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NATURAL RESOURCES AND WORLD POWER

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16 October 1952

COL. RINDLAUB: Today we are going to take up one of the basic elements of the Economic Mobilization Course, natural resources. Unit IV takes up all of those natural resources which form the base for our industrial machine, except manpower, and you are studying the subject of human resources at the present time in the Manpower Course.

A few years ago Professor W. T. Thom, author and Blair Professor of Geology at Princeton, presented what he considers are the component parts of power. His approach is quite unusual and very brief, so I am going to read it this morning. He said:

"For people to develop national power they must have developed and made use of power capacities as follows: first, a capacity for creative imagination and inventive art; second, a capacity to make use of large amounts of natural energy (by the production of coal, water power, and so forth); third, a capacity to produce ample supplies of agricultural and mineral raw materials; and fourth, a capacity for mass production manufacturing, involving highly developed technological research plus good team play between intelligent management and large numbers of highly skilled workers."

This concept of power is interesting because two of the four capacities which Professor Thom gives, the capacity to use energy resources and the capacity to use raw materials, both agricultural and mineral, pertain to natural resources, the subject that I am going to talk about this morning.

You are all familiar with the geopolitical concepts of power. In the first lecture which you had this year, the MacKinder-Haushofer theory and other concepts having to do with the control of land masses were explained to you. At least a part of this audience is very well aware of the concept of national power based upon sea power, and another part of this audience is undoubtedly well aware of the concept of national power based upon air power.

There is another concept which has been held by a large body of people for a long time, which was presented very vividly about 12 years ago by Leith, Furness, and Lewis, writing for the Brookings Institution. They presented the concept that all power is based upon mineral resources, wherever those resources may be, backed, of course, by adequate sea and air power.

It is not my purpose this morning to go into the relative validity of the various concepts of power. I am mentioning these various concepts only to point out to you that there is a large body of thought which

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believes that all national power is based upon the control of natural resources wherever they may be located on the surface of the globe.

With as well an informed group as this, it is certainly unnecessary for me to go any further into the importance of natural resources. Louie Hunter, in one of his first lectures, pointed out to all of you that natural resources are the base for our industrial production. They are more than that--for you all know that without natural resources you could not have food; you would not have clothing, and you would not have shelter. After all, the end products of our modern civilization are nothing but raw materials which have been worked on by the ingenuity of men, aided by mechanical and electrical power; and mechanical and electrical power themselves are derived from natural resources.

Unit IV is a very short course. There are only 12 periods allowed for it. The year's curriculum was made up on the supposition that you would meet in every branch of the College, directly or indirectly, natural resources, and you will. You have met them already in the Technological Progress Unit. In Manpower you get into the relationships between the labor force requirement for mining, for the agricultural industry, and for the manufacturing industry. In the Production and Procurement Units again, you get into the effect or availability of resources upon types and rates of production, and upon lead time. In the Requirements Unit you will find that the feasibility of plans very frequently depends upon the availability of resources. Natural resources are the very base of the Economic Potential Unit and, in the last unit of all of the course, you run into them again when you start studying controls, allocations, and most of the areas of mobilization planning.

For the rest of the time I am going to start out with a very short description of the classifications used in natural resources, for, when we start any new subject, it is essential that we are all talking about the same thing and that we know the meaning of the terms we use. Then I will speak for a few minutes about the growing rate of consumption of materials, and, third, I will talk a little bit about the United States situation with respect to natural resources. Before concluding, I will say a few words about the long-range picture, the thing you gentlemen do not hear about or see written about much.

CHART

All of you who have watched television quiz sessions or listened to the radio are familiar with the popular general division of materials into animal, vegetable, and mineral. Those are not the divisions that we normally use in the serious study of the subject. Normally we consider that natural resources are divided into two broad categories, mineral and agricultural. The agricultural resources are again divided into two parts, subsistence agriculture, or food, and industrial agriculture, which includes the things that are listed on the right-hand column.

