxite is mined but rather in the country where the aluminum is to be used.

However, at this point in the stage of the world's development, the question of nationalism is very definitely rearing its head in the aluminum field. Every country wants to be an aluminum producer. This is now considered a status symbol, just as 10 years ago a steel plant was considered a status symbol. The economies of the location of an aluminum plant are very often disregarded in favor of this national self-interest.

I think in the decade that lies ahead we will see an enormous expansion in the production of aluminum in various countries that today import aluminum metal. Two examples will suffice. These are countries that are not bauxite miners and they are countries that are not cheap sources of power, yet they are building their own aluminum plants. One is Mexico and the other is Argentina. This is a matter of prestige. The resulting aluminum is going to cost the Mexicans and the Argentines considerably more than if they imported finished aluminum from a low-cost producer such as Canada. Nevertheless they are going ahead with the construction of these plants.

It seems logical also to expect that with the passage of time many of the countries that are producers of bauxite are going to take the same attitude toward exporting their raw material as raw material that, let's say, the producers of copper, lead, and zinc have taken. Namely, they will not see why they should not do the processing of the raw material on the spot. This is particularly

going to be true, I think, in the countries of Africa, where there are large resources of hydroelectric power available.

Therefore, the picture in aluminum is that over the years we are likely to see a continued heavy expansion of capacity, very possibly overexpansion, to satisfy nationalist ambitions, and the consequence of all this will be some uneconomic ventures which, nevertheless, will remain in existence because of reasons of national pride.

At present the United States, although it imports 85 to 90 percent of its bauxite requirements, as an aluminum producer accounts for about half of the free world's production of aluminum, and it also uses about half of the free world's production of aluminum. In this respect both our production and our percentage of use of aluminum is considerably higher than for the three other metals that I am going to discuss. In other words, we have developed the consumption of aluminum to a greater point, and there has been a more rapid application of aluminum in this country for uses which in other countries are still satisfied by the use of other materials.

Turning now to copper, the copper position is quite different from that of aluminum. In the first place, although the known copper reserves of the world are quite large, these reserves are contained in extremely low-grade materials for the most part, and these deposits of copper are not widely scattered. In fact, seven countries--the United States, Canada, Chile, Peru, Australia, the Belgian Congo, and Northern Rhodesia--account for well over 90 percent of the free world production of copper. With the exception of the United States, none

of these seven is a highly industrialized country, and at least four of the other six, namely, Chile, Peru, the Belgian Congo, and Northern Rhodesia, are countries with serious political problems and also at times serious labor problems.

Because copper ores are so low in grade, copper is not shipped around the world for reduction in the country of consumption, the way in which bauxite is shipped around the world to be reduced to aluminum where the market exists. Most copper is reduced to metal in the country where the copper is mined. Therefore, unlike the position in aluminum, where countries such as France, Germany, even the United Kingdom, Norway, and Italy are large producers of aluminum metal, ~~the United States is the only major industrial power that has~~ and here again I am speaking in the ~~free~~-world context--a large local production of copper metal. The other major industrial countries must import copper for use by their industries in refined form.

Germany and Japan are two major industrial countries that have been trying to become more self-sufficient in terms of local production of copper metal, although from imported raw materials. This is evidenced by a number of steps they have taken to help their local processing industries. But the effort is going to be a losing one, because not more than 10 percent of the free world production is available in any case to be exported for processing in a separate country.

An interesting comparison can be made between the copper and aluminum industries in terms of the relative cost of production of the two in the type of activity that is carried on. The United States is currently producing about

2 million tons of aluminum a year. This aluminum is produced from, roughly, 8 million tons of bauxite. The bauxite occurs for the most part in surface deposits, where there is little or no necessity for stripping away waste materials, overburden. In other words, the bauxite mine produces bauxite and doesn't have to worry about dealing with waste materials. In the case of copper our current production of copper from our own mines located in the United States is about 1,200,000 tons a year. This 1,200,000 tons of copper is produced from 150 to 160 million tons of ore. In other words, for every ton of bauxite that the aluminum industry has to mine the copper industry mines 20 times the number of tons in copper ore, and it winds up with only 60 percent as much metal as the aluminum industry does.

Now, what is the significance of this? The significance is that the copper industry is an industry where the bulk of the costs are in the mining part of the business. The aluminum industry is an industry in which the bulk of the costs are in the processing. I said earlier that the availability of cheap power is important in the production of aluminum metal. In the case of copper this is not the case. In the case of copper the major part of the cost has been met when the ore has been extracted from the ground, because you have to extract so much ore in order to get a ton of metal.

The consequence of this, as you can see, is that no country can afford a nationalistic policy with respect to its copper industry, because, if it is dealing with a low grade or marginal copper deposit, the extra cost of producing that copper is going to be so high that it is obviously self-defeating in terms of the

local economy. You do not have at all the same trend in the copper industry, of each country saying, "We've got to become self-sufficient in copper," because the cost to them of becoming self-sufficient is going to be exorbitant.

In contrast with the situation in aluminum, in the case of the United States, our copper production in terms of the material which we mine, smelt, and refine here is only about 30 percent of the free world's production, and our consumption is just slightly over 30 percent. We come very close to being self-sufficient in copper, but in spite of this you will see a substantial trade, both import and export trade, in copper, due largely to the importation into this country of copper that has been smelted but not refined, which is refined here and then re-exported as refined copper. The material is already 99 percent copper when it arrives here. When it leaves here it is 99-plus.

