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BY THE COMPTROLLER GENERAL

# Report To The Congress

OF THE UNITED STATES

COASTAL ZONE
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# The U.S. Mining And Mineral-Processing Industry: An Analysis Of Trends And Implications

The report analyzes the decline of several U.S. mineral activities and the resulting increase in reliance on imported minerals. The trends have contributed to (1) increased concern about possible supply interruptions, (2) lost jobs and job opportunities in the mineral industry, and (3) pressure on the U.S. balance of trade.

The causes for the decline are complex, but the report discusses several U.S. Government policies which, in order to achieve other objectives, have contributed to the decline, including access to public lands, environmental requirements, antitrust regulations, and health and safety requirements. Conversely, some foreign governments' policies tend to enhance and encourage their mining and minerals industries.

The report shows the need for better understanding of the cumulative effects of Federal policies on the industry. It suggests that the Congress should give serious consideration to establishing a mechanism to better identify national interest concerns in the industry and to identify and resolve conflicts between goals in the minerals area and those associated with the environment and other national interests.

U.S. General Accounting Office

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COMPTROLLER GENERAL OF THE UNITED STATES
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To the President of the Senate and the
Speaker of the House of Representatives

This report on the declining U.S. mining and mineral-processing industry points out the specific impact of Government actions on the mineral industry and the need to improve the consideration being given to the consequences of Government actions and the resolution of conflicts between national policies to assure that the overall national interest is served.

Copies of this report are being sent to the Director, Office of Management and Budget; Secretaries of State, the Interior, the Treasury, Commerce, and Labor; and Administrator of the Environmental Protection Agency.

R. F. Keller
ACTING Comptroller General
of the United States

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COMPTROLLER GENERAL'S
TO THE CONGRESS

# THE U.S. MINING AND MINERAL-PROCESSING INDUSTRY: AN ANALYSIS OF TRENDS AND IMPLICATIONS

## D I G E S T


Although the United States is rich in minerals, the future of several segments of its mining and mineral-processing industry is dim, and U.S. manufacturers are relying more and more on imported mineral products.

The causes for this decline are complex. One factor is the cumulative effect of U.S. Government actions which, although in response to legitimate public concerns, have tended to discourage investment in domestic mineral projects. By contrast, many foreign governments encourage development of their minerals production.

GAO analyzed many of the trends in the U.S. mineral industry, concentrating on zinc, ferroalloys, copper, and aluminum, and found that:

--The closing of several zinc-processing facilities has reduced domestic capacity by almost 50 percent and imports of zinc metal have increased 89 percent. (See p. 5.)

--Imports of chromium and manganese ores for use in making ferroalloys have declined while imports of ferroalloys have increased substantially. (See p. 7.)

--Despite forecasts of annual growth in copper demand, no major new smelter or refinery capacity is likely before 1985; meanwhile imports of refined copper over the last 10 years have risen from 6 percent to over 19 percent of U.S. consumption. (See p. 8.)



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--Although demand for aluminum is forecast to grow at about 7 percent annually through 1985, U.S. aluminum production capacity is only growing at 1.4 percent annually and imports of aluminum are expected to double by the year 2000. (See p. 9.)

GAO's analysis concentrated on U.S. and foreign government actions that influence these trends, particularly economic access to minerals, development and financing costs, labor costs, and energy availability and price. Because of limitations on available data, GAO did not attempt to quantify the extent to which these actions have contributed to the shift of mineral processing overseas or the extent to which changes in U.S. policies could reverse these trends. However, these actions are increasingly affecting market forces in the industry. For example, the U.S. Government:

--Limits the use of Federal lands for mineral exploration; some countries are actively encouraging and sponsoring exploration. (See p. 19.)

--Imposes strict environmental requirements which add significant costs to the development of domestic mineral projects; some countries are either more lenient in their enforcement or provide assistance to defray costs. (See p. 26.)

--Restricts the use of joint ventures to pool resources and share risks; some countries not only encourage joint ventures but often participate in the financing of projects through direct grants, loans, and loan guarantees. (See p. 34.)

--Adds to the cost of labor by imposing worker health and safety requirements; some countries are more lenient in their enforcement, use different techniques to protect workers, or provide assistance to defray costs. (See p. 38.)

In addition, the absence of a clear U.S. Government energy policy and the restrictions which delay or halt construction of power-generating facilities have created much uncertainty as to the future price and availability of energy supplies needed for the mineral industry.

The decline of the industry has resulted in (1) increased concern about U.S. vulnerability to supply interruptions, (2) lost jobs and job opportunities in the mineral industry, and (3) pressure on the U.S. balance of trade. (See ch. 5.)

The Congress enacted the Mining and Minerals Policy Act of 1970, thereby reaffirming its interest in an economically sound domestic mining and mineral processing industry. That general policy expression was prompted in part by growing concern over the degree to which the Nation was becoming dependent on foreign mineral supplies to satisfy domestic needs. Subsequently, the Congress enacted much more specific legislation pertaining to other national priorities and social goals, such as energy, the environment, and land conservation and use. Implementation of programs for achieving these national goals has tended to aggravate the circumstances which prompted adoption of the 1970 Mining and Minerals Policy Act.

Without a definitive policy for guidance, Government agencies responsible for developing and implementing national policies have little or no basis for making difficult tradeoffs between conflicting mandates. In addition, no criteria or organizational basis exists for considering other alternatives to mitigate trends or events harmful to the domestic mineral industry.

Congressional committees should focus on developing a mechanism for objectively considering the consequences of Government

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actions and for resolving conflicts between policies to assure that the overall national interest is served.

AGENCY COMMENTS

The Department of the Interior agreed that:

--There is a definite trend toward increased imports of processed versus raw materials and this trend is likely to continue in the future.

--Changes in U.S. Government policies over the last 10 years have increased the cost of mining and processing minerals in the United States.

--Some improvements may be appropriate in considering the consequences of Government actions and for resolving conflicts between policies to assure that the overall national interest is served.

However, it did express some concern with the lack of quantified evidence and the apparent reliance on interviews with industry officials and that the report indicated that the Department of the Interior is solely responsible for implementing the Mining and Minerals Policy Act of 1970. (See app. II.)

GAO agrees that the quantification of the impact of each factor on the trends in the mineral industry would be useful; however, doing so was beyond the scope of this report and was not necessary to conclude that the Government should become more aware of the effect of its actions on the mineral industry. GAO did interview corporate officials and reviewed corporate record and reports, but its conclusions were also based on corroborations from academicians, investment analysts, banking officials, U.S. Government officials (including those of regulatory agencies), and officials of foreign governments and corporations.

Although GAO agrees that any agency which deals with the mineral industry has responsibility for carrying out the 1970 Mining and Minerals Policy Act, the act does give Interior prime responsibility for its implementation. However, Interior, as well as other agencies whose actions have adversely affected the mineral industry, has largely ignored the act.

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## ABBREVIATIONS

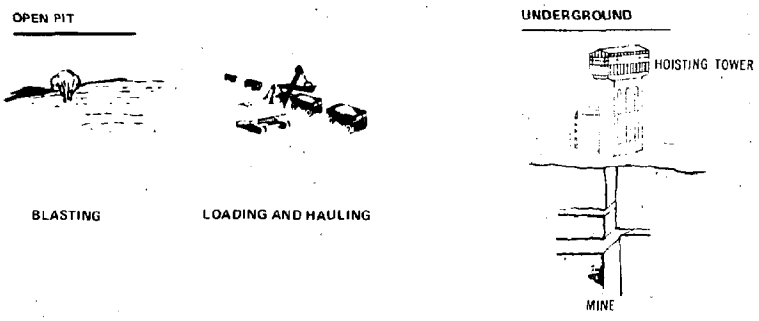
| | |
|---|---|
| BPA | Bonneville Power Administration |
| EPA | Environmental Protection Agency |
| FPA | Federal Preparedness Agency |
| GAO | General Accounting Office |
| OSHA | Occupational Safety and Health Administration |
| PASNY | Power Authority of the State of New York |
| TVA | Tennessee Valley Authority |

## GLOSSARY

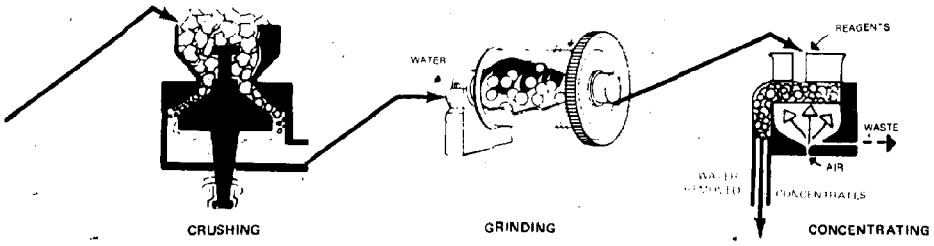
| | |
|---|---|
| alloy | A substance having metallic properties and composed of two or more chemical elements, at least one of which is a metal. |
| concentrate | Ore that has been treated to increase the percentage of valuable metal(s) within it. |
| concentrating | Mechanical and chemical treatment of ores to remove waste materials. |
| ferrous metal | A metal with iron as its major constituent. |
| nonferrous metals | Metals other than iron and its alloys in steel; usually applied to nonprecious metals such as copper, lead, and zinc. |
| ore | A natural mineral or mineral aggregate containing metals in such quantity, grade, and chemical combination as to make extraction profitable. |
| milling | The grinding or crushing of ore: it may include removal of valueless or harmful constituents and preparation for market. |
| primary metal | Metal extracted from ores, natural brines, or ocean water; also called virgin metal. |
| refining of metals | Operations performed after crude metals have been extracted from their ores to produce the metal in higher levels of purity. |
| reserve | An identified mineral commodity which can be economically and legally extracted. |
| resource | A concentration of naturally occurring material in such a form that economic extraction is potentially feasible. |
| secondary metal | Metal recovered from scrap by remelting and refining. |
| smelting | A reduction process, conducted in a furnace, in which metal is separated by fusion from those impurities with which it may be chemically combined or physically mixed, such as in ores or concentrates. |

## TYPES OF MINERAL ACTIVITY 1/

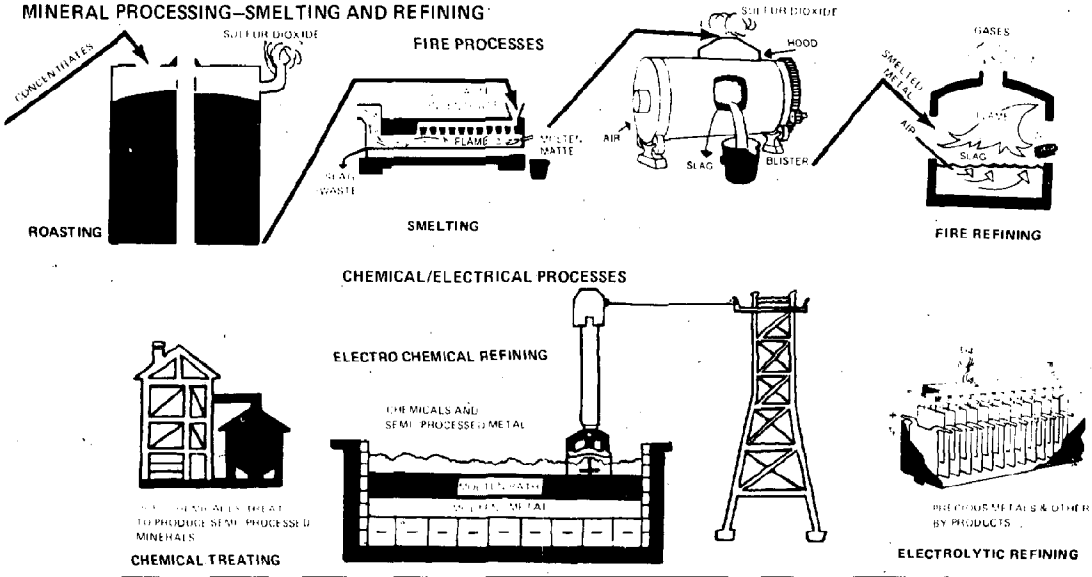
### MINING



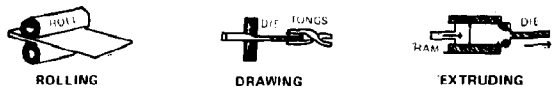

### MILLING AND CONCENTRATING




### MINERAL PROCESSING–SMELTING AND REFINING




### FABRICATING OF PROCESSED MINERALS




*1/ THE ACTUAL ACTIVITIES USED VARY FROM METAL TO METAL AND ORE TYPE TO ORE TYPE.*

*FOR A GENERAL OVERVIEW OF THE PROCESSING STEPS GENERALLY USED FOR THE FOUR METALS DISCUSSED IN THIS REPORT ZINC, FERROALLOYS, ALUMINUM AND COPPER–SEE APPENDIX I.*

# CHAPTER 1

## INTRODUCTION

Assured access to mineral 1/ resources at prices established in competitive markets is important to the economic health of the United States. The question of resource availability and the extent to which the United States should rely on foreign mineral sources is complicated by national goals or policies which often operate at cross purposes. Also, to a large extent, traditional economic factors, such as remoteness of projects, ore grade, facilities and equipment needed, and access to capital, influence trends in the domestic and international mineral industries.

Compared with most nations, the United States is rich in mineral resources. 2/ Domestic smelters and refineries, using foreign ores and concentrates to supplement domestic mine production, have provided U.S. manufacturers with the majority of their mineral needs.

In recent years, however, several U.S. Government actions have reduced the profitability of domestic mineral projects, making investment in such projects less attractive than they otherwise would have been. These actions and the efforts of some foreign governments to encourage development of their minerals production have contributed to the failure of investment in domestic mineral production to keep pace with growth in U.S. demand. And, U.S. manufacturers are having to rely more and more on foreign processed minerals to meet their needs.

Some people contend that this trend is good because the United States can save its resources for future generations. This argument assumes that (1) mineral resources are approaching exhaustion and (2) the difference between the cost of extracting minerals and the price received for them is increasing fast enough to make delaying the earnings more profitable. However, these conditions have not been

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1/Unless otherwise specified, the term mineral as used in this report refers to nonfuel minerals and excludes coal, oil, uranium, etc.

2/Essentially, mineral richness is a function of land area. As would be expected of a geographically large country, the United States ranks first in reserves of copper, cadmium, lead, molybdenum, and silver and ranks high in many others.

historically true. The National Commission on Supplies and Shortages' 1976 report, "Government and the Nation's Resources," stated that:

> "The geologic, economic, and demographic evidence indicates that no physical lack of resources will seriously strain our economic growth for the next quarter century and probably for generations thereafter. Judging by past trends, the estimates of most reserves will increase; for the few cases in which crustal exhaustion is remotely likely, there will be sufficient warning for adjustments."

Another study 1/ of 14 depletable commodities, including aluminum, bauxite, copper, iron ore, and zinc, covering 1900 to 1975 showed that forced resource holdbacks beyond those in response to market forces would not have been economically beneficial to any generation. The study also showed that technological advancement can render unexploited natural resources valueless for future generations.

The Congress enacted the Mining and Minerals Policy Act of 1970 to declare that it is the continuing policy of the Federal Government in the national interest to encourage private enterprise to (1) develop an economically sound and stable domestic mining and mineral-processing industry, (2) develop domestic mineral reources to meet industrial, security and environmental needs, and (3) undertake research into mining, minerals, and metallurgy. The Department of the Interior through its Bureau of Mines and U.S. Geological Survey, the two organizations most involved with nonfuel minerals, is primarily responsible for implementing the act, which provided no new authority or funding.

As expressed in the House Committee on Interior and Insular Affairs report, the Congress expected that, because of the act, questions would be answered regarding: (1) the permissible degree of dependence on foreign supplies, (2) the need for stockpiling minerals for emergency situations, and (3) the impact of Government actions concerning taxation, manpower, health and safety, and environmental quality on the ability of the U.S. private sector to supply domestic needs.