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Frequently there is no clear-cut division between these groups of resources. Some foods are also used for industrial products. I think all of you are familiar with at least one use of corn as an industrial product.

On the other side, mineral resources are normally divided into metallic and nonmetallic minerals. Under the heading metallic, the ferrous alloys and nonferrous groups, are self-explanatory. The non-ferrous group include copper, tin, and zinc, as well as other metals, plus the light metals. The light metals are frequently drawn aside into an individual category, which includes aluminum, magnesium, and titanium. The nonmetallic minerals include principally building materials, ceramics, and fertilizers.

In addition to the general division which is shown on the top of the chart, we frequently use another division which pulls together all of those materials which produce our energy resources. You can see them listed: Coal, petroleum, shale oil, natural gas and water power.

There are a lot of other terms with which you have to become familiar, different kinds of reserves, and so forth. I am not going to go into them this morning. The definitions for those terms are contained in the natural resources monograph, which unfortunately has not come back from the printer, but which should be issued to you early next week.

So much for terms and classifications.

The growth of our consumption of materials during the last century or century and a half has been phenomenal. I think all of you know, when you stop to think about it, that almost all of the industrial developments of mankind have really taken place during the lifetime of people in this room. What we don't stop to consider is that this growth of industrialization has been accompanied by a very rapid increase in our rate of consumption of materials. The United States has been using materials faster than any other nation--we have grown faster. As you have been told several times, our gross national product has increased on the long range about three percent per year, and our use of materials has increased at nearly half that rate.

CHART

Here is a chart which I calculated from data given in the report of the President's Material Policy Commission, which was just released last June. It shows how much we have increased our consumption of metals from 1900 to 1950. This chart is in index form. You will note that 1900 is the base year, and you will see that we doubled our 1900 consumption of metals about 1915. Our consumption trebled about 1929, took a drop during the depression, started up again and, in 1950, we were using five times the amount of metal that we had used in 1900.

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Well, what does this mean to us? What do we care? We wouldn't care at all if our production within the United States was keeping pace with our consumption, but it isn't--and that's why all of us have to be interested in this subject.

There are some minerals, such as coal, which are widely distributed throughout the surface of the globe. There are others, especially the alloying metals, which are found only in scattered, isolated pockets, irregularly spaced on the surface of the earth. Now, it follows from this that no nation can approach self-sufficiency in metals unless it covers a wide geographical expanse; and no nation is self-sufficient. We need very much, for our modern civilization, and especially for our war production, these special alloy metals which are found only in irregularly spaced pockets on the surface of the globe. That is the penalty we have to pay for the technological achievement without which we could not have the new metals of high strength and other characteristics which allow our modern military machine to be built.

Since these metals are so irregularly scattered, we can't have all of them within our boundaries. We don't have the, and we are dependent on foreign sources, as every other nation is, for many of our critical supplies. The United States must keep up trade relations with many scattered foreign areas, and the military forces must be prepared to keep open lines of communication to those areas, if we are going to maintain our production at full speed.

What concerns you particularly is the United States situation, of course, so I am going to say a few words about that. At the time of the First World War, we thought we were a nation of plenty--everybody did--and, as a matter of fact, we were. Except for a very few items we had all we needed. Of course we were short of rubber, and of tin, and we were short of two or three other things, but the situation wasn't very serious.

Between the two World Wars, there were a few people who began to realize that we were becoming shorter and shorter of a growing number of materials, but nobody paid too much attention to it except these few.

At the beginning of the Second World War, we came hard up against the fact that we were short of a great many minerals and other materials. We were in a bad position throughout, and we went to all sorts of extreme means to remedy the situation. During the war our production of durable goods reached heights which we had never dreamed would be possible, and the nation supplied the equipment which was needed both for ourselves and our allies to win the war.