Turning now to lead and zinc, these two industries are usually dealt with together because the ores themselves occur together in nature, for the most part, although this is not universally true. They are also dealt with together because in recent years, unfortunately, they have had a very hard time. Prices of lead and zinc have been trending downward ever since the end of the Korean War. Consumption of these two metals has not evidenced the same startling growth that you've seen in aluminum or even the steady growth that you've seen in copper. The world at present seems oversupplied with these two.

The basic economics of the lead and zinc industry are more similar to those of copper than they are to those of aluminum. The ores that are mined are higher grade than the ores of copper but, because the price of these two metals is so

much lower than the price of copper, the actual value in terms of dollars per ton of mineral extracted is not very different. In other words, a 4 percent lead ore has a contained metal value not much greater than a 1 percent copper ore, for the reason that the price of lead at present is only one-third of the price of copper.

Similar to the situation in copper, the lead and zinc miners also do the greater part of their reduction in the countries where the ores are mined. But the extent is perhaps not quite so great as it is in the case of copper. There is a certain amount of international trade, not in the crude ores but in the beneficiated ores. That is, after the ores are mined, they are put through a process that is referred to as concentration, and a product is obtained running 50 percent or more metal content, which is then subjected to smelting. This product, called concentrate, does enter into world trade to a certain extent, and we have seen in recent years in lead and zinc processing a development somewhat similar to that which I described in aluminum--in other words, many countries want to do the smelting of the lead and zinc concentrates.

The great lead and zinc mining countries--Canada, Australia, Peru, Mexico, and South Africa--which in the past have shipped a good part of their production as concentrates are now saying, "No, we want to do our smelting at home." The countries of Western Europe which have over the years developed a substantial smelting industry, based on the conversion of imported concentrates, are saying, "No, we want to continue to smelt these ores ourselves." In the course of forming the European Common Market, the duties that have been placed in the case

of lead and zinc are clearly discriminatory in favor of the domestic smelting industry. In other words, there is no duty imposed on the import of lead ores or zinc ores into the Common Market area, but there will be a fairly high duty imposed on the importation of lead and zinc metal.

~~You have a struggle going on here somewhat similar to that on agricultural commodities, which is one of the reasons why the two major British dominions, Canada and Australia, are being so difficult in regard to the joining of the British of the Common Market. The Astralians and Canadians, as important exporters of lead and zinc, are saying to the British, "Don't join unless you get this lead and zinc duty knocked off," that is, on metal. They are not interested in shipping lead and zinc concentrates.~~

Turning now to the question of the percentages of world supply and demand accounted for by the United States, in the case of lead our present mine production, which is our truly domestic source of material, is about 15 percent of the free world supply, but we use about 35 percent, so we must of necessity be large importers. This has given rise in part to the struggle over protection for both lead and zinc that has been so prominent a feature of the last few Administrations and the last few Congresses, and which has in the long run brought about a system of quotas which I won't attempt to describe now, but perhaps you will want to ask some questions about it later.

In the case of zinc our mine production is about 18 percent of the free world mine production, and we use about 30 percent. So here, too, we are far from being self-sufficient in terms of a wholly integrated domestic production.

~~Now, to recapitulate the strategic position of the United States, we are not self-sufficient in any of these materials, but we are closer to being self-sufficient in copper than the other three. We are not self-sufficient in aluminum because we must import bauxite.~~

~~If you take North America as a whole and include the Caribbean area, then our degree of self-sufficiency is quite great, because, in Mexico and Canada we have two of the world's major sources of lead and zinc, which are available to us for overland transport by rail or truck, and therefore not subject to interruption of shipping in the event of difficulties. In the case of aluminum, our bauxite supply largely originates in the fringes of the Caribbean area, either in the Guianas, Jamaica, the Dominican Republic, or Haiti.~~

~~The recent Cuban crisis showed quite clearly our vulnerability with respect to aluminum, and in fact it is probably fair to say that, in terms of a strategic concept, aluminum is the one where we are least secure if we have to depend strictly on materials available by means of land transport. When the Cuban crisis developed the Navy warned that the Florida Straits and the Yucan Channel were dangerous waters. These two means of access to the United States ports on the Gulf are the bodies of water through which about 95 percent of all our bauxite imports reach this country. Consequently, it was a matter of some concern to note that only the week before the Cuban crisis there had been a move under way to dispose of part of our aluminum stockpile. I will get into that in a moment when we discuss the stockpile position.~~

~~Dealing very briefly with the position of our major allies in the free world,~~

~~the countries of Western Europe, with the exception of aluminum, where they have some bauxite resources available to them of some magnitude, are heavily dependent on overseas imports of all four of these metals.~~

~~In the case of Japan, they are extremely vulnerable. It is true that Japanese production of metal and such has been rising rapidly in recent years, but it is based on imported raw materials, scrap ores, or whatever you like, and, even with an increasing domestic production of metal, they have also had to import finished metal as such.~~

~~As to the position of our potential adversary, Russia, all we can say is that within the last five years the Russians have been exporters of aluminum, lead, and zinc. So that we assume that they are well satisfied with their own position and are not particularly vulnerable in terms of supplies of these three commodities.~~

In the case of copper, however, it is a different story. The Russians have been consistent buyers of copper in Western Europe. Some of the copper they have taken as refined metal. More of it they have taken in the form of strategic quantities of semi-fabricated goods, particularly copper rod, which is the raw material from which wire and cable are produced. It is hard to assemble figures that mean very much on the extent of the Russian import deficiency in copper, because of the fact that the copper does not all flow into Russia in the form of refined copper, and in any case there is so much of what I would call entreport trade in Western Europe--copper arriving at the free port of Antwerp and being barged down the Rhine to a cable mill in Germany, with the resultant rod being

shipped, perhaps, originally to a destination in Poland and then what happens to it no one knows.