The Congress subsequently enacted much more specific legislation pertaining to other national priorities and

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1/G.Anders, W.P. Gramm, S.C. Maurice. Does Resource Conservation Pay? International Institute for Economic Research, (Los Angeles: July 1978).

social goals, such as energy, the environment, and land conservation and use. Implementation of the latter legislation has largely ignored the Mining and Mineral Policy Act of 1970 and attempts to balance conflicting national goals or to determine other alternatives have been ineffective. During this time, the U.S. mining and mineral-processing industry has continued to decline and the United States has become more dependent on imported mineral products.

## SCOPE OF REVIEW

We analyzed four metal industries--zinc, ferroalloys, copper, and aluminum--that reflect many of the problems and trends generic to the domestic mineral industry. The steel industry was excluded because we are currently evaluating national steel policies.

Our analysis concentrated on trends in production and on Government policy factors influencing these trends. Because of limitations in available data, we did not attempt to quantify the extent to which these actions have contributed to the shift of minerals-processing overseas or the extent to which changes in U.S. policies could reverse these trends.

Our analysis highlights (1) the problems faced by U.S. mineral operations in remaining competitive as a result of U.S. and foreign government actions and (2) the need for the Government to establish a mechanism for objectively considering tradeoffs and alternatives when resolving conflicts between national policies to assure resolutions which are in the overall best interest of the United States. We did not attempt to analyze the tradeoffs which must be made between Government actions.

In this review, we considered the mining and mineral-processing industry to include mineral exploration and identification; mining; crushing, grinding, screening, and separating; and concentrate smelting and metal refining to obtain a desired purity and/or mix of metals. Fabrication (the further processing of the smelted or refined metal) was not included.

We met with various U.S. Government and corporate officials and other interested persons and reviewed congressional hearings, reports, testimony, current legislative material, trade publications, and media articles and analyses. We also visited Mexico, Chile, Argentina, the Philippines, Australia, Sweden, Ireland, West Germany, Spain, and Norway to talk to foreign government, trade association, and corporate officials. Information concerning local mining and mineral-processing was provided by the U.S. Embassies in seven other countries.

## CHAPTER 2

## MINERAL IMPORT TRENDS: INCREASING RELIANCE ON FOREIGN PROCESSED MINERALS

The increasing reliance of U.S. manufacturers on foreign processed minerals varies from metal industry to metal industry, as does the degree to which the minerals have been processed. Imports of processed minerals are replacing domestic metal production, which uses both domestic and imported ores and concentrates. As a result, processed minerals (as opposed to ores and concentrates) represent an increasing proportion of mineral imports.

This trend is often believed to be the result of developing countries' insistence on sharing in the value added to raw minerals by having the processing done in the country where the ore was mined; however, developed countries--both those which are resource rich and those which process imported ore--continue to supply the vast majority of U.S. needs. Plans for further expansions and/or new developments indicate that developing nations will be playing a more significant role in providing processed minerals to world markets.

### RELIANCE ON MINERAL IMPORTS VARIES FROM METAL TO METAL

U.S. reliance on mineral imports is increasing each year. However, a closer look at individual metals shows that the degree of reliance and the impact on the U.S. producers differ considerably. For example, several zinc-processing facilities have closed since 1969, reducing domestic zinc production. During this same period, domestic production of ferrochromium and ferromanganese alloys has been reduced as the facilities were converted to produce other alloys. In both industries, these reductions in domestic production have resulted in significant increases in U.S. reliance on foreign processed minerals, which represent over 50 percent of current U.S. consumption.

The reduction in domestic copper production has not been as pronounced. Few copper facilities have actually closed but reduction in production levels have been quite extensive, and imports of copper now represent almost 20 percent of U.S. copper consumption.

U.S. aluminum production continues at peak levels. However, little expansion of domestic aluminum production

facilities is being planned to meet projected increases in U.S. consumption. Instead, these increases are going to be met by expansions of aluminum production facilities in other countries. Net imports now represent about 10 percent of U.S. aluminum consumption.

Trends for these four metals are discussed in the following sections; their causes and implications are discussed in subsequent chapters.

Zinc

Zinc stands fourth among metals in annual world consumption, and the United States consumes about one-fifth of the annual world zinc production . The construction and transportation industries account for about two-thirds of U.S. zinc metal consumption. Zinc is also a major alloying ingredient in brass and a chemical compound in rubber and paints.

U.S. industrial demand for zinc has been relatively stable for the last decade; however, the Bureau of Mines forecasts an annual 2-percent growth in demand through the turn of the century, although inroads could be made by alternate materials (aluminum and plastics). The Bureau also suggests further increased demand resulting from more extensive use of zinc for corrosion protection of steel. U.S. production capacity, however, has generally declined. Despite the startup of a new zinc plant in 1978, the closing of eight plants 1/ in the last decade, as shown below, reduced domestic capacity by almost 50 percent.

| Company | Plant location | Year closed |
|---|---|---|
| Eagle Picher | Henryetta, Oklahoma | 1969 |
| Anaconda | Anaconda, Montana | 1969 |
| Mathiessen & Hegeler | Meadowbrook, West Virgina | 1971 |
| New Jersey Zinc | Depue, Illinois | 1971 |
| American Zinc | Dumas, Texas | 1971 |
| Anaconda | Great Falls, Montana | 1972 |
| Amax | Blackwell, Oklahoma | 1973 |
| Asarco | Amarillo, Texas | 1975 |

As the following diagram shows, the production lost through these closings has, for the most part, been replaced by increased imports of zinc metal. Over the past decade, overall zinc imports have been relatively constant; however,

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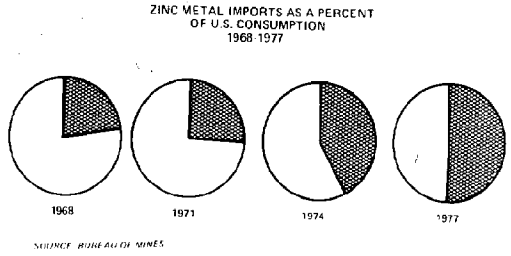
1/Two other plants were also closed during this period; however, they were modernized and have since reopened.

zinc metal imports (shaded) have increased significantly as a percentage of U.S. consumption. Zinc ore and concentrate imports (used by plants to supplement domestic mine production) have dropped 77 percent while zinc imported in metal form increased 89 percent.




Only about half the zinc needed is currently supplied from domestic mines although identified domestic reserves could provide up to 60 percent of domestic needs through the year 2000, and reasonable probability exists that new domestic areas of zinc-bearing minerals can be located that would improve the degree of self-sufficiency.

Ferroalloys

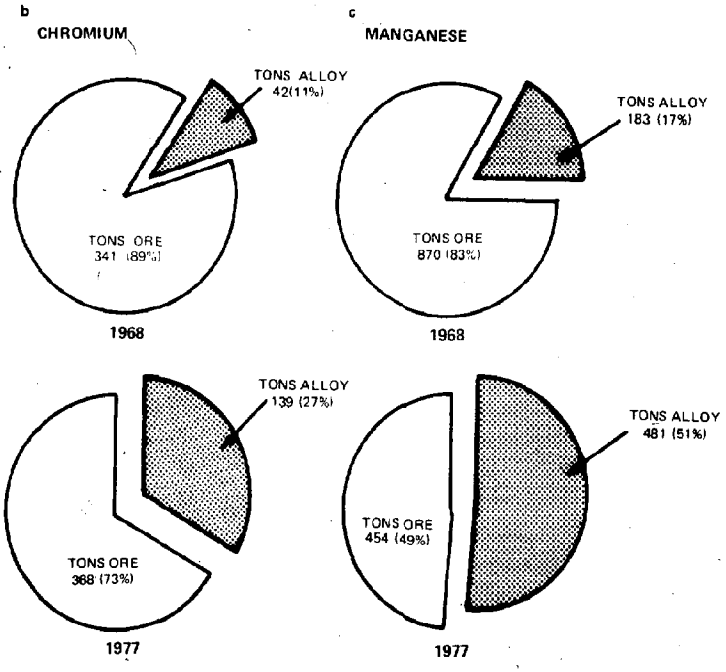
Ferroalloys, primarily mixtures of iron and some other metal, impart distinctive qualities, such as hardness or corrosion resistance, to steel, cast iron, and aluminum, or serve important functions during the production of the three metals. The principal ferroalloys are those which use chromium, manganese, and silicon.

Because of its direct relationship to the iron and steel industry, ferroalloy demand is subject to the cyclical fluctuations historically experienced by that industry. Within this context, demand for ferroalloys has been relatively stable during the last decade; however, the Bureau of Mines forecasts that through 1985 demand will increase at an annual rate of about 3.4 percent for primary chromium, 1.6 percent for manganese, and 3 percent for silicon alloys and metals, reflecting current and expected changes in iron and steel production technology.

Although U.S. demand overall has been relatively steady and is expected to grow, domestic production levels for some ferroalloys are being reduced while others are increasing. Chromium and manganese alloy furnaces in some facilities have been switched to silicon production and, in a few cases, plants are closing. Silicon capacity, on the other hand, has increased due to the switch in product mix and, in a few instances, new silicon facilities have opened.

The result of these changes can also be seen in ferroalloy imports. The United States has been almost 100-percent dependent on foreign sources for chromium and manganese ores and concentrates to supply domestic ferroalloy processors. Recently, as the diagram below shows, imports of chromium and manganese ore have been replaced by imports of ferroalloy metals.

COMPARISON OF THE IMPORT COMPONENTS OF U.S. CHROMIUM AND MANGANESE SUPPLY 1968 AND 1977 (note a)




a/ PERCENTAGES BASED ON METAL CONTENT OF ORE AND FERROALLOY IMPORTS.

b/ CHROMIUM ORE IMPORTS ARE ALSO USED FOR CHEMICAL AND REFRACTORY PURPOSES. DEMAND FOR THESE USES RANGED FROM 21 TO 47 PERCENT OF ORE IMPORTS DURING THE PERIOD 1970-1977. THEREFORE, THE ORE/ALLOY SHIFT DEPICTED ABOVE WOULD BE EVEN GREATER IF THIS WERE TAKEN INTO ACCOUNT.

c/ MANGANESE ORE IMPORTS ARE ALSO USED FOR CHEMICAL AND BATTERY PURPOSES. DEMAND FOR THESE USES RANGED FROM 6 TO 14 PERCENT OF ORE IMPORTS DURING THE PERIOD 1970-1977. THEREFORE, THE ORE/ALLOY SHIFT DEPICTED ABOVE WOULD BE EVEN GREATER IF THIS WERE TAKEN INTO ACCOUNT.

SOURCE: BUREAU OF MINES

## Copper

Copper has been one of the more important metals in the advance of civilization. Its heat and electrical conductive properties make it an essential part of the world's power and telecommunications industries. Electrical applications account for over half of U.S. copper consumption.

The United States used over one-fifth of the 1977 world copper supply and is expected to continue as a major consumer of copper. U.S. industrial demand for a little over 2 million tons annually has been relatively stable, except for 1975, when a worldwide recession severely reduced demand. The Bureau of Mines has forecast an annual growth in U.S. demand of 3.5 percent between 1975 and 2000.

While there may be some increase in mine production, no major new U.S. smelter or refinery capacity is likely to come onstream before 1985. In fact, in 1977 the International Trade Commission reported that only 65.5 percent of refinery capacity was being used. (Optimal capacity use is approximately 90 percent.)

More specifically, Atlantic Richfield Company reported that its Anaconda subsidiary closed down some copper operations and curtailed others (one of its three refineries was shut down). Amax, Inc., reported that its Twin Buttes Mine sulfide ore concentrator (which provides smelter feedstock) operated at only 60 percent of capacity during 1976 and until October 1, 1977, and then was reduced to 40 percent of capacity.

Despite increases in prices in early 1979, many domestic copper production facilities continued to operate at less than optimal capacity. While domestic production was being curtailed, imports grew significantly. Except for 1975, total imports of refined copper have been increasing.

| Year | Imports | Domestic consumption | Imports as percent of consumption |
|---|---|---|---|
| | (000 short tons) | | |
| 1969 | 131 | 2,142 | 6.1 |
| 1970 | 132 | 2,043 | 6.5 |
| 1971 | 164 | 2,020 | 8.1 |
| 1972 | 192 | 2,239 | 8.6 |
| 1973 | 206 | 2,437 | 8.5 |
| 1974 | 314 | 2,194 | 14.3 |
| 1975 | 147 | 1,535 | 9.6 |
| 1976 | 382 | 1,992 | 19.1 |
| 1977 | 391 | 2,185 | 17.9 |
| 1978 | 457 | 2,392 | 19.1 |

## Aluminum

Aluminum's high strength-to-weight ratio accounts for its prominent role in the U.S. economy. In 1977, U.S. industrial demand represented 33 percent of total world primary aluminum consumption. The Bureau of Mines forecasts an annual growth in demand of 7 percent through 1985, partly because of the transportation industry, which is trying to reduce vehicle weight and increase fuel economy.

Despite this demand, the aluminum industry has shown little overall growth in domestic production capacity; a growth of only 1.4 percent annually through 1983 is forecast because of various problems which have discouraged new investment. Thus net aluminum metal imports, which accounted for only 10 percent of U.S. consumption in 1978, are expected to increase to 15 percent by 1985 and 20 percent by 2000.

## TRENDS IN THE SOURCES FOR U.S. MINERAL IMPORTS

Increased advancement of the mineral industries in developing countries is a logical outcome of their insistence that they share in the value added to their raw minerals by having the processing done within their own borders. By doing this, they hope to expand their economic base, improve their standards of living, provide employment, and generate foreign exchange with which to purchase goods they cannot produce themselves.

Because of these positive benefits to developing countries, a perception often exists that the loss of U.S. mineral producing capacity should not be viewed with concern. However, our analysis shows that the developing countries are shipping increased tonnages of processed minerals to the United States, but that most increases in U.S. mineral imports, except for copper, continue to come from other developed industrialized countries.

Canada is the principal supplier of nonfuel minerals to the United States, and in 1975 accounted for one-third the value of all crude mineral ores, concentrates, and scrap and for a slightly higher share of semiprocessed mineral imports. Because of its close proximity and abundance of mineral resources, it is easy to see why Canada is one of the principal sources for 23 of 36 minerals listed by the Bureau of Mines for which the United States depends on imports to some degree. Two other developed countries---Australia and South Africa--are among the principal sources for 6 and 9 of these minerals, respectively. These three countries are the primary sources for 23 of 36 major minerals. (See table 1.)

Table 1

Major Foreign Sources of
Selected Metals and Minerals
1974-77

| Metals and minerals | Major foreign sources (note a) |
|---|---|
| Aluminum: | |
| Metal | Canada |
| Alumina | Australia, Jamaica, Surinam |
| Bauxite | Jamaica, Guinea, Surinam |
| Antimony | South Africa, Mexico, Bolivia, Canada |
| Asbestos | Canada, South Africa |
| Barite | Peru, Ireland, Mexico |
| Cadmium | Canada, Mexico, Australia, Belgium-Luxembourg |
| Cement | Canada, Norway, Bahamas, Mexico |
| Chromium: | |
| Ferrochromium | South Africa, Rhodesia, Japan |
| Chromite | South Africa, Russia, Philippines |
| Cobalt | Zaire, Belgium-Luxembourg, Zambia, Finland |
| Columbium | Brazil, Thailand, Canada |
| Copper | Canada, Chile, Peru, Zambia |
| Fluorspar | Mexico, Spain, South Africa, Canada |
| Gold | Canada, Switzerland, Russia |
| Gypsum | Canada, Mexico, Jamaica, Dominican Republic |
| Iron and Steel products | Japan, Europe, Canada |
| Iron ore | Canada, Venezuela, Brazil, Liberia |
| Lead | Canada, Mexico, Peru, Australia |
| Manganese: | |
| Ferromanganese | France, South Africa, Japan |
| Ore | Gabon, Brazil, Australia, South Africa |
| Mercury | Algeria, Canada, Spain, Mexico |
| Mica (sheet) | India, Brazil, Malagasy Republic |
| Nickel | Canada, Norway, New Caledonia, Dominican Republic |
| Platinum group metals | South Africa, Russia, United Kingdom |
| Potash | Canada, Israel, West Germany |
| Salt | Canada, Bahamas, Mexico |
| Selenium | Canada, Japan, Yugoslavia, Mexico |
| Silver | Canada, Mexico, Peru, United Kingdom |
| Strontium | Mexico, Spain |
| Tantalum | Thailand, Canada, Malaysia, Brazil |
| Tin | Malaysia, Bolivia, Thailand, Indonesia |
| Titanium (ilmenite) | Canada, Australia |
| Tungsten | Canada, Bolivia, Peru, Thailand |
| Vanadium | South Africa, Chile, Russia |
| Zinc | Canada, Mexico, Australia, Belgium-Luxembourg |

a/Listed in descending order of amount supplied

Source: Bureau of Mines

Although developed countries' dominance as suppliers of minerals to the United States will probably continue, many developing countries are expanding their mining and mineral-processing industries and increasing their role as mineral exporters to the United States. The relative importance of these countries now and in the future will vary from metal to metal, as we found in our study of zinc, copper, aluminum, and ferroalloys.