However, in doing so we drained from our mines and from our oil wells a large proportion of the non-renewable resources upon which this

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country's growth, its strength and its power were based. After the war, numerous government agencies and civilian groups, realizing thoroughly the seriousness of the situation, began making detailed studies on how we stood, and this is about what they found.

Insofar as agricultural resources are concerned, our position today is pretty good. We produce more food than we need, and we can increase the caloric value of that production, by shifting from meat to grain production. The development of our synthetic rubber plants has put us in a good position with respect to rubber. We would not be in a good position with respect to wool, manila hemp, jute, and other fibres, had it not been that we have, during the past few years, made great strides in the development of substitute fibres. We are short of a few medicinals and chemicals, but all in all our agricultural picture is pretty good.

How about our mineral picture? It is not so good.

CHART

This chart also is taken from the President's Material Policy Commission, or rather calculated from data of that commission. It shows our growing dependence upon outside sources for metal. It is in ratio form. The orange part of the chart indicates our imports; the imports of metals which have been necessary to keep our economy going. You will notice from about, well, say 1920 on, we started to be really dependent, on the whole, for metals. That dependence has increased right along until today we have to import over 40 percent of the metals which we use.

This is of course only an over-all picture, and any average picture hides the more critical parts of it. There are many metals where our position is much worse than is shown by this chart.

Insofar as petroleum is concerned, our situation right at the moment, and for the past few years, is and has been pretty good. We have for the last 15 years always found enough reserves so that our proven reserves at current rates of production indicated a supply of from 12 to 15 years. We always have been able to find enough new oil to keep our supply at current rates of consumption about the same.

Coal, we have lots of, except the best metallurgic grades. It is going to last us for several decades at least; maybe for many decades.

To sum up this picture, there are over 75 materials which are now on the strategic and criticals list of the Munitions Board. You were issued as you came in a handout developed by the Bureau of Mines, which shows the increasing dependency of the United States on outside sources of materials. The sheet as a whole covers 38 items which are most used by industry. If you will look in the center column, about the middle,

you will find lead. Notice its position and remember that lead is a very common mineral which we have always accepted as available. For the Air Force in particular, lead is an essential item--it is part of aviation gasoline. From the middle of the center column down we have to import over 50 percent of the metal that we need.

Look in the third column, and what do you find? Here we find that we have to import 90 percent or more of that list of items. Look at what some of them are. Cobalt--all of you in the Air Force, at least, know the absolute necessity for meeting our requirements of cobalt. It is the same way with other items, right down that line.

Hasn't the government done anything about this picture? You can see from the existence of this chart that they are doing something about it. Let's leave the chart now for a minute.

For years the Bureau of Mines and other government agencies have been developing research and finding new methods of exploration and exploitation of metals and other materials. Various government agencies have been working on conservation; conservation to prevent the waste in the mines, to decrease it. For instance; we leave 30 to 40 percent of the existing coal in a mine every time we abandon it. Government agencies have been working on conservation and other forestry techniques to raise our timber replacement rate to a level equalling our cutting rate.

So we have been doing some things. But Congress, you know, doesn't turn loose money very easily for long-range future things, unless they get some impetus to do so, and it wasn't until Korea that we were really able to get money enough to start going. Since Korea the government has, through various types of financial incentives, increased or caused the increase of production to a considerable extent. The income-tax laws for the last two years have allowed the rapid amortization of the costs of exploration and of the erection of extractive plants to produce new supplies of raw materials.

We have been for a good many years building up a stockpile, and this build-up has increased very greatly in the last two years. However, at the present time, or rather as of the report of the 30th of June, in money value the stockpile was still only about one quarter filled, and one quarter filled in money value doesn't say anything about balance. That's a point to remember.

So through a combination of government work and independent work by industry, not always in harmony, we have done a great deal in the last few years to ease our critical situation with respect to minerals. Nevertheless, our situation over the next few decades, doesn't look good, and especially it doesn't look good in case of an all-out war.