~~But the best estimates that those of us in the copper industry can make are that the Russians are importing 200,000 to 300,000 tons of copper a year, either as refined copper or as fabricated goods. What their overall production and consumption would be we wouldn't know. There are some estimates published, but I have no reason to think that these are anything but uninformed guesses. It seems quite clear that the Russians don't use as much copper as we do. We use a million and one-half tons a year in this country. But they may very well be using something like 600,000 or 700,000 tons a year. In that case an import deficiency of the size that I have indicated would seem to indicate about a 30 or 40 percent deficiency.~~

~~Well, so much for our strategic position. On previous appearances before this group, in discussing the problems that our industry may pose for the defense effort in this country, I have had kind words to say about our stockpile policy. It is certainly true, I think, that the stockpile policy as a policy, regardless of the method of its execution, has been a wise step taken for the benefit of this country.~~

(Slide)

I am going to show you now a slide which illustrates the position not only with regard to four metals we have been discussing but two others in regard to the stockpile. Let me say first that none of us knew in the industry what the stockpile goals were, nor did we have any very clear concept of how they were

set, other than they were presumed to represent a quantity sufficient to meet our import deficiency in the event first of a five-year war and later reduced to a three-year war.

I am still unable, following the publication of data which became available to industry for the first time in the early part of this year, really, to puzzle out the method by which the present stockpile goals have been arrived at.

But let's deal first with aluminum. The first column represents the current goals. The second column represents the actual stockpile on hand. As you will see, there is an apparent excess of about 700,000 tons. The third column represents the amount of aluminum we are actually using in this country. Note that the goal is set at about 60 percent of our current rate of consumption of aluminum. In other words, we have perhaps a 7- or 8-month target for aluminum in the stockpile.

In the case of copper, the three figures are closer together. The goal is at a million tons. The stockpile itself is 1.2 million, and the use is just short of 1.5 million tons. In other words, we have an apparent excess of about 150,000 tons of copper in the stockpile, but we have less than a year's supply in the stockpile, and the goal is about two-thirds of a year's requirement.

Lead presents what to me is an extremely startling picture. The goal is only a little over a quarter of a million tons. We've got a million and a quarter tons on hand. Our annual consumption is about a million tons. We've got a goal that represents about 25 percent of a year's consumption--three months.

Nickel I haven't talked about earlier, but nickel is a material that, with

one exception, is not produced in the United States. It is an element of considerable importance from a strategic standpoint. The goal is set at about 180,000 tons, as I recall it. The quantity on hand is a little over 200,000 tons. The annual consumption of nickel is about 100,000 tons. Here we have a goal that is well in excess of a year's consumption. In the case of lead we have a three months' goal. In the case of copper and aluminum we have an eight months' goal.

In tin our goal is about 180,000 tons, again. Our stockpile is over 300,000 tons. Our annual consumption is only 50,000. Our goal is equivalent to about a five years' consumption.

In zinc the goal is 178,000 tons. The quantity on hand is over 1.5 million tons, and we use about a million tons of zinc a year. In terms of relationship between our goal and our consumption, we have only a two months' supply of zinc as our goal.

The problem that I find in these figures is that they seem--the goals I mean--to be set largely on the basis of the import patterns. This was the original concept in stockpiling, that what we needed to do was to stockpile the materials that we imported, very largely. But, even if you allow for that, I have given you figures earlier showing that 18 percent of the free world zinc production is obtained here, but we use 30 percent. In other words, roughly 40 percent of our requirements for zinc must be imported. It is hard to reconcile these two figures.

The other aspect, of course, in setting stockpile targets, would be their use in direct munitions production. Here one must admit that zinc is not an

important element in the production of implements of war. It has, however, a major use in terms of the overall industrial effort. The great bulk of zinc is used by our steel industry for the protection of steel against wastage, through the process of galvanizing. I am simply unable to understand why the zinc target should be as low as it is.

I have the very radical theory about this that, in terms of the present realities of the world, the import criterion is not the only one of which we should be thinking when we set stockpile goals, and the strict military use of these commodities is not the only one that we should be thinking about. We should also be thinking about the problems of civilian reconstruction that may face this country in the event of a nuclear war.

In terms of these problems, I think it would be a crime--and I mean that word very seriously--if we were to dispose of the large surpluses that this chart shows for lead and zinc simply because we do not need these particular commodities in terms of the production of military weapons. If this country is ever faced with the problem of reconstruction after a holocaust, we are going to need all of the available raw materials that we can possibly lay our hands on, just as they were needed in Western Europe. To dissipate the tonnages of lead and zinc that we now have in our stockpile may lead to some very serious regrets at a later date.