Zinc metal imports have continued to come mainly from developed countries, especially Canada, as shown in table 2. Although import tonnage from developing countries almost doubled between 1971 and 1977, these countries' relative contribution to total U.S. zinc imports has changed very little. In the future, however, a greater share of new smelter capacity seems to be planned for developing countries, which could result in increased imports of zinc from them.

Table 2

Zinc Metal Imports

| | 1971 | | 1974 | | 1977 | |
|---|---|---|---|---|---|---|
| Developed countries | 000 short tons | Percent | 000 short tons | Percent | 000 short tons | Percent |
| Australia | 38.6 | 12.1 | 38.9 | 7.2 | 29.3 | 5.1 |
| Belgium | 9.4 | 2.9 | 30.4 | 5.6 | 43.0 | 7.5 |
| Canada | 150.9 | 47.2 | 270.2 | 50.1 | 239.6 | 41.5 |
| Finland | 31.7 | 9.9 | 10.6 | 2.0 | 32.7 | 5.7 |
| Japan | 8.7 | 2.7 | 52.7 | 9.8 | 14.4 | 2.5 |
| West Germany | 3.7 | 1.1 | 8.3 | 1.5 | 41.6 | 7.2 |
| Others | 28.3 | 9.0 | 28.7 | 5.2 | 81.3 | 14.0 |
| | 271.2 | 84.9 | 439.7 | 81.5 | 481.7 | 83.5 |
| Developing countries | | | | | | |
| Mexico | 10.1 | 3.2 | 23.5 | 4.3 | 30.0 | 5.2 |
| Peru | 23.9 | 7.5 | 31.1 | 5.8 | 18.9 | 3.3 |
| Zaire | 8.9 | 2.8 | 17.8 | 3.3 | 35.7 | 6.2 |
| Others | .3 | .1 | 5.6 | 1.1 | - | - |
| | 43.2 | 13.5 | 78.0 | 14.5 | 84.6 | 14.7 |
| Planned economy countries | | | | | | |
| Poland | 2.6 | .8 | 9.2 | 1.7 | 3.9 | .7 |
| Yugoslavia | .1 | - | 12.3 | 2.3 | 3.6 | .6 |
| Others | 1.2 | .4 | .2 | - | 1.1 | .2 |
| | 4.0 | 1.2 | 21.8 | 4.0 | 8.6 | 1.5 |
| Unidentified | 1.2 | .4 | - | - | 1.9 | .3 |
| Total a/ | 319.6 | 100.0 | 539.5 | 100.0 | 576.7 | 100.0 |

a/Figures may not add to totals due to independent rounding of individual country data.

For refined copper, imports from developing countries have increased in both tonnage and relative contribution to total U.S. copper imports. As table 3 shows, refined copper imports from developing countries now exceeds the volume imported from developed countries. Canada continues to be the major import source, but imports from developing countries are likely to continue increasing because major copper smelter/refinery expansions are planned for such developing countries as Mexico, Zaire, Peru, Iran, the Republic of Korea, Panama, and the Philippines. In addition, plant expansions are planned for the centrally planned economy countries of Poland, Yugoslavia, and the People's Republic of China.

Table 3

Refined Copper Imports

| Developed countries | 1968 (note a) | | 1971 | | 1974 | | 1977 | |
|---|---|---|---|---|---|---|---|---|
| | 000 short tons | Percent | 000 short tons | Percent | 000 short tons | Percent | 000 short tons | Percent |
| Belgium | 57.9 | 14.5 | .5 | .3 | 8.0 | 2.6 | 14.1 | 3.6 |
| Canada | 135.1 | 33.8 | 123.0 | 75.0 | 118.4 | 37.8 | 101.2 | 25.9 |
| Japan | - | - | - | - | 73.1 | 23.3 | - | - |
| Netherlands | 3.7 | .9 | 1.6 | 1.0 | 3.2 | 1.0 | 10.4 | 2.7 |
| West Germany | 55.3 | 13.8 | 4.4 | 2.7 | 7.2 | 2.3 | 10.4 | 2.7 |
| United Kingdom | 22.6 | 5.6 | 5.5 | 3.4 | 6.6 | 2.1 | .4 | .1 |
| Others | 8.6 | 2.2 | 2.7 | 1.6 | 1.2 | .4 | 16.7 | 4.2 |
| | 283.2 | 70.8 | 137.7 | 84.0 | 217.7 | 69.4 | 153.2 | 39.2 |
| Developing countries | | | | | | | | |
| Chile | 42.9 | 10.7 | 11.0 | 6.7 | 66.5 | 21.2 | 87.6 | 22.4 |
| Mexico | 1.1 | .3 | 1.0 | .6 | .9 | .3 | 6.3 | 1.6 |
| Peru | 18.5 | 4.6 | 3.5 | 2.1 | 6.9 | 2.2 | 49.0 | 12.5 |
| Zambia | 22.9 | 5.7 | 6.7 | 4.1 | 2.8 | .9 | 77.9 | 19.9 |
| | 85.4 | 21.3 | 22.2 | 13.5 | 77.2 | 24.6 | 220.7 | 56.5 |
| Planned economy countries | | | | | | | | |
| Poland | - | - | .4 | .2 | 2.2 | .7 | - | - |
| Yugoslavia | 9.7 | 2.4 | 3.6 | 2.2 | 14.8 | 4.7 | 16.8 | 4.3 |
| Others | - | - | - | - | 1.1 | .4 | - | - |
| | 9.7 | 2.4 | 4.0 | 2.4 | 18.1 | 5.8 | 16.8 | 4.3 |
| Unidentified | 21.9 | 5.5 | - | - | .5 | .2 | - | - |
| Total | 400.2 | 100.0 | 164.0 | 100.0 | 313.6 | 100.0 | 390.8 | 100.0 |

a/Imports were unusually high in 1968 due to a labor strike which closed more than 90 percent of the domestic industry plants. The strike started in July 1967, and full operation did not resume in most plants until April 1968.

Reliance on developed countries for aluminum also is decreasing. Several developing countries, such as Brazil, Venezuela, and Guinea, have good aluminum-producing potential because of the availability of low-cost energy and government support for development. Meanwhile, the expansion of aluminum production in developed countries will probably occur primarily in Canada and Australia.

Table 4

Aluminum Metal and Crude Alloy Imports

| Developed countries | 1970 | | 1972 | | 1974 | | 1977 | |
|---|---|---|---|---|---|---|---|---|
| | 000 short tons | Percent | 000 short tons | Percent | 000 short tons | Percent | 000 short tons | Percent |
| Canada | 327.0 | 93.4 | 508.2 | 76.9 | 408.3 | 80.3 | 500.2 | 74.6 |
| France | - | - | 17.2 | 2.6 | 2.7 | .5 | 5.8 | .9 |
| Japan | .5 | .1 | .2 | - | 10.2 | 2.0 | - | - |
| Norway | 20.0 | 5.7 | 63.9 | 9.7 | 14.4 | 2.8 | 12.5 | 1.9 |
| United Kindgom | .4 | .1 | 24.5 | 3.7 | 3.1 | .6 | 10.4 | 1.6 |
| Others | .1 | - | .2 | - | 3.6 | .7 | 7.0 | 1.0 |
| | 348.0 | 99.4 | 614.3 | 92.9 | 442.3 | 87.0 | 535.9 | 80.0 |
| Developing countries | | | | | | | | |
| Bahrain | - | - | - | - | - | - | 9.3 | 1.4 |
| Ghana | - | - | 40.6 | 6.1 | 56.7 | 11.1 | 105.6 | 15.8 |
| Mexico | - | - | 5.0 | .8 | .2 | - | - | - |
| Surinam | - | - | - | - | 7.6 | 1.5 | 13.7 | 2.0 |
| Others | - | - | - | - | - | - | 5.6 | .8 |
| | - | - | 45.6 | 6.9 | 64.4 | 12.7 | 134.2 | 20.0 |
| Planned economy countries | | | | | | | | |
| Poland | 1.7 | .5 | .5 | .1 | - | - | - | - |
| Yugoslavia | - | - | - | - | 1.2 | .2 | .1 | - |
| Others | - | - | - | - | .5 | .1 | - | - |
| | 1.7 | .5 | .5 | .1 | 1.7 | .3 | .1 | - |
| Unidentified | .4 | .1 | .6 | .1 | .2 | - | - | - |
| Total | 350.1 | 100.0 | 661.0 | 100.0 | 508.6 | 100.0 | 670.2 | 100.0 |

For ferroalloys, developed countries continue to dominate U.S. imports, despite the fact that South Africa is the only developed country with significant ore reserves of both chromium and manganese. While this reliance is likely to continue, production capacity is being expanded in developing countries; Brazil is expanding alloy production capacity for manganese and chromium alloy, and Mexico and India are expanding their ferromanganese capacities.

Table 5

Ferromanganese Imports, including Silicomanganese

| Developed countries | 1968 | | 1971 | | 1974 | | 1977 | |
|---|---|---|---|---|---|---|---|---|
| | [a] 000 short tons | Percent | [a] 000 short tons | Percent | [a] 000 short tons | Percent | [a] 000 short tons | Percent |
| France | 39.3 | 22.1 | 71.6 | 34.2 | 164.9 | 44.3 | 112.2 | 23.6 |
| Japan | 0.7 | 0.4 | 2.3 | 1.1 | 34.2 | 9.2 | 41.2 | 8.7 |
| Norway | 13.1 | 7.4 | 27.4 | 13.1 | 23.4 | 6.3 | 29.7 | 6.3 |
| Portugal | - | - | - | - | 0.4 | 0.1 | 30.1 | 6.3 |
| South Africa | 33.2 | 18.7 | 70.9 | 33.9 | 101.8 | 27.3 | 119.0 | 25.1 |
| West Germany | 29.8 | 16.8 | 1.3 | 0.6 | 2.2 | 0.6 | 18.4 | 3.9 |
| Others | 33.6 | 18.9 | 7.4 | 3.5 | 26.6 | 7.1 | 37.6 | 7.9 |
| | 149.7 | 84.3 | 181.0 | 86.5 | 353.6 | 94.9 | 388.2 | 81.8 |
| Developing countries | | | | | | | | |
| Brazil | - | - | - | - | 3.0 | 0.8 | 40.8 | 8.6 |
| India | 13.0 | 7.3 | 24.5 | 11.7 | 11.2 | 3.0 | 4.2 | 0.9 |
| Mexico | 1.0 | 0.6 | 1.7 | 0.8 | - | - | 25.4 | 5.3 |
| Others | 8.9 | 5.0 | - | - | 1.0 | 0.3 | 4.3 | 0.9 |
| | 23.0 | 12.9 | 26.2 | 12.5 | 15.2 | 4.1 | 74.7 | 15.7 |
| Planned economy countries | | | | | | | | |
| Yugoslavia | 4.9 | 2.8 | 2.1 | 1.0 | 3.7 | 1.0 | 11.5 | 2.4 |
| Total (note b) | 177.6 | 100.0 | 209.2 | 100.0 | 372.6 | 100.0 | 474.4 | 100.0 |

a/Maganese content.

b/Figures may not add to totals due to independent rounding of individual country data.

Table 6

Ferrochromium Imports

| Developed countries | 1968 | | 1972 | | 1974 | | 1977 | |
|---|---|---|---|---|---|---|---|---|
| | [a] 000 short tons | Percent | [a] 000 short tons | Percent | [a] 000 short tons | Percent | [a] 000 short tons | Percent |
| Japan | 1.5 | .4 | 11.9 | 13.2 | 5.6 | 5.4 | 5.3 | 3.9 |
| South Africa | 17.4 | 42.4 | 31.5 | 34.9 | 37.4 | 36.4 | 61.0 | 45.4 |
| Sweden | 5.5 | 13.4 | 7.9 | 8.8 | 5.1 | 5.0 | 5.6 | 4.2 |
| West Germany | 6.5 | 15.9 | 3.6 | 4.0 | 4.5 | 4.4 | 2.5 | 1.9 |
| Others | 7.0 | 17.1 | 13.4 | 14.8 | 4.4 | 4.3 | 4.7 | 3.5 |
| | 37.9 | 92.4 | 68.3 | 75.7 | 57.0 | 55.4 | 79.1 | 58.9 |
| Developing countries | | | | | | | | |
| Brazil | - | - | 2.5 | 2.8 | 6.1 | 5.9 | 6.1 | 4.5 |
| Rhodesia (note b) | - | - | 10.7 | 11.7 | 23.5 | 22.9 | 33.7 | 25.1 |
| Turkey | 2.4 | 5.9 | 4.7 | 5.2 | 1.9 | 1.8 | - | - |
| Others | - | - | - | - | 0.1 | .1 | - | - |
| | 2.4 | 5.9 | 17.9 | 19.8 | 31.6 | 30.7 | 39.8 | 29.7 |
| Planned economy countries | | | | | | | | |
| Yugoslavia | 0.8 | 2.0 | 4.0 | 4.4 | 14.2 | 13.8 | 15.3 | 11.4 |
| Total (note c) | 41.0 | 100.0 | 90.2 | 100.0 | 102.8 | 100.0 | 134.2 | 100.0 |

a/Chromium content.

b/The apparent shift to reliance on developing countries for ferrochromium is explained by increased imports from Rhodesia in anticipation of U.S. compliance with the U.N. sanctions against Rhodesia, which precluded purchases of Rhodesian chromium.

c/Figures may not add to totals due to independent rounding of individual country data.

## CONCLUSIONS

Although the degree of reliance varies among minerals, the general trend is toward increased reliance on imports. More importantly, these imports are increasingly coming into the United States in the form of processed minerals--that is, metal rather than ores or concentrates.

While these trends currently cause concern, of more concern is the probability of increasing U.S. reliance on mineral imports in the futures. As discussed in chapters 3 and 4, many of the factors contributing to these trends are continuing and in some cases seem to be intensifying. As a result, most replacement and expansion of mineral-processing capacity for the four metals reviewed is planned for locations outside the United States.

# CHAPTER 3

## FACTORS INFLUENCING THE IDENTIFICATION AND DEVELOPMENT OF DOMESTIC MINERAL PROJECTS

The increasing reliance of U.S. manufacturers on foreign processed minerals stems from the fact that investment for expanding and modernizing domestic mineral production capacity has not kept pace with growth in demand. This is happening because investment in domestic mineral projects has become less attractive, due in part to several Government actions which adversely affect their current and/or expected profitability.

With demand for mineral products growing and some existing operations playing out or becoming obsolete, continued investment in the development of mineral-producing operations is needed. A 1977 World Bank study estimated that $12.7 billion (based on constant 1975 U.S. dollars) must be invested in copper mines and smelters simply to maintain current levels of world copper production through the mid-1980s.

Mineral projects are very expensive. A $100-million project is not uncommon, and some projects cost more than $1 billion. Consequently, few companies can afford to finance such projects from cash generated through operations, and outside investors, usually commercial lending institutions, are sought to provide the needed capital.

When deciding on investment options, investors assess a project's expected development costs, operating costs, and expected revenues. Making such an assessment in the mineral industry is difficult because of the generally long payback period, cyclical nature of mineral prices, and general uncertainty about many of the costs involved.

Prospective investors also consider how projects' production costs compare with those of competitors. Projects with relatively high costs will cross the line between profit and loss earlier than will those of competitors as prices fall or costs rise; therefore, such projects will be less able to sustain operations during periods of low prices. Conversely, those projects that have relatively low costs (including fixed charges, such as interest on debt), are less sensitive to downward price fluctuations and are less risky ventures.