Our very dependence in time of war on outside sources for materials means that we not only have to keep a favorable political climate in

our source nations but we have to keep open routes of communication to those nations. It is interesting, I think, to see what routes of communication we need.

CHART

Let's start with Africa. From Liberia, Nigeria, and the Gold Coast we need columbite, we need rubber and we need manganese. From the area of the Belgian Congo, which is one of the richest sources of critical raw materials in the world, we need tin, tungsten, columbite, cobalt, palm oil, industrial diamonds, and many other things, all of which we practically have to have in case of war. We need the vast mineral supplies of the Union of South Africa. We need the copper, the sisal fibre, and the chrome of Rhodesia and Tanganyika.

So we have to keep open supply lines down the East Coast of Africa, up the West Coast, and to the East Coast of North America. In addition to that we need a supply line from India, because India is now our principal source of the manganese which we used to get from Russia. We cannot produce a single ton of steel without manganese. You can't do without either manganese in the ore or added manganese. It is required in the purification process for making steel.

Let us go to South America. From British Guiana and Surinam we get the bauxite without which the Canadian and American aluminum plants could not operate. From Brazil we get the mica and the quartz crystal and other things which we need. From Venezuela we get iron ore. We need a supply line along the East Coast of South America running to both coasts of the United States, because we have aluminum plants on the West Coast, we are building more in the Northwest, and we have plants on the East Coast of the United States. Besides all that, we need the bauxite of Jamaica.

On the West Coast, the Pacific side, of South America, in the area of Chile, Bolivia, and Peru, we need, and we need desperately in a war situation the copper, the antimony, the tungsten, the tin, and other metals that come from that area. So we must keep a supply line open from this area, most of the material going to the Atlantic Coast of the United States.

And then go over to Southeast Asia. From here we need the tin and tungsten of Thailand and Burma, the tin and rubber of the Malay Peninsula, the tin, rubber, and bauxite of Indonesia, and we need the chrome of the Pacific Islands.

That sets up another supply line. We need chrome and manila hemp from the Philippines. And then, last of all, we need the wool of Australia, for our uniforms, if nothing else, as well as its tungsten and other minerals.

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So you see that there are bands of supply lines that we need to keep open in time of war, due only to our deficiency of minerals and other resources. The most important of these supply lines, of course, are those from Africa and from South America.

All that I have said so far has been widely written about in popular magazines, scientific publications, and government pamphlets, and has been discussed in hearings before Congress.

Now I would like to talk for a minute about something which is not so widely publicized, and that's the long-range situation. Geologists point out that there are under the surface of the earth, undiscovered as yet, great deposits of minerals which will be available for our use when we have developed the means of finding them and the methods of extracting them economically. Scientists, extolling the progress of technology, point out the great increases which have been made and are being made and will be made in our efficiency in agriculture, and predict that we will be able to substitute agricultural products for our scarce minerals. Geologists also point out that there are, close to the surface of the earth, large quantities of low-grade ores which we can use in the future at greater real cost, when we have developed methods of using them, and we are developing the methods.

All of these views are, to a great degree, correct. But we must remember that we have been conditioned during the past few years by a combination of fact and fiction to believe that almost anything can happen by the year 2000--rocket passenger traffic to the moon, for instance. We are beginning to get into the attitude that Oscar Wilde expressed when he wrote, "I can believe anything, provided it is incredible."

One is frowned at today if he even so much as suggests that our modern civilization may be in any future danger due to the depletion of minerals. It just isn't the popular thing to do. We are to sit back and say, "The scientists will take care of us all." I think this blind optimism requires a little bit of investigation, for regardless of the number of deposits of minerals which may be found in the future, some time there is an end to those resources. You can't grow more metals in a mine, regardless of the number of deposits that there may be. They are going to be exhausted some day, and maybe in the not too far distant future. I think all of us would like to see the world exist for our children and our grandchildren.