I am not one of those who think that the stockpile is the whole answer to our problem of industrial self-sufficiency in times of war. That's a Maginot Line approach which I do not share. I can well understand that there are many other

aspects of industrial preparedness besides stockpiling. But, when you are talking about basic elements of industrial life in this country, they represent a very rare asset. In the first place, they are taken from the ground, and once taken they cannot be replaced. If today one of the underdeveloped countries of the world--let us say, Ghana, for purposes of illustration--were to have a geological study made which showed the existence underground, unmined and unprocessed, of reserves of copper, lead, zinc, aluminum, nickel, and tin, equivalent to what we have in the stockpile, and if the Ghanaese government would show any inclination to allow private industry to participate, you'd have a gold rush to Ghana the equivalent of the Yukon gold rush of 1898. The world would be falling over with eagerness to exploit these riches.

Here in the United States we have in the stockpile, above ground, the imperishable raw materials, which cost very little to hold on to, and yet we are talking about dissipating them because they are in excess of some target that has been arrived at by a means of calculation unknown to me and unknown to most of us in the industry, but which, frankly, looked at in terms of what our current use of these materials is, don't seem to make a great deal of sense. I would say that, with respect to any industrial raw material that is basic, this country should have on hand in its stockpile a year's supply.

Now, I am not even urging that where we don't have a year's supply we go out and buy some more to get a year's supply, but we should certainly not sell to below a year's supply, for all purposes, regardless of what the purpose is. What we are faced with is total war, affecting the total industrial picture of this

~~country and not just simply the production of military weapons.~~

In making these remarks I do not intend in any sense to say to you gentlemen that this same criterion should apply to every material in the stockpile, because there are many items in the stockpile which are specialty items. One which the press has had a great deal of fun with is the goosefeathers. There is castor oil, there are quartz crystals, there are even supplies of industrial diamonds, where there have been developments that indicate that possibly we can rely on synthetic sources or substitute materials. I am not talking about these commodities. Each of these must stand on its own feet and take critical examination. But I am talking about the major items in which the major values in our stockpile are contained. Those are the commodities like copper, lead, zinc, and aluminum, that have widespread application and that under no possible concept can become obsolescent technologically overnight.

So that, gentlemen, is the burden of my story as to the defense considerations with regard to these four major nonferrous metals. I'll take just a minute to talk about some of the lesser important elements--lesser important not because they are dispensable or expendable, but simply because in terms of total tonnage or total value they do not rate with these four.

There is a group of nonferrous metals that are produced entirely as byproducts from the production of the major nonferrous metals. These include cadmium, bismuth, selenium, and tellurium, and each of these has important defense application. The thing that is interesting about these four elements--and there are a number of others, but they will serve for purposes of illustration--is that,

~~because they are derived as byproducts, it is not possible to increase the production of these simply in order to get a larger supply.~~

The world's production of cadmium is about 10,000 tons a year. That is obtained in association with the production of 2.5 million tons of zinc. In other words, there is one ton of cadmium produced for 250 tons of zinc. If you need an extra ton of cadmium you've got to figure out how to do something with that other 250 tons of zinc, or you have to pay a price for the one ton of cadmium equal to the price for the 250 tons of zinc, and that is something that is not likely to happen. So you have an inflexible supply.

Bismuth is in the same category. The world production of bismuth is about 1,000 tons a year, and that is produced in association with roughly 2 million tons of lead--one ton of bismuth for every 2,000 tons of lead. If you suddenly need bismuth for some purpose more serious than tummyache powder, you may have a hard time getting an extra supply.

Selenium has had a very important application in the communications field. It is one of the major semi-conductors. It is now a little outmoded in certain of its applications, but it is still important. The world production of selenium is about 600 tons a year, and it is obtained from 4, million tons of copper. In other words, you produce one ton of selenium for every 7,000 tons of copper. I told you earlier that the copper production of 7,000 tons on the basis of ores running under 1 percent would come from over 700,000 tons of ore.

So try to figure, gentlemen, that you will get one ton of selenium from every 700,000 tons of copper ore that you mine, and you can see that if you need an extra

ton of selenium you are going to have to do a lot of extra work to get it, if you need it in a hurry.

Tellurium is the most striking of all. Tellurium has recently had some very interesting developments in the thermoelectric field, where in combination with bismuth or with lead it has a highly unique property of reversing the flow of electric current, so that you can get hot from cold or cold from hot, and refrigerators are now being made with no moving parts in them but simply containing a bismuth-telluride point through which electricity flows.

The world production of tellurium currently is 250 tons. That's obtained from a world production of 4 million tons of copper. One ton of tellurium is produced for every 15,000 tons of copper. For every 15,000 tons of copper you can expect to get a ton of tellurium.

If you've got some important applications for tellurium it's a good idea to have a little extra on hand.

Now, I recognize that these commodities, particularly the last two, are the kind that could become technologically obsolescent almost overnight. But, is this an answer, any more than the fact that perhaps you've lived past the point at which you expected to obtain protection through life insurance? Is this a good reason for not taking out life insurance when you know that you need it? In the case of each of these materials, it seems to me, there needs to be a very careful calculation of what the stockpile target should be, recognizing that production of these elements in their number of others like them can under no set of circumstances be increased in order to get these particular commodities, except with

~~a tremendous effort of time and labor. So it's a good idea to have~~ a little in the bank if you think you ~~may need some.~~ When you put it in the bank, it's a good idea also that, for purposes of later reference before Senate investigating committees, the circumstances be spelled out in some detail.