Because prices are basically established through the interaction of supply and demand and not upon an individual producer's costs, 1/ expected gross revenues would vary little between projects of similar capacity. Therefore, costs and the risks associated with them are the primary distinguishing factors in investment decisions. For that reason, we have focused on these aspects of the investment decisions.

Although investment decisions are very complex and are based upon many considerations, we focused on five that are significantly influenced by government actions:

--Economic access to minerals.

--Development and financing costs.

--Opportunity to pool resources.

--Labor costs.

--Energy availability and price.

This chapter discusses the first three areas. Chapter 4 discusses labor costs and energy availability and price considerations as well as several other U.S. and foreign government actions that affect revenues and costs and ultimately influence investment decisions.

To place the factors in perspective, we briefly discuss their importance to the investment decision and some traditional economic considerations. Measuring the effects of individual factors on investment decisions was beyond the scope of this review, however we do show the directions of influence (positive or negative) that U.S. and foreign governments are having in these areas. Similarly, reducing the adverse effect of any one government action would not neccessarily alter the trends discussed earlier and our discussion should not be interpreted as implying this. We do believe, however, that, taken together, government actions have and are influencing the trends.

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1/Conversely, because there is little to differentiate one producer's metal from another's, prices paid by users at one point in time are essentially the same whether the metal is produced in the United States or abroad.

We recognize that tradeoffs must be made and that balancing the benefits of developing domestic mineral supplies versus achieving other national goals is a complex problem that cannot be easily resolved.

## ECONOMIC ACCESS TO MINERALS HINDERED BY GOVERNMENTS' ACTIONS

One of the most critical factors in deciding whether to invest in developing or expanding mineral-processing facilities is the ability to locate and obtain adequate supplies of ores, concentrates, and unrefined metal at competitive prices. However, minerals are widely dispersed throughout the earth's crust and major mineral ore deposits are extremely rare.

The United States has vast amounts of many minerals needed in its economy but only small quantities or none at all of others. It has sufficient supplies of copper and silicon, although higher grades of copper ore are available in some other countries. Only about half the zinc needed is currently supplied from domestic mines, although U.S. reserves are large. Again, some foreign reserves are of higher grade.

U.S. processors are almost totally dependent on foreign sources for ores and concentrates of bauxite used in producing aluminum and chromium and manganese used in producing ferroalloys.

Consequently, the domestic mineral-processing industry relies on a mix of domestic and foreign sources for its processing requirements. And, events outside the United States as well as within can effect the availability of raw materials. For example, expansions of zinc-processing capacity in Canada in the early 1970s reduced the amount of zinc concentrate available for import by the Anaconda Company's Montana zinc smelter and was a factor in the Company's decision to close the smelter in 1972. This closure eliminated 162,000 tons of domestic zinc metal production capacity and resulted in increased zinc metal imports.

### Effects of government actions

Although the natural distribution and quality of mineral deposits plays the major role in the availability of minerals, government actions can also greatly limit their availability. In the United States, restrictions on the use of Federal land hinder exploration and development of domestic mineral resources. Also, the imposition of embargoes or other

measures can affect the ability of U.S. companies to import minerals at competitive prices.

Restrictions on Federal land use

The identification and development of new domestic mineral deposits is the important first step in assuring that U.S. mineral processors can continue to obtain minerals at competitive prices. The long leadtime from exploration to development dictates that the United States be concerned today if future production reductions are to be avoided. However, trends in exploration activity may be inadequate to provide for future consumption.

According to the Bureau of Mines, there is no evidence that land restrictions have affected domestic mineral production as yet because current production is using mineral reserves identified years ago. Therefore, as apparent as the trends in mineral production are, the influence of this factor is yet to be felt.

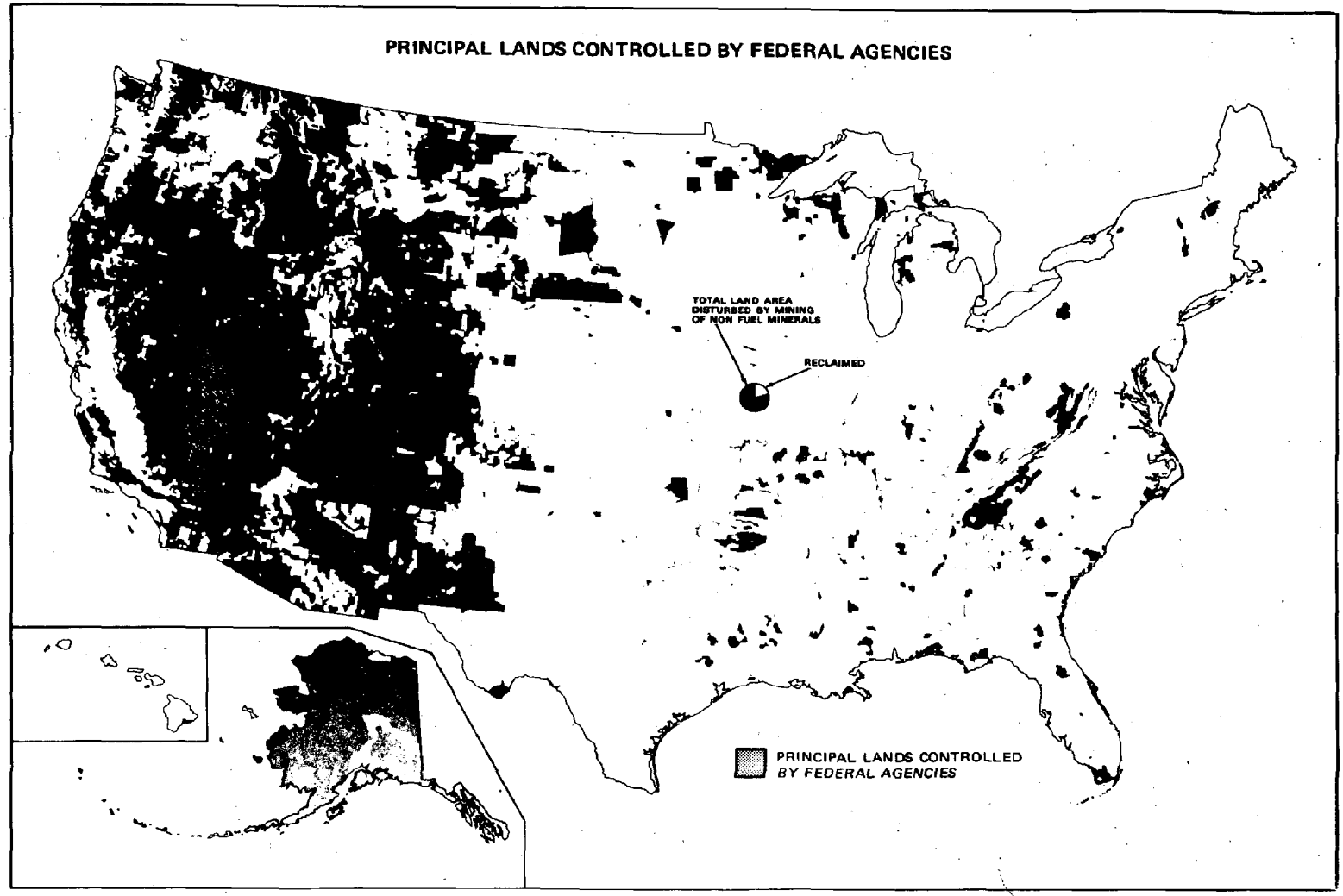
Currently, the Federal Government controls more than 760 million acres (about half of it in Alaska), or about one-third of the land in the United States. While access to these lands was once unrestricted, according to the Department of the Interior Task Force on Availability of Federally-owned Mineral Lands, about 42 percent of these lands have been completely withdrawn from mineral activity, another 16 percent is severely restricted, and 10 percent more is moderately restricted. These restrictions can seriously jeopardize or delay mineral exploration and development. For example, it has been estimated that Arizona contains 65 percent of U.S. copper reserves, but 70 percent of Arizona's land area is federally controlled.

The methods used in exploration require large land masses to be covered to find the few small areas with potential mineral deposits. The probabilities are relatively strong that, when deposits are identified they will be on Federal lands, so access to some federally controlled lands are important to have meaningful exploration in the United States. According to the Task Force, because of the lack of a comprehensive withdrawal inventory and the inadequate mineral information compiled concerning Federal lands, the overall mineral capabilities of the Federal lands cannot be adequately determined. The Task Force also found that the level of mineral information entered into the decisionmaking process is frequently inadequate and little use is made of quantified economic analyses to compare costs and benefits.

In the 95th Congress, a bill that would withdraw approximately 100 million acres of Alaskan wilderness from mineral exploration was passed in the House but was opposed in the Senate and died without being resolved. However, through executive branch action in December 1978, about 100 million acres of Alaskan land was withdrawn from exploration as recommended in a Department of the Interior environmental impact statement.

Assessing the economic benefits to the Nation from development of Alaska's mineral potential was beyond the scope of our work. Accurate assessments of the mineral potential of these lands is very complex. However, one analysis of the mineral potential of Alaskan Federal lands was conducted by SRI International. According to this March 1978 study, "Impact of the Withdrawal of Alaskan Federal Lands:"

> "* * * in the absence of extensive legislative or regulatory impediments to the development of mineral resources, a mining industry could develop by the 1990's that would:
>
> > "Provide the nation with substantial quantities of nonfuel minerals, including gold, silver, copper, nickel, lead, zinc, molybdenum and asbestos, valued at between $900 million and $1 billion annually (in 1977 dollars).
> >
> > "Provide the nation with 20,000 to 40,000 additional jobs, representing about 0.5 percent of current unemployment.
> >
> > "Reduce the nation's balance of payments deficit by between $700 million and $1 billion annually (in 1977 dollars).
>
> "The above results are based on an analysis of seven specific mineral deposits considered commercially attractive * * *."
>
> * * * * *
>
> "All of the deposits are affected to some extent by proposed withdrawals of Alaskan lands, either because they fall within or close to lands proposed for withdrawal, or because access to the deposit is curtailed by the proposed withdrawals, or both. While more detailed study would be needed to fully determine the




**OVER 760 MILLION ACRES OR ABOUT ONE-THIRD OF THE LAND IN THE UNITED STATES IS CONTROLLED BY THE FEDERAL GOVERNMENT. IN COMPARISON THE AMOUNT OF LAND AREA DISTURBED BY THE MINING OF NON FUEL MINERALS FROM 1930 THROUGH 1971 REPRESENTS ONLY 2.3 MILLION ACRES.**

impact of the proposed withdrawals, it seems questionable whether any of the seven deposits could be developed if the more extensive proposals for withdrawal were enacted into law. Of perhaps even greater significance for the long term, the proposed withdrawals would likely have a severe effect on the possibilities for additional discoveries of rich deposits, such as the ones studied, because much of the area graded favorable or highly favorable by the Bureau of Mines for metallic minerals is included in the proposed withdrawals * * *."

* * * * *

"The land area disturbed by mining would be small; with proper reclamation procedures, the effects would be temporary. The total land area that would be disturbed by the seven mines analyzed in arriving at the above economic values, including all roads and other infrastructure would be about 25 square miles * * * that compares with about 586,000 square miles in all of Alaska and about 180,000 square miles proposed in various bills * * * for inclusion in parks, wildlife refuges, wild and scenic rivers, and wilderness areas."

In Montana another mineral development is being threatened by Federal land withdrawal. The Department of Agriculture's Forest Service is currently considering designating about 8,000 acres of land in Montana's Stillwater complex as a wilderness area under its RARE II program. According to the company considering development, this land contains commercially promising deposits of platinum and palladium. These are critically important industrial metals for which the United States depends heavily on the Soviet Union and the Republic of South Africa. Imports of these metals in 1977 adversely affected the U.S. balance of trade by about $275 million. Should the Forest Service decide to withdraw this land, the United States will lose the opportunity to develop domestic access to these important metals.

Because of such land withdrawals and the uncertainty over access to Federal lands in the future, several mineral exploration efforts are either being disbanded or shifted to areas outside the United States. For example, St. Joe Minerals Company has redirected much of its exploration from Alaska to Canada's Yukon Territory because, Company officials stated, it has similar land formations and the potential mineral development of Alaska but is more open to exploration.

Even when authority to explore Federal lands for minerals is granted, operating conditions must be followed which industry officials believe are overly restrictive and impede exploration and development. The conditions imposed include

--restrictions on the types of equipment that can be used, i.e., size limitations on helicopters;

--parameters for construction of roads and drill sites; and

--provisions for restoration.

Mineral exploration and development has also been hampered by administrative delays. To process lease applications for exploration and development on Federal lands, coordination is needed between Interior's U.S. Geological Survey and Bureau of Land Management and Agriculture's Forest Service. A Forest Service official estimated, based upon actual examples, that the minimum processing time for approval of a prospecting lease was 17 months and for a mineral lease and mining plan 3 years. For example, in August 1976, a U.S. firm applied for two hardrock Federal prospecting permits covering tracts in Idaho. It took about 24 months of processing time for the permits to reach the Secretary of the Interior's office, where they were presented for signature by July 1978. As of April 1979, the applicant had not been advised of the final disposition of these permits.

In contrast to U.S. restrictions, several countries, in line with their own national priorities, successfully encourage exploration and mine development through government programs. For example:

--The Republic of South Africa funds and actively participates in exploration for certain minerals in areas selected for development.

--Ontario, Canada, funds one-third of approved exploration in selected areas.

--Argentina provides financial support and risk-sharing programs to assist in identifying and developing resources.

--The Republic of Korea directly funds a substantial mineral exploration program in support of its metal-processing industry.

--The Philippines and Spain provide development loans and loan guarantees to private companies to finance exploration and development of mineral deposits.

--Brazil has programs to finance or subsidize up to 80 percent of exploration costs.

Additionally, a number of countries, such as Japan, the Republic of Korea, France, and the Federal Republic of Germany, provide substantial incentives and subsidies to their minerals industries for exploration in foreign countries, usually with the understanding that their own processing industries will be assured access to the ores and concentrates from any deposits found.

Embargoes and other measures

Government actions can hinder the ability of the U.S. mineral industry to import raw materials.

The U.S. Government has imposed embargoes on imports from specific countries. A current example of this is the U.S. embargo on products from Rhodesia, including chromium ore. During 1966-71 and since 1977, U.S. ferrochrome alloy producers have not been permitted to obtain chromium ore from Rhodesia. This could have posed a serious problem to the ferroalloy industry but, fortunately, by the time the embargo was reimposed in 1977, new steelmaking technology permitted use of lower grade chromium ore from South Africa, the Soviet Union, Brazil, and Finland.

Foreign government actions have also limited the ability of U.S. firms to import raw materials at competitive prices.

Ontario, Canada, discourages exports of unprocessed minerals by requiring that all minerals produced in Ontario be processed in Canada. Firms must periodically apply for exemptions from this statutory provision in order to export ores or concentrates. Ontario also provides an economic incentive, called a "processing allowance," which reduces a company's tax liability as minerals are further processed in Canada.

The Mexican Government has imposed export levies on minerals. These have the practical effect of making the prices charged for exported Mexican ores higher than those paid by users in Mexico.

## Conclusions

Relatively secure sources of ores, concentrates, and unrefined metals must be available at competitive prices if the domestic mineral industry is to be maintained or expanded. However, U.S. actions to preserve the environment hinder the exploration and development of domestic mineral resources and embargoes add to the problems of importing ores for processing in the United States. In contrast, some foreign governments tend to have less restrictions on exploration and development of mineral resources, and, in some cases, actively support such efforts. They also frequently provide incentives for the increased processing of minerals within their borders, which can further limit the availability of ores and concentrates to U.S. mineral processors.

## DEVELOPMENT COSTS AND ACCESS TO CAPITAL ARE INFLUENCED BY GOVERNMENT ACTIONS

The cost of developing a mineral project is very large, and raising sufficient capital is very complex. In 1976 the Southern Peru Corporation began operating its copper mine and processing complex at Cuajone, Peru, at a cost of about $730 million. Over 50 financial institutions participated through direct loans in the complex financing arrangements that began in 1969. Supplier credits for the purchase of equipment and machinery and loans arranged through copper purchasers also helped finance the project.

