

age. The only alternative is to hope that such situations afford us sufficient leadtime, and that capital will materialize to support developments that have uncertain long term economic aspects.

If you look back at World War II we decided to produce aluminum from clay. We have plenty of clay. But if I recall the figures, we only produced about 50 tons of aluminum, and none of it was satisfactory.

In other words, the 4 years of World War II was too short a time to gear up for aluminum from clay production. And this is the problem. We can't suddenly switch from domestic production on an economic basis if our supplies are cut off; we have to have leadtime, 5 to 10 years. And if we don't have it, we are likely to face a crisis.

Senator ALLOTT. Along the lines of what you have been saying, Dr. Hibbard, this may not be true 100 percent of the time, but it would be true that in every instance that we have been caught in a national emergency, and have had to increase the supply of minerals from foreign countries, we have been caught in the box of higher prices, haven't we, almost entirely? There may be one or two exceptions, but this has been generally true.

Dr. HIBBARD. Yes; that is true. Shall I continue?

Senator GRUENING. Please continue.

Dr. HIBBARD. We understand the need for stockpiling as a security measure but we must not let our present favorable position in this regard obstruct our understanding of the significance of assured overseas supplied in meeting the growing domestic needs for many critical materials.

III. ACCOMMODATING TO CHANGING END-USE PATTERNS

The third important area is the accommodation to changing end-use patterns.

Those of us associated with the mineral industries must remain alert to the supply problems inherent in a continuous changing pattern of mineral demand. We must provide ourselves with techniques that can be applied to detect the imminence of change, to estimate its magnitude, and to reduce the potential hazards it represents to the nation's economy and security.

The demand for mineral raw materials is constantly shifting in terms of quantities, form, and substance, and the supply is subject to similar changes in quality, abundance, and source.

Reflect for a moment upon the dramatic examples of changes in the pattern of demand for mineral substances over the past few decades. At the beginning of this century we relied almost wholly upon coal to satisfy our energy needs. The significance of petroleum and natural gas as predominant energy sources has materialized subsequently over a very short time frame and the appearance of nuclear energy is so recent that its future in the total energy picture continues as a favorite subject for speculation. Similarly, a host of new minerals and metals have become important items of commerce only during very recent years, and even more dramatically, the way materials are used and synthesized has changed and progressed repeatedly. A few metals like iron, copper, lead, zinc, mercury, gold, and silver made up the basic items of commerce for centuries. But since 1900, the growth in significance of metals like aluminum and magnesium