I'll say one final word and then I'll close this presentation, with the hope that later on we can have some good questions.

That has to do with silver. I have been on the losing side in silver in thousands of arguments with my financial and economist friends, because silver, ever since the days of William Jennings Bryan, has been looked on as something that is just a shade above selling whiskey for snake bites. Really, anybody who tried to discuss silver seriously was considered to have something wrong with him and not to belong in the modern world.

The world silver production is in the order of 200 million ounces a year. The world use of silver is now in the order of 350 million ounces a year, and is growing very rapidly. There's a gap of 150 million ounces a year between the new supply of silver and the use of silver, and this gap has been filled over the last few years by drawing on accumulated stocks of silver that are held by various governments in various forms.

When Mr. Castro came on the scene Mr. Batista dumped about 80 million ounces of silver that he had on hand on the market. The Spanish and the Japanese have been selling silver, and <sup>some</sup> Saudi-Arabian riyals have been melted down to get the silver content. The British withdrew silver from circulation as coinage. All these things have temporarily filled the gap. For a while our own

Government was also filling the gap by selling silver from its so-called free stock. I won't get into the very controversial political aspects of this. It is enough to say that the United States Government at one time had several hundred million ounces of silver that was not actual backing for paper currency or was not actually minted into coin. This reserve of noncommitted silver in Treasury hands was down to 30 million ounces last ~~November~~, just about a year ago, when President Kennedy decided to suspend Treasury sales of <sup>free</sup> silver. As a consequence of that the price of silver has risen from the previous level of 91 cents, at which the Government had been selling it, to a present market of around \$1.20 an ounce, and it seems inevitable to many of us that very shortly silver will be selling at its monetary value.

You take a paper dollar and take it to the Treasury and they have to give you .7 of an ounce of silver for it, because the paper dollar says on it that it is backed by silver, and you can redeem it for silver. Now, at \$1.29 an ounce, the Government has about a billion 600 million ounces of silver, and there will be some people who will say, "Well, this is just lying fallow in the Treasury and the Treasury ought to pay it out freely to fill this gap." And perhaps it will. But, what happens, gentlemen, when that billion 600 million ounces is gone and we run into a period when we still have a deficiency in world silver production as compared with the world silver demand? You are then going to see the price of silver skyrocket.

Some of the uses of silver are of major industrial significance, and even of defense significance, because silver-zinc and silver-cadmium batteries are

being used widely, for instance, in connection with missiles, space exploration, et cetera. The Navy has converted to the use of silver batteries in certain applications.

This problem is going to be debated and fought about in the Congress in the coming session. It is important for the Defense Department and for all of you gentlemen who will have something to do with the thinking on this subject to think the problem through carefully and clearly, because it has some very interesting overtones.

We've been engaged in two world wars, and in each of these world wars silver was a virtually indispensable element in dealing with our allies. We lend-leased over 400 million ounces of silver during World War II. Of all the commodities on lend-lease, this was the only one where we insisted on repayment in kind. What was the silver used for? It was used to mint coin to reassure the population of India, Burma, and the other countries threatened with Japanese aggression--in the case of Burma, of course, it was actually overrun--that they would have currency of some value, because the underfed, illiterate masses of the world, when faced with a crisis, will not put their confidence in paper money. They want something that they recognize to be a store of value. If you look at China today there can be a good argument made that one of the reasons that China went Communist was the withdrawal of silver coinage from circulation and the substitution of paper money, because, when Chiang Kai-shek paid his troops paper money in which they had no confidence, they began to desert him in large numbers.

~~If we are going to fight any wars in Africa or Asia, we are going to need~~  
silver on hand. So I say that it is an extremely important question for this  
country to consider whether it wants to dissipate the billion 600 million ounces  
of silver that it now has on hand by simply cashing in paper currency and re-  
placing it with paper currency that is not backed by silver. At the end of that  
time we may be in a serious fix.

Well, I have run five minutes over my allotted time already, and I guess  
it's time to stop.

Thank you very much.

COLONEL McELWEE: Gentlemen, Mr. Strauss is ready for your questions.

QUESTION: Sir, one of the congressional criticisms of the stockpiling pro-  
gram was that the firms involved made more than a fair profit. Would you  
comment on this aspect?

MR. STRAUSS: Yes, I'll be glad to. Actually, I have felt right along that  
the public discussion of the stockpile program has confused two quite separate  
problems. One is: What should a proper stockpiling policy be? The other is:  
In acquiring these stockpiles, were there some errors of omission or commission?  
Now, your question is directed to the second one. It has really very little bear-  
ing on whether we should have a stockpile or not. It's just whether there were  
mistakes made. I believe there were mistakes made, just as there are in any  
human endeavor. I worked on stockpiling prior ones during World War II here.  
We were under terrific pressure. I recall one occasion in which an ensign,

junior grade, if I may call him that, from the Navy took me to task in an inter-departmental committee because I objected to flying barrel ore up from Brazil on Pan-American planes at a cost of \$1.50 a pound, which would be \$3,000 a short ton, to carry material worth about \$150 a short ton. He thought that the war emergency was such and we were losing boats off the coast of Brazil that we ought to be flying this barrel ore up. Well, my point was that we weren't using the barrel ore at the time and must leave it in Brazil until we really needed it, and that if it became desperate we could always fly it up, but in the meanwhile, if he was worried about sinkings, we should just keep it down there.