The costs of developing mineral projects can vary significantly depending on many traditional economic factors, including their remoteness, facilities and equipment needed, and material and labor costs for construction. However, government actions are influencing these costs more and more; and to the extent that these actions increase costs, create uncertainty about future costs, or hinder capital formation, they discourage investment in mineral projects within a country's borders.

Mineral deposits are often found in relatively isolated areas, necessitating substantial investment for the roads, harbors, utilities, housing, and health and education facilities needed to support the project and its employees. For the most part, the United States has well-developed transportation and communication systems and supporting industries (for equipment and parts) and is a ready market for mineral products, giving many domestic mineral projects a relative cost advantage over projects in many other countries. However, some U.S. projects require considerable investment in infrastructure. For example, at Bagdad, Arizona, a domestic copper producer provides

the housing, hospital, school, and shopping facilities for about 3,500 employees and dependents; a recent addition of 354 employee homes cost about $10.6 million.

The type and extent of facilities and equipment needed to develop projects also vary. Whether a mine is open pit or the more expensive underground type depends upon the nature of the rock formation and the closeness of the mineral deposit to the surface. Also, the quality of the ore, in terms of percent of desirable minerals and impurities, affects the processing methods and related facilities and equipment needed.

U.S. Government actions to protect the environment increase cost and uncertainty

One of the most significant ways the U.S. Government influences mineral development costs is through mandated environmental protection requirements. For instance, a study performed under contract for the Department of Commerce estimates that if compliance with Federal air and water pollution control standards and land-use requirements are fully enforced, it will cost the U.S. copper industry over $1.4 billion (1974 dollars) in capital expenditures during 1978-87. (Operating costs during this period are estimated to be an additional $1 billion.)

The regulatory issue is by no means simple. The desirability of protecting the environment is indisputable; however, the mineral industry and various U.S. Government regulatory agencies disagree considerably about the strictness and timing of the rules. Frequently disputed are the status of various control technologies, environment and health exposure thresholds, the cost to and ability of the industry to comply with regulations, and the value of anticipated benefits.

The Federal environmental regulations concerning sulfur dioxide emissions illustrate the complexity of these issues and the extent to which they increase the cost of projects in the United States. The Clean Air Act of 1970 requires the U.S. Environmental Protection Agency (EPA) to establish air quality standards for sulfur dioxide.

In a 1970 report to the Congress, entitled "The Cost of Clean Air," the Secretary of Health, Education, and Welfare

asserted that 98.8 percent 1/ of sulfur dioxide emissions could be feasibly removed from copper, zinc, and lead plants (49 percent removal was average at the time) and that this could be accomplished at all primary nonferrous metallurgical plants in 100 selected areas over a 5-year period for a probable capital cost of $67.6 million.

However, domestic copper producers spent an estimated $695 million from 1974 to 1978 for sulfur dioxide emission controls. According to a report by Arthur D. Little, Inc., for EPA in 1978, producers could have to spend as much as an additional $953.5 million through 1987 (1974 dollars). 2/

The magnitude of these costs is such that EPA, as of January 1979, believes the anticipated future expenditures for sulfur dioxide control may prove to be beyond the means of a large portion of the smelting industry. Industry observers believe that, while 4 of the 16 primary copper smelters may be able to achieve a 90-percent sulfur dioxide removal rate, most smelters will continue to have difficulty. Our October 1978 report, "16 Air and Water Pollution Issues Facing the Nation" (CED-78-148-A/B/C) discusses the problems in implementing EPA's sulfur dioxide standard.

Other Federal environmental regulations are evolving with similar effects in much of the domestic mining and mineral-processing industry. For example, EPA has proposed new air quality standards for lead. A study for the Lead Industries Association by Charles River Associates, Inc., showed that meeting these standards will require substantial capital expenditures and could force the closure of as much as 80 percent of U.S. lead smelting and refining capacity, with a resulting increase in imports of a metal for which the United States is essentially self-sufficient. One Missouri lead smelter estimates its cost of compliance with this standard at more than $50 million.

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1/EPA subsequently determined that capture of about 90 percent of the sulfur present in the ores/concentrates entering copper smelters would achieve national air quality goals.

2/The report assumes that three smelters will close in 1983 for a variety of reasons, no new capacity will come onstream, and only small additions to electrowinning capacity can be expected during 1983-87; this estimate assumes that the same smelters will close rather than incur compliance costs.

Compliance expenditures influence the competitiveness of domestic metals producers. This is particularly important during periods of weak metal prices, such as in 1977 when prices for copper fell as low as 51.9 cents a pound. Various industry and Government authorities estimate that environmental regulations have added an average of 10 to 15 cents a pound to the cost of producing refined copper. This can make the difference between profits and losses for U.S. copper producers.

Shifts in mineral sector investment due to regulatory constraints could benefit countries whose approaches to regulations are more flexible or willingness to support the additional costs may give projects cost advantages. For example, several countries, including Australia, the Philippines, Brazil, Venezuela, Sweden, West Germany, and Ireland give high priorities to the costs and practical consequences of environmental standards in determining the extent to which they will be enforced. Norway, Sweden, and West Germany also provide financial support for new equipment needed by firms, including equipment needed for environmental protection.

Because of the relatively high costs of emission control standards for the mineral industry in the United States, the industry and others have expressed concern that the development of new mineral processing may shift to other countries. The Arthur D. Little report prepared for EPA stated that "there appears to be emerging the perception that * * * the end of environmental regulations in the United States is nowhere in sight. Hence, new investment is likely to be exported abroad * * *." An official of a major U.S. primary aluminum company, in a paper presented to the American Mining Congress in 1977, commented that the probable consequence of standards and their implementation for aluminum producers will be that "most of the capacity growth needed to serve historical demand levels will have to take place off shore."

Representatives of several major commercial banks commented that in recent years banks have increasingly attempted to assess "regulatory risks" in considering mineral project proposals and that as perceptions of such risks grow, access to loan capital diminishes. One bank representative indicated that any loan made to finance a new domestic copper smelter would be loaded with protective conditions which would give a borrower difficulty but which would be necessary to protect the bank against "regulatory risks," specifically emissions regulation compliance problems.

A senior economist for Arthur D. Little, Inc., in remarks to a panel on corporate responsibilities and opportunities in June 1978, indicated that during the next decade the United States may have to make a basic policy tradeoff between environmental regulation and increasing dependence on foreign supplies of key nonfuel resources.

In addition to the administrative delays in gaining access to land, obtaining various Federal and State government approvals and permits to develop a mineral project in the United States can be lengthy. This puts domestic projects at a distinct disadvantage by adding to the uncertainty of the ultimate cost by delaying development while construction costs escalate.

Approval to develop a domestic mineral project usually requires

--preparation and approval of environmental impact statements and air, water quality, and solid waste disposal plans;

--preparation of a Cultural Resource Survey Report by a State historical preservation officer;

--negotiation of water rights; and

--a variety of State and local clearances.

Other countries sometimes have similar requirements, but the time required to obtain clearances is usually shorter and the escalation of project costs is minimized. For example, a steel mill in Japan, which has very strict environmental standards, could take 2 years from planning through construction and cost about $600 per annual ton of capacity. A similar project in the United States could take about 4 years and cost about $1,000 per annual ton of capacity. The time delay and related inflation were cited as one of the main reasons for the difference in costs.

Such delays and related increases in costs may result in new investment in mineral projects being made in other countries. For example, ALUMAX, Inc., has been planning to develop a 187,300-ton-capacity primary aluminum facility costing $184 million in Oregon. However, the project has been delayed since 1973 awaiting submission of an environmental impact statement by the Bonneville Power Authority, which

would provide electricity for the facility. The statement has still not been finalized (the draft is 3,100 pages long and cost $5 million). Meanwhile, the cost of the project has escalated over 200 percent, to $400 million. An executive of ALUMAX stated that situations like this will probably force new primary aluminum projects out of the United States, thus increasing aluminum imports.

## Financing of mineral projects becoming more difficult

Because of the large amounts of capital needed to finance the development of mineral projects, firms in recent years have been unable to fund projects with cash generated through operations. Instead, new projects or major expansions must be financed through a variety of other sources, such as commercial bank loans, government grants and subsidies, international financial institution loans, or sale of equity in the projects.

The ability to generate funds from these sources, however, can be constrained by the relative financial standing of the company developing the project. In recent years, the poor financial condition of many domestic mining and mineral-processing firms has hindered their abilities to obtain capital for mineral projects.

The Arthur D. Little report, in describing the financial performance of the nonferrous metals industry for the 6-year period ended in 1974, stated that "* * * the picture has been one of modest growth in sales, low return on invested capital, eroding profit margins, and higher debt * * *."

From financial data provided by Merrill Lynch Pierce Fenner & Smith, Inc., for domestic and foreign operations of eight U.S. minerals firms, we examined trends in returns on invested capital and the amount of debt and preferred stock compared with equity from 1966 to 1977. The average return on investment had declined dramatically from 1973 to 1977. Prior to that, it had fluctuated from year to year with no clear trend. (See table 7.)

Also, during the 12-year period, the companies increased their reliance on borrowed funds as sources of capital. Thus, for every $10 of equity in 1966, these firms had slightly less than $1 of debt; by 1977 they had over $5 of debt for every $10 of equity.

Table 7

U.S.-Based Mineral Industry Financial Trends

| Year | Average return on invested capital (note a) | Average percent of debt and preferred stock to total equity |
|---|---|---|
| 1966 | 16.6 | 9.4 |
| 1967 | 12.5 | 9.7 |
| 1968 | 14.2 | 12.4 |
| 1969 | 18.5 | 17.9 |
| 1970 | 18.0 | 22.9 |
| 1971 | 10.6 | 30.2 |
| 1972 | 10.9 | 34.4 |
| 1973 | 14.8 | 38.1 |
| 1974 | 16.9 | 32.0 |
| 1975 | 8.9 | 40.5 |
| 1976 | 7.3 | 48.1 |
| 1977 | 3.9 | 53.8 |

a/Return on investment computed after taxes; invested capital is equity and long-term debt with no credit for deferred taxes.

Banking representatives stated that when debt and preferred stock exceeds 23 percent of total equity or when debt exceeds 30 percent of total capitalization in a high-risk cyclical industry, such as mining and mineral-processing, there is a cause for concern and at least some of these firms are at their debt limit. Because of these problems, many firms do not have access to additional capital to expand or modernize their facilities or to undertake new projects.

Banking and investment industry representatives also expressed concern about the mineral industry's poor earnings record. They commented that firms in this industry should have an after-tax return on invested capital at least equal to that of U.S. manufacturing in general (about 15 percent).

Of 41 industrial groups analyzed by Citibank in 1978, the nonferrous metals group finished 40th in terms of net income (after taxes) as a percent of return on net worth in both 1976 and 1977. In both years, 1,745 firms in these 41 industrial groups averaged 15 percent on net worth. In contrast, the nonferrous metals group achieved only 8.5 percent in 1976 and 7.8 percent in 1977 (only 4 others of the 41 groups achieved less than a 10 percent return in 1977--one of which was iron and steel).

While the financial condition of U.S. mineral firms is hindering their ability to accumulate capital for domestic projects, foreign governments are often subsidizing or sharing the risks of projects within their borders as a way of stimulating development perceived to be in their national interest. One increasingly common technique is for governments to guarantee loans for projects. For example:

--Guyana guaranteed repayment to three banks for a $50-million loan to finance the development of bauxite/alumina facilities.

--The Government of Qatar guaranteed repayment to 25 banks for a $100-million loan to finance development of steel production facilities.

--New Zealand guaranteed repayment to a consortium of banks for a $100-million loan to finance mining activities.

--The Philippines guaranteed the loan for a recently completed copper mine which would not have been financed without the guarantee.

Foreign governments also have provided direct subsidies to finance new developments. For example, the Government of Ireland provided direct subsidies totaling more than $33 million for an aluminum company to construct and equip alumina production facilities. In 1974, the Canadian Government contributed $7.7 million in direct cash grants to the firm sponsoring a $63-million ferrosilicon production facility. Canada also recently contributed $18 million in cash grants and easy term loans as part of its participation with two European companies in a joint venture to develop a zinc mine.

Some governments have formed national development banks to foster growth in the minerals sector as part of economic development plans. The Development Bank of the Philippines has been effective in Philippine mining ventures through (1) loan guarantees to third parties, (2) direct funding of loans, and (3) direct investment in the project if necessary to get it started. Brazil's National Development Bank has aggressively loaned funds for steel and nonferrous metals projects as part of a national effort to reduce imports of these commodities. During 1976-79, the Bank estimated its participation in nonferrous metals projects at $111 million and in the steel industry at $518 million.

The Australian Resources Development Bank Limited was formed in 1967 by the country's major commercial banks with

the support of the national government. The Bank's primary objective is to provide medium to long-term loans (5 to 12 years) for natural resource development projects. These loan periods are longer than those generally allowed by commercial banks and improve a project's financial viability. The Bank has loaned over $1 billion for natural resource development projects, including iron ore, nickel, tin, bauxite/alumina, zinc, copper, and mineral sands ventures in Australia during 1967-77.

Funds are also available for overseas projects through such international financial institutions as the International Bank for Reconstruction and Development (World Bank), the United Nation's Revolving Fund for Natural Resources Exploration, and regional development banks (i.e. the Asian Development Bank) and through international financing agencies of the United States, such as the U.S. Export-Import Bank and the Agency for International Development. In addition, the Overseas Private Investment Corporation, a Federal agency, is available to insure foreign projects against certain political risks.

These financing sources can play an important role in providing funds for projects in other countries that commercial banks will not support or for which specific governments cannot provide sufficient loans or loan guarantees. For example, the Government of Botswana provided $80 million to finance infrastructure facilities for the Selebi-Pikwe nickel-copper project with funds obtained through loans from the World Bank, Canadian International Development Agency, and the U.S. Agency for International Development.

Because of the availability of these project support techniques, access to capital for projects outside the United States is often greater and interest rates lower than they otherwise would have been. While this accomplishes one of the program objectives of increasing the supply of minerals to U.S. mineral processors, it can also put the U.S. mining and mineral-processing industry at a significant disadvantage in developing new domestic mineral projects.

Conclusions

The natural and traditional economic advantages and disadvantages of specific mineral projects greatly influence which projects are developed. However, more and more, U.S. Government actions have increased development costs and have influenced the availability of capital outside the United States, which has tended to make investments in domestic projects less attractive than they otherwise would be.

## U.S. ANTITRUST LAWS MAY BE HAMPERING OPPORTUNITIES FOR POOLING RESOURCES

Companies engaged in capital intensive activities like mining and mineral processing often see the legal pooling of money, skills, property, equipment, and/or knowledge by two or more parties for some specific business purpose as a highly desirable way to share costs and risks.

However, officials of the U.S. mining and metals industry stated that U.S. antitrust policy discourages domestic firms from initiating joint ventures with each other and discourages foreign firms from forming joint ventures with U.S. companies because:

--U.S. antitrust laws are based on definitions of monopoly and competition that do not recognize the role of foreign competition in the domestic market.

--U.S. antitrust laws are nonspecific, and companies often spend considerable time evaluating proposed joint arrangements only to find that after initiation they are subject to Government surveillance and investigation.

--The extent of the applicability of U.S. antitrust laws to international activities of American multinational corporations is unclear and confusing.

--The Justice Department is antagonistic toward the Webb-Pomerene Act, a major antitrust exemption available to certain U.S. exporters.

Justice Department officials generally contend that the businessmen's assertions that they are discouraged from entering into joint ventures by fear of antitrust investigations goes to their state of mind and is impossible to verify or refute. The Department believes that the large number of joint ventures currently being operated by Americans and the lack of prosecutions of joint ventures in the last two decades tend to refute any concrete assertion about the inhibiting effect of the antitrust laws.

State Department officials, on the other hand, believe industry officials are truly fearful of antitrust investigations. They told us that in several instances industry officials have refused to participate with the Government in international mineral discussions because of antitrust concerns.

One specific example cited by State Department officials was the International Lead-Zinc Study Group.