Man has existed on earth for some 500,000 years--100,000 or so either way doesn't make any difference. He has been using minerals for about 5,000 years. He has been fabricating terrestrial iron for about 3,000 years. But almost all of his consumption of metals has taken place in the last century, or century and one-half. From the beginning of the First World War to the end of the Second World War, we consumed more minerals than had been consumed by man in all history.

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To take a specific example, we have consumed more coal since 1937 than was consumed by man in all history. Put that up against the fact that you heard a couple of weeks ago that scientists consider that the earth will be suitable for mankind for about five billion years. Something may be wrong with the picture.

There have been numerous attempts to estimate how long the world's resources are going to last. Most of these are on the optimistic side, for they make their predictions on the basis of current consumption. You remember that I said that since 1880 our consumption of many metals has more than doubled every twenty years. Mr. Elmer Pehrson, an eminent economic geologist of the Bureau of Mines made some predictions last year in a United Nations publication. He showed that at current rates of production, our known world reserves of copper will last about 45 years; lead, 33 years; tin, 38 years; zinc, 29 years. I think most of us hope to live that long.

On the other side of the picture, of course, we are finding more reserves all the time, and it is a race between the finding of reserves and the increasing of our consumption of minerals. In the United States, though, we are losing this race, and we are losing it very rapidly, as you can see by the chart that I showed you on ratios of imports.

Some scientists have said, as I mentioned--and you have heard it from the platform, too--that we are going to be able to replace our mineral resources when they are gone, with agricultural resources. Well, that's very fine, but there's a little bit of a catch to that. The world population is growing at a very very rapid rate. Most of it is underfed at the present moment, and there is considerable disagreement between experts as to whether or not that growing world population can even be fed in the future.

We have another group of scientists that come along and figure independently that they are going to use agricultural production to substitute for scarce minerals. I think there may be some doubt that there is going to be enough arable land in the world for both purposes. You see, we have two opposing forces, both trying to use the same land. Sometimes when we hear things and think of things like this, it is a good thing to remember that occasionally we hear an expert defined as a person who avoids the small errors as he sweeps on to the grand fallacy.

There is another more immediate pessimistic view that I would like to give you, although I don't like to be typed as a pessimist completely. How do our rates of consumption with respect to our reserves compare to those in the U.S.S.R--in the Soviet area? I think any examination you make of data which is available will show you that we are using up our resources in the United States much faster than the Soviet Bloc is.

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I have a chart to show that, which I am not going to take time to expose now, but it will be up during the break and you can look at it if you want to. If we keep on using up our reserves faster than Russia-- and we are in a long-term conflict with Russia right now--if that extends over many decades, where are we going to stand in the end?

I think it is something we forget, and something we ought to very seriously consider.

Well, gentlemen, that's the natural resources picture as I see it.

QUESTION: In looking over this handout I notice that the production of mercury was adequate during the war. I assume that means that we have low grade reserves which can be exploited.

COL. RINDLAUB: We have sub-marginal reserves, that is correct. Of course that is a question of the efficiency of the use. The dependence on sub-marginal reserves is a question which is fought over all the time among the minerals people. We can greatly increase our production of certain minerals in the United States if we pay enough for them. If you listen to the purchasing agents in the metals field, they will all tell you that we can get all the materials we want in the United States if we will put up high enough prices for them. They are the most optimistic gang of people alive. All they want is to see the price go up.

In the natural resources situation you run into very different statements, depending on who says them, what their background is, what they are tied to. Industry right now is rabid against the government--that is, the metals industry, because they claim that the government, through its exercise of control and its publication of what they say are highly erroneous estimates of the shortages which would occur in the last two years, has caused industry to lose millions of dollars. The price of metals is going down. Copper dropped down to 13 cents. That's pretty low. It all depends on who is talking.

There's another item about most of these sub-marginal reserves, too. I think we should realize that most of them--I don't believe it is quite so much true with mercury--but most of them we can't open up in a hurry. It takes two to five years to develop a mine, and with a good many types of mining, when you once close a mine, sometimes it is harder to open that mine again than it is to start a new one, because of flooding, the rotting of timber, cave-ins, and so on.