This is the kind of question of judgment that arises, and when you are in a military situation such as we had at the time of Korea, some people's judgment will be, "Forget the cost; get the material."

Most of the specific criticisms that have been directed at mistakes in the acquiring of the stockpile seem to be revolving around the question of nickel. I remember very well in World War II that a major concern of the Chiefs of Staff was our vulnerability because we were depending on one source of nickel, namely Canada, and that that nickel was moving to our country largely over the transportation facilities at Sault-Ste.-Marie, and if we got a little sabotage there it might interrupt the whole supply of nickel to our war effort, which was terribly important. So, taken in that context, I believe that most of the so-called mistakes that are being criticized are not cases where there has been any evidence, really, of wrongdoing, in the sense of corruption. I think they have been errors of judgment. Was too high a price paid to the Hander Nickel Company? Was too high a

price paid to the Falconbridge Nickel Company?

Well, in the calm reflection of Monday morning when you are reading the sport pages, you can always look and see where the quarterback made a serious mistake on Saturday. But on Saturday when he made that mistake he was in the thick of the combat. That was the case with the nickel program.

QUESTION: What is the labor position in South America, particularly in the copper industry?

MR. STRAUSS: The problem in regard to the labor position in South America in the copper industry is the following: The miners in those countries are well aware of the high rate of wages paid in this country and they think they should get the same. Nevertheless, the wages that they receive in those countries are far in excess of those paid by any other industry. This is particularly true in Chile, where the present wage in terms of the going rate of exchange with the Chilean escudo is between \$10 and \$12 a shift, in other words, from \$1.25 to perhaps \$1.50 an hour. I would venture to guess that no other laborer in Chile is paid much over 30 or 40 cents an hour.

The big mining companies are faced with this terrible dilemma. If they grant these higher wages they are then accused by all the other local industrialists of completely upsetting the local economy. A job in a Chilean copper mine is as early sought after as an appointment to West Point or Annapolis. These jobs really have a sort of hereditary value to them, and the men get compensated out of all relationship to the going wages in other industries. Furthermore, of course, you have the fact that labor is not quite as efficient--although in all

fairness I must say that the Chilean and Peruvian copper miners do a damn good job--as labor here, not quite up to our standards, but nevertheless far in excess of, for instance, the work done in, let's say, Rhodesia, where black labor is employed.

There has been some feeling, and I can't either prove it or disprove it, that there has been a certain amount of Communist propaganda involved in this. It seems reasonable that the Russians would try to embarrass us in what would seem to them to be a vulnerable spot. Here are these huge American investments which do earn a very substantial profit, and it's relatively easy for them to make trouble for us. On the other hand, looked at from the standpoint of the American investor, he has to get a good return on his money. Our company, in association with three others, within the last five years has opened a major new copper deposit in Peru, situated at an altitude of 11,000 feet in the Andes. The investment is \$240 million. One hundred million dollars of that was put up by the Export-Import Bank. The balance was put up by the four partners. We built a railroad from sea level to 11,000 feet. It's only 100 miles long, so you can figure out for yourselves what the grade is. We built two towns, one up at the mine and one down at the seacoast. The \$240 million was invested before we had one dollar in sales. The investment, actually, from the time we started drilling until we began production, covered a period of something like 13 years of exploration, drilling, construction, and finally getting into production.

We have to pay off the Export-Import Bank before we get any dividends. Peru is a country with a certain amount of political instability, although it is

far superior to most of the other South American countries in this respect in its past history. Obviously, unless we can get a return that is commensurate with these risks, we won't take the risks.

Now, from the Peruvian standpoint, was it worth while to do this? Well, we have created two modern communities in an area that was formerly desert. We have provided transportation facilities which are now available for the development of this area for other purposes than mining. We are employing 3500 people. The exports of copper from Peru have resulted in the Peruvian balance of exchange being the most favorable now of any of the major Latin American countries, with the result that, unlike the severe inflation that you have had in Brazil, Argentina, and Chile, Peru's three major neighbors, the Peruvian sol has been quite steady ever since we got into production.

Sure, a Communist agitator may say, "Here are the Yankee imperialists taking our hard-won natural resources and benefitting themselves from these resources." But, how many years do you suppose it would have taken the Peruvians, with their limited capital resources, and lack of technical know-how, to develop this deposit? The answer is, they never would have done it, because the average Peruvian who has some capital would much rather build a skyscraper in Lima and start getting a 10 percent return on his money the year after he puts the skyscraper up.

We started in 1946. We don't expect our first dividend until 1966.

QUESTION: Mr. Strauss, are we maintaining adequate supplies from abroad in competition with Western Europe and Japan, and also seeking the same raw materials?