Industry contends laws are outmoded

U.S. antitrust laws are intended to foster competition and to protect the American public from collusive business practices. However, some industry officials contend that these laws originated in an era when foreign producers held insignificant shares of domestic markets and definitions of monopoly and relative competitiveness were based almost entirely on production in the United States. They say that, while foreign competition has increased, the laws have not been updated to recognize its effect on the domestic market.

In contrast, antitrust legislation enacted by a number of other countries after World War II recognizes that their economies, for the most part, are no longer closed. In these countries, maintaining competition between domestic firms has become less important than maintaining competition between domestic and foreign industries. As a result, antitrust exemptions in these countries are more liberal than those of the United States. For example, Japan and the European Economic Community permit domestic companies to combine into commodity group cartels in order to improve production and marketing efficiencies and to encourage small, relatively inefficient firms to combine into one large-scale operation. Most of the major metallurgical plants built in Japan and Western Europe in recent years were built as joint ventures under this concept.

A Justice Department official disagreed that U.S. antitrust laws are somewhat outmoded due to their lack of recognition of the effect of foreign competition on U.S. markets. He said that, in fact, one of the earliest antitrust laws, the Wilson Tariff Act of 1894 (actually a tariff law with antitrust provisions), recognized the existence of foreign competition in the United States in its aim to halt abuses in U.S. import trade.

Concern about the lack of specificity

The major U.S. antitrust statutes--the Sherman Act (1890), the Clayton Act (1914), and the Federal Trade Commission Act (1914)--do not provide checklists of specific legal and illegal practices, but instead set forth principles of business behavior. Even though judicial precedents have helped to define the principles more clearly, firms considering a joint project must invest considerable time and resources in assessing whether the partnership might be susceptible to Government investigation.

According to domestic mineral industry officials, the perceived threat of investigation has inhibited a number of firms from considering joint ventures.

For instance, in the early 1970s, when U.S. copper smelters were pressed into producing sulfuric acid from waste gases as the most practical means of conplying with the Clean Air Act, some companies in the Southwest considered the possibility of a joint disposal effort. Because of their distance from the main sulfuric acid marker (the industrial Midwest) and because of the high cost of producing sulfuric acid, the companies believed that a joint venture would ease some of the difficulties involved in disposal of the acid. However, they decided that even though they could make a strong case for the legality of the venture, it would still be viewed with great suspicion by the Justice Department and lead to increased surveillance of the copper industry. In contrast,
Canadian copper producers formed just such a joint venture for selling sulfuric acid in the United States and, as a result, will have a lower disposal cost than they would have had otherwise.

A Justice Department official said that such concerns as financing or feasibility are usually more important then fear of antitrust investigation to firms considering joint ventures and that instances of antitrust concern being cited as a major deterrent were exceptions, not the rule. He also said that, under Justice's Business Review Procedure, companies voluntarily submit all relevant information about the venture to Justice attorneys, who then issue letters of enforecement intention. Industry officials said that the procedure is often less than facilitating, due to the 6-week delay in ascertaining opinions, and that the letters of intention do not preclude Justice from later investigating a venture's participants.

## Overseas application appears uncertain and confusing

Mineral industry officials said that susceptibility to U.S. antitrust investigations not only makes domestic firms wary of joint ventures with each other but also makes foreign firms apprehensive about participating in joint ventures with U.S. firms. At any point during the investigation of a joint undertaking involving U.S. firms, the records of all concerned parties, including foreign firms, can be subpoenaed, even when the operation is outside the United States.

The Justice Department's Antitrust Guide for International Operations states that, in general, U.S. antitrust laws are applicable to American business transactions overseas when the transactions have, or will have, substantial effects on U.S. commerce. However, it also states that the extent of antitrust extraterritorial application is uncertain and cites the activities of U.S. multinationals and the fact that purely domestic decisions cannot always be readily generalized to the international context as factors contributing to the uncertainty.

Webb-Pomerene antitrust exemption

The Webb-Pomerene Act is a special antitrust exemption which permits the formation of collective export associations of U.S. producers of "good, wares, or merchandise" so that they may compete more effectively in overseas markers against foreign cartels. The Justice Department is admittedly hostile towards the act because, according to one Justice official, it does not require parties to demonstrate that conditions warrant formation of an association and all that companies have to do to qualify is register with the Federal Trade Commission. He said that the Justice Department has been pressing for revocation of the act for a number of years.

Another official denied that there was any concerted effort to investigate Webb-Pomerene groups. However, in view of admitted Department hostility toward the act, many domestic mineral industry officials stated that companies combining as Webb-Pomerene associations make themselves very susceptible to Government investigation.

Conclusions

The debate about the effect of U.S. antitrust laws and Justice Department enforecement on domestic industry's ability to pool resources is not new nor is the solution to the problem easy.

Pooling resources and sharing risks through joint ventures can make investiment in mineral projects more attractive. Certainly, not all cooperative ventures would be in the national interest; however, Justice's efforts to foster competition and to protect the American public from collusive business practices through the enforecement of U.S. antitrust laws discourages domestic firms from taking full advantage of the benefits of joint ventures.

## CHAPTER 4

## FACTORS INFLUENCING THE OPERATING COSTS AND REVENUES OF DOMESTIC MINERAL PROJECTS

In addition to the factors discussed in chapter 3, several others can influence the operating costs and revenues of projects. These factors include labor costs, energy availability and price; and a variety other U.S. and foreign Government actions.

### DOMESTIC LABOR COSTS INCREASED BY U.S. HEALTH AND SAFETY STANDARDS

The cost of labor, including wages, fringe benefits, and health and safety measures, can account for as much as one-third of total production costs in some mineral projects. Because labor costs vary from country to country, they can often influence the location of investments in new or expanded facilities. Several mining officials in other countries cited the significant differences in labor costs as a reason for the expansion of foreign mines at a time when U.S. mines were closing.

#### Net effect of wage and productivity differences is unclear

Differences in wage rates and labor productivity among countries affect the competitiveness of individual projects, but their net influence is unclear. Certainly U.S. wages are higher than those of most countries; for example, the average wage in the South Korean primary nonferrous metal industry is $300 a month, 1/ compared with $1,489 for U.S. workers. The hourly wage, including fringe benefits at one major Philippine mining company is 86 cents, while at a major U.S. copper mine the basic hourly wage is $8.06. Local daily workers at a copper mine in Iran receive about $12 a day in wages and food.

Comparisons of labor productivity are more difficult because of such elements as the use of outside contractors instead of company employees, differences in product mix, and a general lack of comparable data.

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1/ It should be noted that productivity and other bonuses could increase basic wage levels in South Korea by 50 to 100 percent.

Some observers believe that U.S. workers are relatively more productive than their foreign counterparts. An official of a major Canadian metals company estimated Canadian productivity at 30 percent less than that of the United States, while Canadian wage levels tended to be a bit higher.

Others point to some of the more modern foreign operations and contend there is little difference in productivity.

Although a scientific assessment was not made, it appears that U.S. wages and productivity are relatively high but other countries are catching up in both categories. As shown below, the difference between productivity of U.S. iron and steel workers and workers in three other nations was much higher in 1964 than in 1976.

Relative Levels of Output Per Hour
Iron and Steel Industry (note a)

| Country | 1964 | 1976 |
|---|---|---|
| United States | 100 | 100 |
| Japan | 46 | 106 |
| France | 48 | 61 |
| West Germany | 53 | 81 |

a/Based on U.S. = 100 for each year

Source: U.S. Bureau of Labor Statistics

U.S. health and safety standards affect competitiveness of domestic projects

Although it is not clearto what extent differences in wage and worker productivity affect investment, domestic mineral operations clearly are incurring higher costs due to health and safety standards set by the U.S. Occupational Safety and Health Administration (OSHA). As in the case of EPA regulations, weighing the benefits of these standards versus their cost is not simple. Considerable uncertainty surrounds the medical need for the stringent requirements of some standards and the financial and technical ability of the mineral industry to meet them. The implementation of new production processes to achieve compliance with OSHA standards has, in some industries, led to increased productivity and lower production costs. For the mineral industry, however, OSHA standards have generally imposed substantial costs and threatened the continued operation of some domestic facilities which may not be able either to achieve compliance or to remain competitive with foreign producers that do not have to meet such standards.

For example, in 1978 OSHA established a maximum standard of 10 micrograms of arsenic per cubic meter of air averaged over an 8-hour period in the workplace atmosphere. Several copper processing companies disputed the standard as being unnecessarily stringent, costly, and not technically feasible.

--One company estimated the cost of compliance at almost $80 million in capital costs at three of its smelters and more than $11 million in added annual operating costs.

--Another company stated that the arsenic standard was so strict that current engineering controls could at best achieve only a 50-percent confidence level of compliance; it estimated capital costs would be $35 million and increased annual operating costs over $10 million. Furthermore, should rotational work practices be required to meet the standards, the company would have to double its work force at a cost of $41 million a year, resulting in a 75-percent increase in the cost of smelter operations.

--A third copper company was pessimistic that processing equipment could be designed capable of achieving such low exposure levels and believed that, after spending a lot of money, the company would still not be in compliance.

--A copper smelter in Washington State, which employs 750 workers and is the only U.S. producer of arsenic, may have to close because of inability to meet the arsenic standard.

Another OSHA standard established a maximum exposure of 50 micrograms of lead per cubic meter of air averaged over an 8-hour period. A consultant's study prepared in 1977 for the Lead Industries Association found that an earlier proposed standard of 100 micrograms would cost the domestic lead industry about $416 million in capital costs and about $112 million in annual operating costs, or about $6,600 per exposed employee. The study concluded that enforcement of the standard could result in closing domestic primary lead refinery facilities, lead mines, battery plants, and secondary refineries. An OSHA analysis of the lead standard reached the same conclusion and estimated that it would add capital costs of $452.3 million and annual operating costs of $74.6 million to the domestic lead industry, and lead to a 10 to 14 percent decline in worker productivity at primary and secondary lead facilities.

A proposed OSHA standard would require that employees not be exposed for more than 8 hours to a concentration of 2 parts sulfur dioxide per million parts of air (2 ppm) or more than 15 minutes to 10 ppm. The standard also contains requirements for employee exposure measurements, methods of compliance, personal protection clothing and equipment, training, medical surveillance, and recordkeeping. The standard would apply in all workplaces where sulfur dioxide is used as a raw material or is emitted as an unwanted by-product from a chemical process or fuel combustion.

OSHA has estimated that compliance with its proposed sulfur dioxide standard by the copper, lead, and zinc smelting and refining industries would require capital costs of over $43 million and annual costs of almost $19 million.

Foreign standards

Measuring the differences between worker health and safety standards of the United States and other countries is difficult because the strictness and methods of enforcement vary from country to country. However, a significant difference in the approach to such standards does seem apparent from our observations. U.S. worker health and safety standards are enforced at all locations generally without regard to circumstances, and, although OSHA allows some variances, its latitude in permitting these variances is limited. In contrast, other countries apply their standards case by case, obtaining the level of compliance feasible for each particular facility, and seemingly giving priority to the continued operation of the facility.

OSHA also prefers engineering controls (design of processing machinery and facilities to contain emissions) for achieving compliance, while less expensive control methods, such as protective clothing, respirators, and work practices, are acceptable in some foreign countries. For example, Swedish health and safety standards are generally strict; however, a copper smelter in Ronnskar that processes copper ore with a high arsenic content, similar to a smelter in the United States, has been permitted to use protective clothing and respirators to protect its workers from arsenic exposure and has been given considerable time in which to comply with Sweden's arsenic emission standards. In 1975 the Swedish Government also authorized a $13 million grant to the firm for processing equipment that would reduce arsenic emissions.

In the Philippines, Australia, Chile, Mexico, and Spain, enforcement of worker health and safety standards does not appear to be as strict as in the United States; such needs

priority and companies are often allowed great latitude in enforcing the standards. A copper smelter in Chile, for example, uses a process that occasionally emits large concentrations of sulfur dioxide gas into some work areas; a more efficient and energy-saving process is being developed which will also reduce and facilitate treatment of these emissions, but efforts directed specifically at reducing sulfur dioxide emissions will not be made until this process is implemented.

### Conclusion

Balancing the benefits of health and safety standards and their costs to the mineral processing industry or identifying other alternatives for handling these costs is a complex problem.

Efforts to assure the health and safety of workers in the United States, while helping to improve some worker conditions, are adding significant costs to the processing of minerals. These added costs are contributing to the problems that domestic mineral facilities face in competing with foreign processors. As a result, investment in domestic mineral projects is less attractive.

## GOVERNMENT ACTIONS RESTRICT ENERGY AVAILABILITY AND INCREASE ENERGY COSTS

The transformation of ores into metal requires large quantities of energy. An investor, before investing in a mineral processing facility, must be assured of the availability of energy for at least long enough to recover the cost of building the facility. Certainly the cost of energy can also be a factor if it makes the project unprofitable, but this is a secondary consideration to energy availability.

Of the metals we surveyed, aluminum production is the most energy intensive and the most affected by energy considerations. Production of alumina from bauxite or of primary aluminum metal from alumina is especially vulnerable to a loss of electric power. A sudden loss for about 30 minutes would require several months to return to maximum production after power is restored. Consequently, aluminum producers look for reliable sources of electricty when deciding where to build a facility.

In the United States, a large portion of aluminum metal smelter capacity is linked with public power sources that had offered low cost, dependable power during and after World War II, when the major portion of present capacity was installed.

Two Federal power authorities, the Tennessee Valley Authority (TVA) and the Bonneville Power Administration (BPA), supply about 46 percent of the aluminum industry's electricity requirements. The Power Authority of the State of New York (PASNY) supplies another 7 percent. Thus, Government agencies supply over half of the domestic aluminum industry's electric power needs.

U.S. generating capacity is insufficient to meet growing energy demands

TVA, BPA, AND PASNY all started as predominantly hydropower systems. PASNY and BPA are meeting demand for electricity by diversifying into thermal plants. TVA has become predominantly a coal-based system. To continue to meet the energy needs of the aluminum industry and the increasing population, however, will require even more expansion; but for many utilities, licensing delays, inability to meet pollution control standards, and lack of capital have forced cancellation or delay of many expansion projects.

In the Pacific Northwest, BPA provides about 31 percent of U.S. domestic primary aluminum capacity. A provision of the Bonneville Project Act, known as the preference clause, requires that BPA give publicly owned utilities and Federal agencies first call on BPA energy. Demand for electricity is now approaching BPA's generating capacity. To meet growing demand, BPA planned construction of several thermal energy plants to be completed by the mid-1980s; however, construction has been delayed. Faced with possible power capacity shortage as demand continues to expand in the 1980s, BPA has notified the aluminum producers that their power supply contracts will not be renewed when they expire during the 1983-88 period. As a result, those producers are faced with an uncertain supply and some production capacity may close.

Our August 10, 1978, report to the Congress, "Region at the Crossroads--the Pacific Northwest Searches for New Sources of Electric Energy" (EMD 78-76), detailed the difficulties that increased demand is placing on BPA and the problems BPA has in increasing its capacity.

Increased demand for electrical power in other parts of the country is also causing concern. The future availability of power for industrial expansion will depend upon construction of new thermal plants. The growth in Government regulatory reviews and permits required to build new thermal electricity plants, however, has significantly increased the time required to bring new capacity onstream. For example, in 1968 one major electric utility system was able to build

a new coal-fired power plant in about 4 years at a capital cost of about $200 per kilowatt of capacity. The same operator is currently building another coal-fired plant that will take 8 to 10 years to complete at an estimated capital cost of $560 per kilowatt of capacity.

According to representatives of the utility industry and the Department of Energy, increasing regulatory delays and related capital costs have reduced construction of new and replacement power plants.

As a result of uncertainty about electric power availability, only one major planned addition to domestic aluminum production is going forward and others have been canceled or postponed. For example, an 82,000-ton-per-year expansion of an aluminum smelter in Maryland was stopped because of possible electricity supply shortages forecast for the mid-1980s. Construction of the needed electricity generating facilities was delayed because of problems in obtaining Government permits and in complying with EPA regulations.