This sub-marginal picture isn't all gravy, by any means.

QUESTION: I think we have heard both that we need natural rubber and that we are self-sufficient in rubber. What is the economic picture on rubber?

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COL. RINDLAUB: I think industry at the present time is using about 80 percent synthetic right now. Industry people--I heard some talking in New York about three weeks ago--think, some of them, that they need about 20 percent natural; they would like to have it. We have to have natural for our big truck tires. We have to have natural where we get into the big flexing of rubber, which causes high heating. Now, the synthetic rubber people will tell you--I have heard them say, the experts in that game--that you can use synthetic rubber for over 95 percent, and pretty close to 100 percent of your needs. The rubber industry doesn't say that. So we probably need about 20 percent of natural, and we are stockpiling and rotating the stockpile in order to keep our supply fresh.

QUESTION: You have zero, zero, zero for quartz crystal.

COL. RINDLAUB: I haven't. That's the Bureau of Mines.

COMMENT: We were making those in 1947.

COL. RINDLAUB: We were, to some degree, and we are rapidly developing an industry which can produce synthetic quartz. Correct.

COMMENT: It is cheaper than you could import it.

COL. RINDLAUB: It may be. I don't know.

COMMENT: Synthetic quartz isn't so good. It doesn't work out as well as claimed.

COL. RINDLAUB: You see, that's what you get into. That illustrates my point about as well as anything that could happen.

QUESTION: The picture on manganese is very disturbing. According to your opinion this morning, my question is along that line. It seems conceivable that our lines across the Atlantic or Pacific, or both, can be cut to the extent that this supply of manganese from India would be non-existent. Do you happen to know of any plans of industry or the government to take care of a situation like that, except by stockpiling?

COL. RINDLAUB: Yes, we have other sources of manganese, other foreign sources, all small amounts, which together amount to a considerable volume. However, we are--I say "we"--the government and industry are working on domestic sources of manganese, and one very large source which exists is in the slag piles, reworking of the slag piles. There's a lot of manganese in the slag piles scattered over the surface of the United States which can be used in an emergency and may be used commercially. We are getting the prices down to a reasonable figure now.

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QUESTION: Referring back to your transportation chart there. I have heard recently that the rail facilities and port facilities in Africa are such that they could not handle the tonnage on materials that would be required in the event of full mobilization. Will you comment on that, please?

COL. RINDLAUB: I don't know too much about that situation. I know there's trouble. I know they're building some railroads. I think one difficulty is in the road from the interior of the Belgian Congo to the Coast. I'll have to confess I am not up on such developments as that. Does anybody know?

COMMENT: I'll take care of that in my paper, Colonel.

QUESTION: In the energy picture, I notice you have skipped over the nuclear and solar energy. You don't agree with Dr. Conant that the solar energy will remain?

COL. RINDLAUB: I think our future with respect to the energy sources is better than any other. We have water power, which is a renewable source. Our resources of coal are the largest of any that we have. We are going to have some time to develop energy resources, and then we do have our radioactive sources of energy. So the energy picture is really better than any other picture.

QUESTION: I wonder what the status of the natural rubber production in Malaya is since the war, and who get it now.

COL. RINDLAUB: I can't answer that specifically. Since three years ago I haven't specifically looked into it.

QUESTION: Didn't we at one time take most of that in the United States?

COL. RINDLAUB: We took a large part of it, because our tire production was by far the largest in the world. We get a good portion of it now, I know. The rubber production has been down. It went down right after the war, and it came up gradually; but all the trouble with guerrillas in the Malay Peninsula and the revolution in Indonesia and various other factors have served to keep the production of rubber in those areas down. In the last couple of years it has come up some. To what extent, I can't answer the question. Do you happen to know?