MR. STRAUSS: Yes. In the materials with which I am the most familiar, the United States is losing its place in relation to both Western Europe and Japan in the importation of lead and zinc concentrates. Our domestic smelting industry is unable to compete with these other areas for two reasons: First, we have put limitations on ourselves through the imposition of a quota system under which we restrict imports to a certain tonnage a year. Secondly, the smelter has no protection in the form of tariff protection, whereas in all of Western Europe, as I described earlier, there is now, under the Common Market System, a substantial protection for the smelting industry in the form of a tariff on metals. There is none on ores.

The Japanese go a step further. The Japanese not only have tariffs on metal and none on imported ores but also have a system of licensing which they ascribe to their exchange problems. It is not necessary to get an import license in order to bring in ores. It is necessary to get an import license in order to import metals. Consequently, if we wish to sell, let's say, Mexican lead or Mexican zinc in the Japanese market, we can only do so after the local producers have first sold all of their production, because no import license will be given.

So there is a very serious disadvantage there, and the result of this is that the Japanese custom smelters, the people who buy these raw materials, are able to pay higher prices because of government protection.

QUESTION: Sir, what are the outlooks for technological improvements in the processing of these nonferrous metals?

MR. STRAUSS: This is a complex subject. In the case of aluminum there is a great deal of work being done, first in the treatment of the clays, to which I referred, other raw materials than bauxite, and very possibly this will be successful--if not now at some time in the future. The Anaconda Company, for one, has done a good deal of work on the treatment of clays that are found quite abundantly in our own West.

The other more interesting and probably more immediate technological improvement in aluminum will be a step by which an intermediate phase of the reduction of bauxite to aluminum metal will be eliminated. This is the production of so-called alumina. Two companies, the Aluminum Company of Canada and the ~~Pechiney~~ ~~Company~~, a French producer, both have pilot plants in operation on this, and they believe that they are making great strides. This may well cut the cost of producing aluminum by anywhere from 10 to 20 percent if it is successful. At present it is in the exploratory phase.

In the other metals, copper, lead, and zinc, further improvements in processing are to be expected, but they will be marginal. I'll indicate the nature of some of the things that are being done. In the case of copper, one of the problems of copper is, after you have electrolyzed it, removed all the impurities and have the pure copper, at present it costs a fair amount of money to cast that copper into the so-called refinery shape--wire bars, billets, and cakes. There is certain work under way by our company, which is already on the threshold of success. It might achieve a saving equivalent to, say, 1/4 of a cent a pound on copper, not a big saving. But it's the kind of chipping away at the overall cost

that the industry faces.

I don't see any major technological breakthrough. In zinc smelting, in recent years, there have been several improvements in processing developed, as the result of which the recovery of the zinc contained in the raw materials has been greatly improved. It used to be that only 85 percent of the zinc content was recovered and the other 15 percent went out to waste with the slag. Today that's up around 90 or 91 percent. The obvious ceiling is 100 percent, because you will never recover more zinc than is in the ore originally. But if you can recover more then obviously you cut cost, because you still have the same original cost of mining the rock, whether you cover 80 percent, 90 percent, or 95 percent.

QUESTION: Sir, it has been a rather well known fact that the mine, mill, and smelter workers have been and possibly still are heavily influenced by Communists. Has this fact had a particular result in your industry's relationship with labor as compared to the rest of the metals industries?

MR. STRAUSS: Yes, there are several aspects of it. They were times during the Korean crisis when we began to feel that possibly other than purely economic situations were motivating some of the actions of the union. Nothing was ever proved, but we had one or two wild-cat strikes, particularly in plants of ours that supply the export market, where it seemed that this might very well be the case.

However, there is a concerted drive now being made by the United Steel Workers to organize our industry, and they have succeeded in taking over a

~~a number of major plants which were previously dominated by mine, mill, and smelter workers' unions. Considering the strong financial backing of the United Steel Workers and considering the fact that the mine, mill, and smelter workers have been treated more or less as outcasts in the labor movement, I would suspect that this will go further.~~

The most recent ~~change has been in Canada, where International Nickel, the largest single employer in the Canadian mining industry, has been taken over by United Steel Workers, as against Mine, Mill. The United Steel Workers is a very able, tough union, and I do not think that this will necessarily mean that our industry will be faced with any simpler course in its labor relations, but I think it is fair to say that any suspicions of other than economic facts will probably disappear, and the Steel Workers will simply fight on economic issues.~~

QUESTION: Would you care to comment on our position with regard to tin, which appears to be a metal that we don't seem to have too much of?

MR. STRAUSS: Yes, sir. That is an understatement. We really have no tin, except for some small deposits in Alaska, which are extremely high cost. The tin industry is a curious one, in that all the major sources of tin in the world are in underdeveloped countries, and consequently virtually all of the world's tin production must be exported, and it is for this reason that tin, probably alone among the major metals, is peculiarly well adapted for the instrument of international commodity agreements. There is one in the tin industry, as you know. The United States is not a member, but most of the other principal consuming countries are, and all of the principal producers are.

~~The commodity agreement can be made effectively simply by regulating the rate of export from the producing countries. This is the way in which they have undertaken to do it. In the case of a commodity such as copper that would be a very difficult thing to do, because in copper, since so much copper stays here in the United States, and a fair proportion of the Canadian production stays in Canada, a formula based solely on exports just wouldn't operate.~~

To get back to tin, the use of tin in this country has been static for a good many years. This is due primarily to the success of the steel industry in developing means of coating an equivalent surface of steel with smaller and smaller quantities of tin, getting a more uniform but thinner coating. I suspect they have gone about as far as they can go if they are going to stay with tinplate, and I think certainly in the food industries they will.