TVA is having similar problems in expanding its facilities. Our November 29, 1978, report to the Congress, "Electric Energy Options Hold Great Promise for the Tennessee Valley Authority" (EMD 78-91), cited several problems that TVA was having in complying with EPA standards.

Foreign governments attempt to minimize uncertainty about energy availability

Industry officials believe the uncertainties regarding electric power availability in the United States will hinder future expansion of mineral processing capacity and will encourage expansion overseas where power availability will be more assured by host governments. Some countries have a natural advantage over the United States in providing energy because they have underutilized energy resources; others are giving high priorities to securing energy for industrial expansion. For example:

--Chile, although it does not have abundant energy resources, has taken steps to assure the minerals industry of long-term energy availability.

--The Republic of South Africa provides long-term energy supply commitments to industrial customers.

--Australia, South Korea, Norway, and Sweden negotiate special energy rates of fixed (often long-term) duration.

These approaches reduce the uncertainty regarding energy availability that is important to an investment decision. This is in apparent contrast to the climate of increased uncertainty in the United States.

Energy costs are increasing

The Government has historically aided development of the mineral industry by making energy available at attractive rates; however, the tightening availability of energy coupled with Government actions, such as the recent regulations for coal mine reclamation, are expected to significantly increase energy costs. According to the Department of the Interior, uncertainty about future energy costs increases is affecting mineral investment decisions.

Conclusion

Government restrictions which delay or halt the construction of power-generating facilities are limiting the availability of energy in the United States and actions which are increasing energy costs are further discouraging the expansion and development of the domestic mineral industry.

## OTHER GOVERNMENT ACTIONS INFLUENCE REVENUE AND COST

U.S. and foreign Government actions also are affecting the costs of producing mineral products or the prices received for them.

### Tax laws seem to favor foreign mineral projects

The structure and stability of a nation's tax system affects the relationship between the costs and the revenues of mineral projects and, thereby, the investment decision. In addition to generating revenue, tax structures have historically been used to stimulate industry. Although no comprehensive comparisons of the effect of various countries' tax systems on the mineral industry have been made recently, analyses made in 1970 and 1975 show that the U.S. tax structure does not provide as good an investment climate as that of most other countries.

A Presidential task force on business taxation 1/ reported in 1970 that U.S. tax laws cause American industry to recover capital outlays much slower than do industries in most foreign countries. A 1975 study by the public accounting firm of Coopers & Lybrand for the American Mining Congress, analyzed the tax structure of Belgium, Canada, France, Japan, the Netherlands, Switzerland, the United Kingdom, and West Germany and measured the burden of the U.S. structure relative to those countries. According to the analysis, involving hypothetical mining ventures with varying capital expenditures, revenues, and operating costs in a number of capital-importing countries, the United States ranked eighth for average return on equity and seventh on investment.

The limitation of this analysis is that it (1) compared investments among only eight other developed countries and (2) did not compare the tax implications for a domestic project with similar projects in developing countries. The absence of these additional comparisons is significant because many developing countries (and some developed countries not considered in the study) seem to have systems which provide more encouragement for development of mineral projects than does the United States.

We looked at tax incentives offered by several foreign countries, realizing that specific incentives may not be representative of a country's overall tax structure and, therefore, such comparisons could be misleading. However, we believe that the extra incentives offered to industry by other countries generally indicate the extra encouragement they offer to industry.

For example, in the United States, companies are allowed accelerated depreciation that enables assets used in mining and beneficiation to be depreciated on a diminishing-value basis over 8 years 2/. (The minimum depreciation period for manufacturers of primary ferrous and nonferrous metals is 14.5 and 11 years, respectively.) The companies also may deduct 20 percent of the cost of qualifying property (subject to dollar limitation) as additional first year depreciation. Net

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1/"Business Taxation," the report of the President's Task Force on Business Taxation, Sept. 1970.

2/This is the lower limit of IRS' Class Life Asset Depreciation Range System of computing the reasonable depreciation allowance for all eligible property (IRS publication 534, 1979 ed.). Under the system, useful life is generally shorter than under normal methods of depreciation.

operating losses may be carried back 3 years and forward 5 years. In contrast:

--In Ireland, mining firms may claim at any time depreciation up to 100 percent of the cost of fixed plant and machinery. In the underdeveloped areas, a 20-percent investment allowance is available for new plant and machinery in addition to 100-percent depreciation (total 120 percent). Unlimited loss carryforward and a one-year loss carryback is also permitted.

--In Australia,mining firms enjoy an accelerated depreciation allowance that enables capital expenditures on the mine to be deducted on a diminishing-value basis over 5 years. They may also take a 20-percent investment allowance for new plant and equipment costs. Net operating loss carryovers may be carried forward 7 years, but not carried back.

--In South Africa, mining firms may deduct 100 percent of mining capital expenditures as incurred. While there is no loss carryback, there is no limit on loss carryforward.

--In Canada, mining firms may deduct up to 100 percent of the costs of depreciable assets acquired for new mines or major expansions of existing mines in any one year, limited to the amount of income before depreciation. Net operating losses may be carried back one year and carried forward 5 years.

Also, similar to the U.S. system which allows an investment tax credit equal to 10 percent of the cost of eligible property, some countries allow companies to set aside a portion of their profits as tax-free income to be used for new investment. For instance:

--Swedish companies are allowed to set aside 40 percent of their profits from any one year as tax-free income. These funds may be used later, under certain conditions, for new investments.

--Norwegian firms may set aside and exempt from taxable income up to 25 percent of their profits for investment in certain developing areas of Norway. Companies must reduce the depreciable amount of of assets purchased with these reserves, but the reduction may be as little as 55 percent of the the reserves used.

--Spanish companies may place up to 50 percent of their undistributed earnings in a tax-free investment reserve which may be used to acquire fixed assets.

Some countries also offer other exemptions or reductions in the amount of taxes paid by companies located there.

--Ireland offers a tax exemption on all export profits until 1990.

--The Philippines allows certain enterprises a diminishing tax exemption over a 15-year period from all national taxes except income taxes.

--The Republic of Korea allows foreign enterprises exemptions or reductions for up to 8 years for income and corporation taxes, property and acquisition taxes, and taxes on dividends.

Uncertainty about future tax laws can also detract from the investment climate. An official of the zinc industry stated that frequent changes and calls to overhaul U.S. tax laws creates a climate of uncertainty that affects long-term planning. For instance, the percentage depletion allowance has come under frequent attack as a subsidy to mineral enterprises which deprives the Federal Government of large amounts of revenue. Largely on the basis of such arguments, the Tax Reform Act of 1969 reduced percentage depletion rates for a number of minerals.

As a way to attract desired investment, some countries are guaranteeing tax rates for a period of years.

--Chile allows foreign-owned companies to pay either the prevailing tax rate, which might fluctuate, or a rate guaranteed to remain the same for 10 years.

--Peru negotiates reduced tax rates during a project's investment recovery period.

--The state governments of Australia (which have primary authority over mineral development) negotiate the terms for new ventures, including the tax rate, which may be less than the statutory rate.

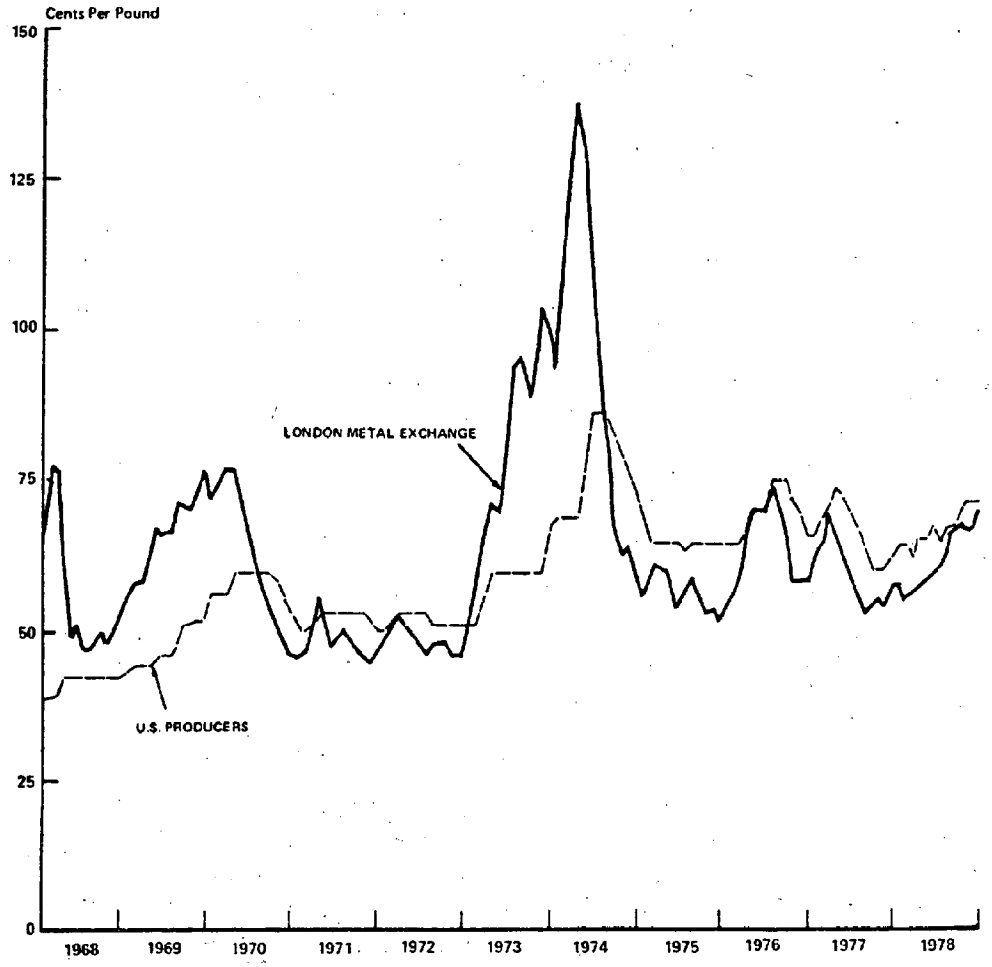
Foreign governments have allowed firms to recover a higher percentage of capital outlays in the early years of new projects. This is particularly important since the earlier the tax benefits, the sooner cash is freed for such purposes as

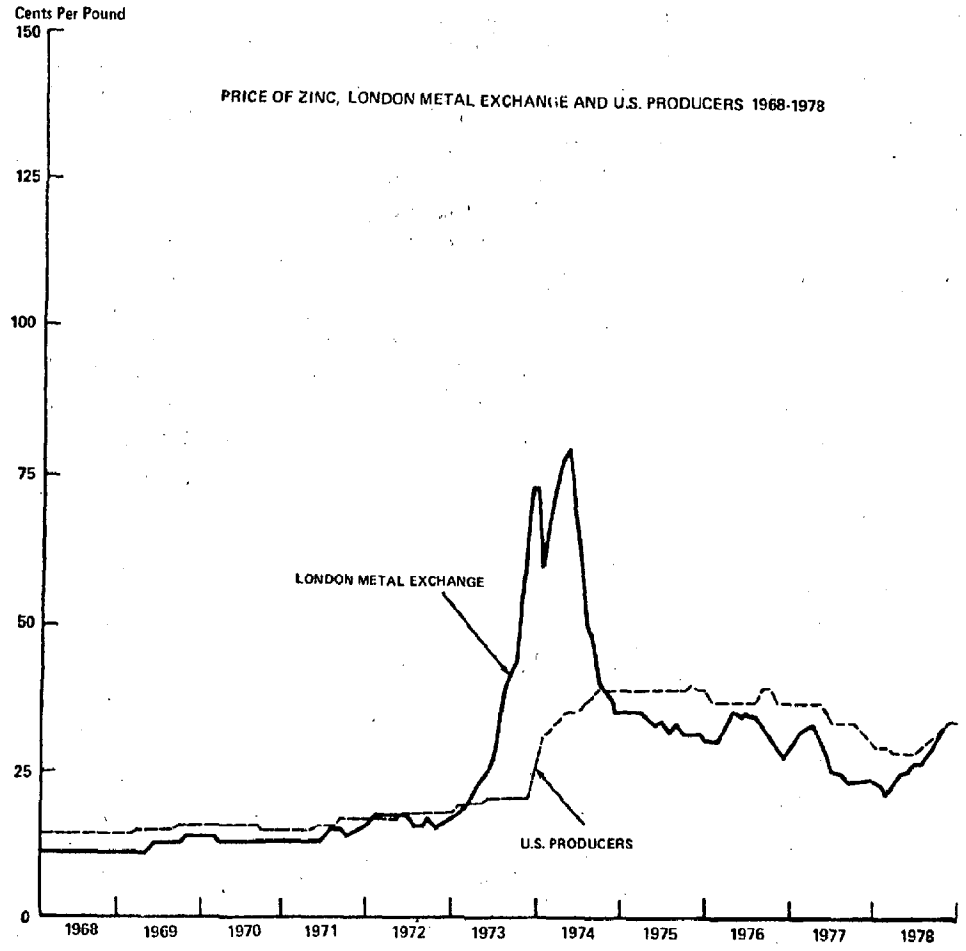
further capital investment. Moreover, especially during periods of high inflation, the early recovery of capital outlays minimizes the effects of inflation on depreciation allowances.

## Government actions influence U.S. metal prices

As noted earlier, the minerals industry is a cyclical industry that frequently encounters short run imbalances between supply and demand, causing sharp fluctuations in metal prices as well as in company profits. For example, as shown below, during 1968-78 domestic and world market prices for copper and zinc fluctuated dramatically. On the London Metal Exchange, annual average copper prices varied between 48 and 93 cents per pound, and zinc prices varied between 12 and 56 cents per pound.

PRICE OF COPPER, LONDON METAL EXCHANGE AND U.S. PRODUCERS 1968-1978






Although these fluctuations often show the effects of day-to-day events, such as strikes, calamities, wars, price controls, threats of stockpile releases, and actual stockpile sales, the effect of any specific event is difficult to measure. Two of these factors--price controls and stockpile manipulations--are particularly important to our discussion because they represent Government actions which have an affect on revenues from U.S. metal sales and, therefore, influence profitability.

Price controls

Because metal prices fluctuate, the high profits made during periods of high prices offset the low profits or losses incurred when prices are low. However, while controls help consumers in the short run, the establishment of price controls during periods of rising prices can interfere with this normal business process.

For example, in August 1971, when price controls for zinc were set at 17 cents a pound, the price on the London

Metal Exchange was 15 cents. Domestic zinc prices rose to 21 cents until the price controls were removed in December 1973. However, during the same time period, the price of zinc on the London Metal Exchange jumped to over 73 cents a pound. A report by the Lead-Zinc Producers Committee concluded that the price controls prevented domestic zinc producers from having the same advantage of higher prices as foreign producers, thus damaging the profitability and financial strength of the domestic producers.

The 1971 price controls also made it difficult to compete for foreign concentrates needed to supplement domestic mine output. As the price of zinc increased in world markets, the price of foreign concentrates also rose; but, since the price of metal produced in the United States was fixed, it was not economical to import concentrates.

The copper industry was also significantly affected by 10 months of price controls imposed in June 1973 which set copper prices at about 60 cents a pound until early December when prices were increased to between 68 and 69 cents. London Metal Exchange copper prices, which were about 51 cents a pound at the start of 1973, increased to over 99 cents by November. The 68 to 69-cent restriction on domestic producer prices continued until the end of April 1974, when price controls were lifted. London Metal Exchange prices shot from 92.1 cents a pound in January to $1.375 for April, with an all time high daily quotation of $1.52 on April 1.

The copper price controls may have also prevented the U.S. producers from taking advantage of the high prices on the world market.

A major U.S. metal-producing corporation said that during a period of strong demand, price controls slice the top off earnings but do nothing to shorten the duration or magnitude of depressed markets--a bad scenario for a cyclical industry.

More recently, the implementation of the President's voluntary wage and price guidelines may have had a negative impact on the ability of U.S. steel producers to secure adequate supplies of molybdenum. The guidelines, which do not cover exports, have resulted in a two-tier price structure, under which exports are priced higher than molybdenum sold domestically. Prior to the price controls, molybdenum was already in short supply and U.S. producers were being forced to allocate supplies to their customers. The American Iron

and Steel Institute believes the two-tier price structure (while in compliance with the President's guidelines) may also have the effect of encouraging greater exports of molybdenum thus, aggravating an already serious domestic shortage.