COMMENT: I think there is a waste in the production of rubber in Malaya. The actual production has been away above the peak of World War II. The reason for the waste has been because the plantation owners, most of whom are British, have to operate using guns at all times, and they are cutting incisions on the trees much faster than the normal rate.

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They are really utilizing the existing resources of Malaya much faster than they are growing rubber. The United States has been taking--if I am right--about 40 percent of the output. Of the rest, about 40 percent goes to Western Europe and other countries, and Russia has been buying in very large volumes, too, in the magnitude of about 50,000 tons per year.

COL. RINDLAUB: You spoke about this high rate of cutting, though. Isn't there some disagreement about that, that actually the high rate of cutting that was practiced during World War II didn't turn out to be as detrimental to the rubber trees as they thought it was going to be?

COMMENT: What I read was a report by the British Rubber Association, and it was that they were concerned about the high rate of cutting. The point is that the guerrillas are cutting the trees, too, making several incisions in the trees.

QUESTION: Your presentation of our problem in minerals was excellent, but I found myself wondering what conclusion you were leading to, Colonel. Certainly we can't cut down on our minerals--they are the source of our productive power. On the other hand, we cannot divert too much of our resources to stockpiling, because that also tends to reduce our productive capacity. We are also trying to stimulate, I think, the maximum production in foreign areas--in Africa, say--of these minerals. Do you have any conclusive direction here, for the lecture?

COL. RINDLAUB: Yes. If I had another half-hour I would be glad to go into it. But principally I think we can say these things: We have got to keep on using materials. There are a great many disadvantages in cutting off our domestic supply, stopping our domestic production, because if we did that and relied entirely on imports entirely aside from the strategic situation, we would be closing our mines, closing up oil lines, and probably we would lose a large proportion of the minerals in those places, because the mines would collapse, and so forth. We would probably lose because we would lose our trained mining labor, our technical personnel. We would lose because our incentives to do more exploration would disappear.

So I think most people feel now--although it was the thing to do perhaps ten or twenty years ago--most people feel now that cutting off our own production and relying on imports isn't a good thing for us economically.

Well, about the only thing that leaves, then, is conservation practices. How many tons of metal do you use every morning to come from your home, and how many tons do you use to return home? It is sort of foolish, isn't it? How much gasoline, how much lead, do we consume every day getting to and from the office?

In our forests we are still cutting saw timber much faster than we are replacing it. In our mines we are leaving in the ground in a condition where we can probably never get it, 30, 40, or 50 percent of the metal the mine contains. We made great strides in oil production. We are beginning to get a greater percentage of the oil that is in the ground, but we are still leaving a lot there.

In other words, there's a tremendous field for conservation practice. What are you up against? You are up against the American public, in the first place. They have to have the biggest of everything--not what they need--what they would like to have--what Mr. Jones has. You are up against a conflict between private interests and government on who is going to do the controlling. You are up against a conflict between state and federal government.

About the only thing we are going to be able to do, other than develop substitutes to the best of our ability, is to practice many kinds of conservation; anti-corrosion practice, the coating of metals so we won't lose them so fast; the more complete reclamation of scrap. There's no reason why we can't gradually develop processes where we reuse almost all of the steel, for instance, and copper, so that we don't waste 60 percent of it. How do we waste it? Well, it is wasted when we scatter it over the surface of the globe and don't get it back again.

Military forces are the most wasteful of any. We shoot iron all over the hemisphere. We sink ships, sink planes, drop them in the ocean; that's the end. Right now, in our military program--we can't avoid it, but what are we doing? We are shipping out of the country vast tonnages of our own resources.

What the exact solution is, I don't know. The main reason I am bringing this all up is, there are things we ought to be thinking about that none of us do think about. There are very few of us who stop and think of what we are doing in the United States and where we are heading.

But the immediate answer is more conservation, in the broadest use of the term.

I am sorry there's no more time for questions. I am going to turn the group over to Dr. Reichley.