The other uses of tin that are significant are primarily in the brass and bronze industry, where it's a small alloying constituent, and in the production of solder, which is really important in all fields of metalworking. Therefore, even though our consumption of tin hasn't increased, our dependence on tin is still a significant strategic matter and it is important because our tin comes to us from overseas that we have a large stockpile of tin.

I think you can make an argument whether it ought to be a three-year, four-year, five-year, or, as at present, apparently close to a seven-year stockpile of tin. But certainly we need that.

The principal producing countries, with the exception of Malaya and Nigeria, all seem to have serious political problems. I don't think that you can expect

~~very much of an increase in tin production over the world.~~ This commodity is likely to get scarcer rather than more abundant as time goes on. That is, Bolivia, Indonesia, and the Belgian Congo, which are the other important sources, are all areas that have serious troubles, and in the case of Bolivia in addition there is reason to suspect that most of the mines have been pretty well worked out.

QUESTION: Sir, will you tell us the status of the bauxite deposits in Arkansas?

MR. STRAUSS: Yes. The bauxite deposits in Arkansas have been operation, I guess, ever since our aluminum industry got started. They will continue to produce, but the quality of the ore is deteriorating, and there is no possibility of production there being stepped up to supply any significantly larger fraction of our aluminum requirements than they do at present. In other words, it is a static situation which will continue to supply a small but possibly significant part of our needs. The ore now has to be beneficiated, which wasn't the case originally.

QUESTION: Will you tell us what the effect or what you think the effect will be of removing the quota system on lead and zinc?

MR. STRAUSS: If the quota system were removed overnight with no treatment of any kind with respect to existing tariffs, the result would almost certainly be a drop in domestic prices of lead and zinc, and therefore it would be something that the domestic producers would be most unhappy about. In the appearances made by the industry before the Tariff Commission, there has been

~~general agreement on the part of the industry that the quota system is becoming obsolete and should be replaced by something else. What that something else is varies depending on whom you are talking to. The people who are primarily domestic miners want rather substantial increases in tariffs. The people like ourselves who are both domestic miners and also importers of materials for processing here want somewhat smaller increases in tariffs.~~

Lead and zinc are both four-letter words and perhaps it is for that reason that they have run into so much trouble over the last 10 years. The lead and zinc industry has been suffering for 10 years now from the understandable reluctance of successive Democratic, Republican, and now Democratic Administrations to face up to the basic problem in the industry. We have been temporizing with it. The stockpile purchases, which were motivated not by strategic considerations but rather by simply the desire to help the industry--and there was good justification for that; I am not intending to be critical--were one step, and the quotas have been another. There have been small subsidy schemes such as the one Congress passed two years ago, which was purely a political gesture and has no real significance, and all of these things have been skirting the real issue. The real issue is that this country has only a few lead and zinc mines that can compete with the lead and zinc mines in other parts of the world.

If we want a substantial lead and zinc mining industry there's only one other way, really, to keep it going, and that is to have tariff protection, or what I would hope for, of course, to greatly expand the market of these two metals.

In the long run that is the real solution of the lead and zinc problem, and the

industry is working hard and has some prospects of that. But it won't come overnight.

QUESTION: Mr. Strauss, you speak of a direct tie-in in the production of selenium, tellurium, and <sup>some</sup> other elements with other major metal production.

My question is, is there any research under way to eliminate this direct tie-in and to produce directly some of these critical items, or is this technologically impossible?

MR. STRAUSS: It's technologically impossible. During the Korean crisis the Bureau of Mines did some work on a form of grass which is found principally in Wyoming and is supposed in some mystic way to collect the selenium natural constituent in the soil there and concentrate it. I think they actually did produce a little selenium by this process, but from a cost standpoint it was impossible.

No, it is not possible to produce them separately, for the reason that they are constituents of the very same ores, and you've got to mine the ores that have the copper, the lead, or the zinc in them in order to get the selenium and tellurium and the bismuth or cadmium. There is no other way to go about it.

A lot of exploration effort has been undertaken to find ores that are particularly high in these elements, but it has not been successful. You see, you are talking about one part in several hundred thousand of the original ore. The only other possibility is to improve the extraction or recovery of the selenium fraction in the ore, or the tellurium or the cadmium or the bismuth fraction. We have done a lot of work on that and have made significant progress.

But you can well understand that when you are looking for a needle that is

one part out of several hundred thousand, as I tried to illustrate in the case of selenium, you are going to have a hard time finding it, and you may not always get every needle that is in the haystack.

I think this is just one of these things of nature that we've got to live with.

QUESTION: Many of our advanced airborne weapon systems are operating in heat extremes which require the replacement of nonferrous metals by steel. Do you foresee developments in the future of the lightweight metals for use in our advanced weapon systems?

MR. STRAUSS: I am afraid I am not enough of a technologist to give you a good answer on that. My friends tell me that it is not likely. You are referring to things like, for instance, aluminum for airframes, I assume. I think it is rather unlikely that such developments will occur.

COLONEL McELWEE: Mr. Strauss, on behalf of Admiral Rose, thank you very much for a very stimulating hour and one-half.