Stockpile manipulation

The Government has used the national strategic stockpile, both indirectly and directly, to keep domestic metal prices down during periods of rising world prices.

The national stockpile consists principally of mineral commodities deemed to be strategic and critical for meeting defense and essential civilian requirements in any possible future war. However, large fluctuations in stockpile objectives over the past three decades have affected domestic mineral prices and expectations about future prices and have added uncertainty to the domestic mineral industry.

An industry official, speaking on behalf of the American Mining Congress before a congressional committee, 1/ said that "In the view of most mining people the strategic stockpile program has had a disruptive influence on commodity markets."

Threatened disposals, actual liquidations, and the continuing existence of excess stockpile mineral inventories have all had an affect on keeping domestic prices down and inhibiting additional investment.

The First Annual Report (March 1972) of the Secretary of the Interior released under the Mining and Minerals Policy Act of 1970 noted that development of domestic resources was not keeping pace with demand. One of the problems identified was that actual and threatened stockpile disposals were hanging over the domestic mineral markets and posing a concern for domestic producers. The report cited various tonnages of metals in the stockpile which were in excess of stockpile objectives and concluded that, despite the orderly disposal of these excesses, their existence and the possibility of sale tended to discourage the domestic industry's exploration and development of new mineral projects.

The Arthur D. Little January 1978 report on copper for EPA noted that:

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1/Hearings before the Subcommittee on Materials Availability of the Joint Committee on Defense Production, "Purpose and Organization of Econmic Stockpiling," June 8 and 9, 1976.

"In the 1950's, when the stockpile was being purchased, the increased demand, along with the demand resulting from the Korean War, caused producers to greatly overexpand their capacity, which was later to prove quite costly to them in the late 1950's when, with a severe drop in demand, they were faced with sizable idle capacity. When prices rose in late 1959, sales from the stock pile were used to keep the price down. In 1965, when copper producers proposed raising their price by two cents per pound at the same time that the LME [London Metal Exchange] price was rising fast, President Johnson reacted by threatening to have 200,000 tons of copper sold from the United States strategic stockpile and forced producers to rescind their price increase. Later, the United States stockpile undoubtedly prevented copper prices from increasing beyond the high levels attained during the Vietnam War. Finally, following the unprecedented surge in copper prices (as well as in the prices of other nonfuel primary producers) in 1973, President Nixon ordered the complete disposal of the national stockpile to stabilize copper prices. Copper from the stockpile was then sold at a price considerably above the producers' price, at a time when the producers' price was fixed by government price controls."

Tariffs

U.S. tariffs on some metals are less than those of other countries, so foreign producers can often make greater profits by selling their metal in the United States rather than other markets. Zinc and ferroalloy industry officials, in particular, believe that the large increases in imports have been caused, in part, by low tariffs on these commodities.

According to industry officials, the United States, with no quota on metal imports and a tariff of only 0.7 cent a pound (about 1.8 percent of the April 1979 price), is the only major market relatively open to zinc metal imports. The European Economic Community, many of whose countries export zinc metal to the United States, has a tariff of 3.5 percent on the value of zinc imports.

Ferroalloy industry officials also believe that low tariffs have encouraged imports. In a submission nominating certain ferroalloys of chromium, manganese, and silicon to be exceptions from a tariff reduction, the executive director of the Ferroalloys Association stated that:

"The current disparity in duties between the United States and the other consuming countries (Japan and the EEC [European Economic Community]) and the extension of GSP [Generalized Systems of Preferences] to the developing countries have made the United States the most attractive market for ferroalloy exporting countries (including both developing and developed countries)".

One reason for the difference in tariff effectiveness is that U.S. tariffs on many metals are based upon weight (i.e., X cents a pound) while foreign tariffs are based on a percentage of the value. Because of this difference in tariff structure, inflation has reduced the relative effectiveness of U.S. tariffs. For example, the U.S. tariff on high-carbon ferrochromium has been 0.625 cent per pound of chromium since 1963. In 1967, this charge amounted to 5.3 percent of the value of a pound of alloy; by 1972 it equaled 4.9 percent; and in 1976, 1.9 percent. During the same period, tariffs of Japan and the European Economic Community were 8 percent of the value.

Other market interventions

In the United States, the production levels of mining and mineral processing firms are determined generally by market conditions, especially world metal prices, and by company policy.

In some countries, government participation may keep production levels up even if prices and demand are low (thus subsidizing world consumers). For example, in Bolivia, Peru, Zaire, and Zambia, where mineral production is an important factor in providing employment and foreign exchange, the governments intervene in some cases to continue mineral production even when normal market conditions indicate production should be reduced. These governments, through their state-controlled mineral sector enterprises, represent "new players" in the international minerals market, "playing" according to non-marketplace rules.

In other countries, production levels are not necessarily controlled by the government directly but subsidies keep production continuing even though market conditions are unfavorable.

One unique approach is the copper fund used in Norway in an attempt to maintain employment and give the more efficient producers some relief during periods of low prices. The fund is anticipated to spend some $37.8 million over a 2-year period

(about $15,000 per miner). Copper producers pay into the fund when prices go above a certain ceiling price and are paid from the fund when prices fall below a certain floor price. Norway also subsidizes interest payments for the financing of ores, minerals and metals inventories during periods of weak demand.

In 1977 the Australian Government, in conjunction with state authorities, agreed to provide about $8 million in cash grants to cover the operating losses of the Mt. Lyell copper mine to prevent its closure and subsequent employment losses. The State of Tasmania also agreed not to force compliance with water pollution control measures that would require the expenditure of about $50 million and would likely close the mine.

In 1974 the Japanese Government agreed to a request by the Intergovernmental Council of Copper Exporting Countries 1/ to withhold copper from the world market. Council members contended that Japanese copper exports were contributing to the sharp fall in copper prices on the London Metal Exchange. Thus metal supplies were withheld at a time of diminishing demand.

## CONCLUSIONS

The trend toward increasing reliance by U.S. manufacturers on foreign-processed minerals results primarily from the failure of investment in expanding or modernizing domestic mineral projects to keep pace with U.S. consumption. Although the problems faced by the domestic industry can be related to traditional economic factors that affect relative profitability, U.S. and foreign government actions are becoming more and more important in mineral investment decisions and are accelerating the trend toward increased reliance on foreignprocessed minerals.

The adverse effects of U.S. Government actions on the mineral industry often result from efforts to minimize or prevent inherently undesirable aspects of the industry. Foreign governments, on the other hand, are either more lenient in

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1/An organization of governments that works for worldwide copper price stabilization and market development. Members are Zambia, Chile, Peru, Zaire, and Indonesia; associate members are Australia, Mauritania, Papua-New Guinea, and Yugoslavia. Members provide about 60 percent of the Western world refined copper.

dealing with these problems, providing support to solve the problem without jeopardizing the mineral industry, or are actively assisting development of mineral projects in pursuit of their own social and economic priorities.

## CHAPTER 5

## IMPLICATIONS OF THE INCREASING RELIANCE ON FOREIGN MINERALS

The decline of the U.S. mining and mineral-processing industry has contributed to the loss of jobs and job opportunities in the industry, adversely affected the U.S. balance of trade, and increased concerns about vulnerability to mineral supply disruptions.

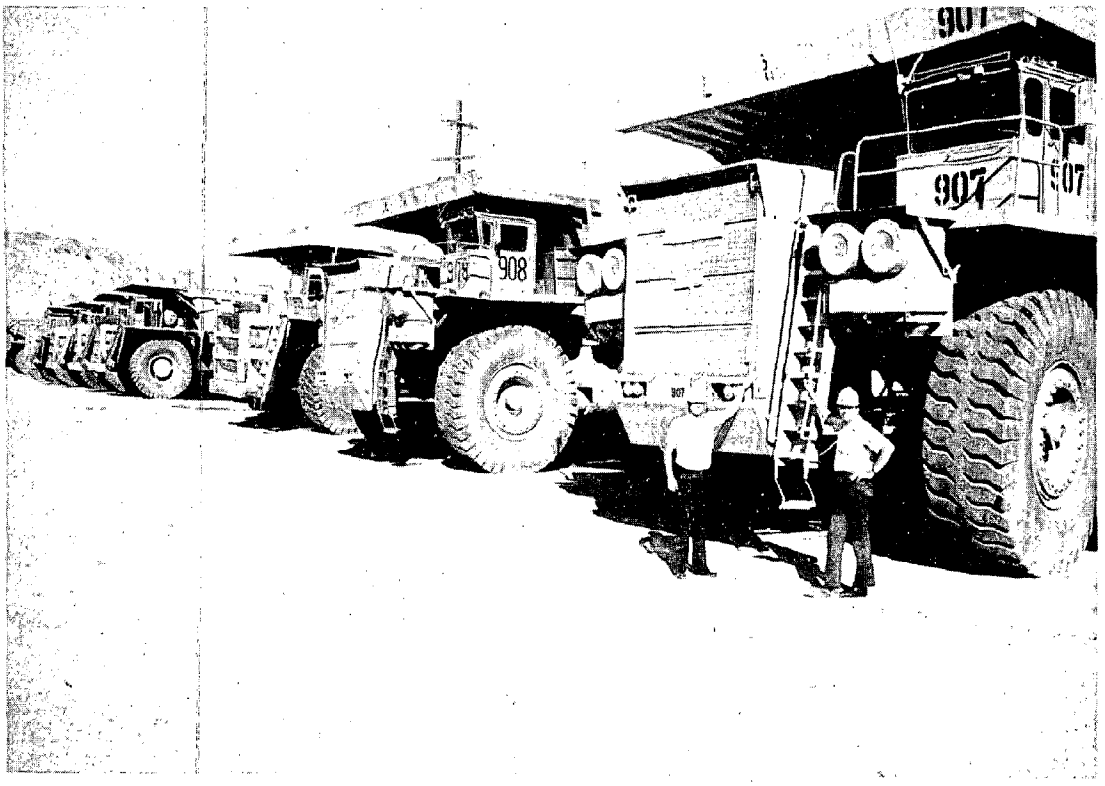
It is not the purpose of this discussion to debate the value of the mineral industry or to take sides in the balancing of Government actions with their consequences. In presenting this information, we hope to provide the Congress with greater insight into the implications of the problems of the mineral industry to the Nation.

### JOBS AND JOB OPPORTUNITIES LOST

The total number of jobs lost in the mineral industry cannot be readily determined, but various reports indicate that over 18,000 workers directly employed in the mining and/or primary processing of zinc, copper, and ferroalloys have lost their jobs due to plant closings or curtailment of production during the past several years. While this number is small in comparison to national unemployment figures, these jobs can have major local or regional impacts. For example, 1,600 copper miners in Michigan's remote upper peninsula were laid off in 1976 and the already high unemployment rate in the affected area rose from 10.1 to 22.1 percent. In Ajo, an Arizona copper-mining community, retail sales declined by 40 percent after most of the 1,100 local mine and smelter workers were laid off in August 1977.

In addition to direct loss of jobs, "multiplier effects" extend unemployment; when a job is lost in mining/mineral-processing, other jobs which had provided service to the industry or its employees are also lost. In Tucson, Arizona, a construction firm which provided services to local mines laid off 1,161 employees by May 1978 as a result of mine closures and/or curtailments.

A comprehensive study of the impact of U.S. environmental, health, and safety regulations on the U.S. copper industry made by the Arthur D. Little Company for the Department of Commerce forecast that by 1987, 36 percent of the industry's potential employment, or 31,000 full-time jobs, would be lost because of these regulations.



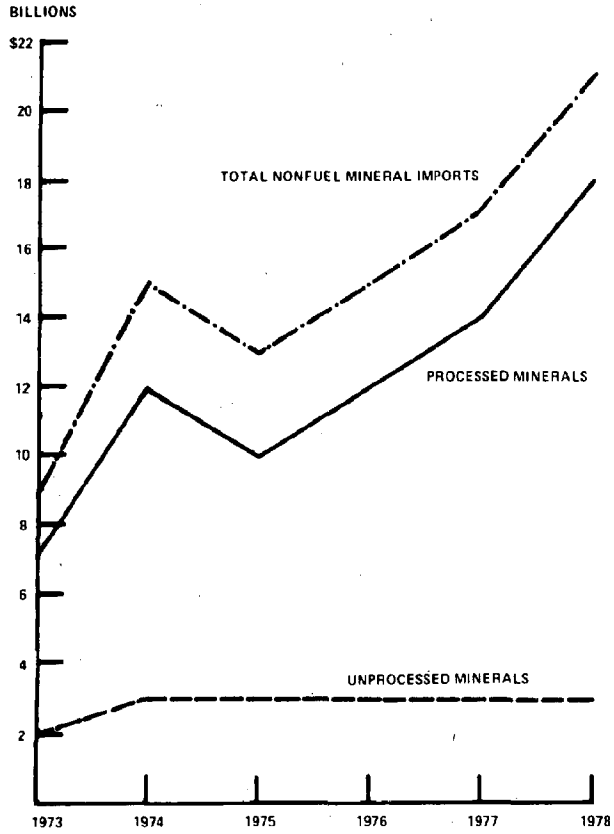

In addition to the loss of jobs, mine and processing facilities are often idled. Shown above are some of the forty four 170-ton capacity trucks idled between September 1977 and May 1979 at the Cyprus Pima Mining Company in Arizona. These trucks cost more than $500,000 each and are part of more than $140 million in idled plant and equipment.

## TRADE BALANCE ADVERSELY AFFECTED

In 1978, the United States incurred a deficit trade balance of $34 billion, continuing the trend of an increasing trade deficit. Although many factors, particularly oil imports, are responsible for the deficit, part of it can be attributed to nonfuel minerals whose own deficit in 1978 represented $9.9 billion (including steel but excluding chemicals and plastics).

Nonfuel mineral imports have contributed to the deficit in at least two ways. The most obvious factor is that such imports have been increasing faster than exports. More significant, however, is the growing valued-added impact as imports shift from lower value ores and concentrates to higher value processed minerals or metals. The change in makeup and the increase in value of nonfuel mineral imports since 1973 is shown on the next page.

IMPORTS OF NONFUEL MINERALS (note a)




a/ DATA INCLUDES ALL NONFUEL MATERIALS OF MINERAL ORIGIN, INCLUDING NONMETALLICS. IMPORTS OF METALLIC MINERALS, INCLUDING STEEL, HAVE HISTORICALLY REPRESENTED OVER 50% OF TOTAL NONFUEL MINERAL IMPORTS. PLASTICS AND INORGANIC CHEMICALS ARE INCLUDED, HOWEVER, THEY ARE RELATIVELY INSIGNIFICANT (1978 IMPORTS TOTALED $0.5 BILLION).

SOURCE: BUREAU OF MINES

Specifically, for three of the four metal industries included in our analysis, the increase in imports of processed metals in lieu of raw materials is quite pronounced, as shown in tables 8 through 11.

Table 8

Imports of Manganese Ore and Alloy

| Year | Ore | Alloy (note a) | Alloys as percent of total imports |
|---|---|---|---|
| | (000 short tons | manganese content) | |
| 1968 | 870 | 183 | 17.4 |
| 1970 | 847 | 238 | 21.9 |
| 1972 | 793 | 305 | 27.8 |
| 1974 | 593 | 376 | 38.8 |
| 1976 | 649 | 478 | 42.4 |
| 1977(note b) | 454 | 481 | 51.4 |

a/Includes a small amount of manganese metal.

b/Based on recent costs for manganese ore and ferromanganese, in 1977, the value added or extra cost of importing alloy rather than ore to be processed was about $112 million.

Table 9

Imports of Chromium Ore and Alloy

| Year | Ore | Alloy | Alloys as percent of total imports |
|---|---|---|---|
| | (000 short tons | chromium content) | |
| 1968 | 341 | 42 | 11.0 |
| 1970 | 443 | 26 | 5.5 |
| 1972 | 341 | 92 | 21.2 |
| 1974 | 329 | 107 | 24.5 |
| 1976 | 365 | 158 | 30.2 |
| 1977 (note a) | 368 | 139 | 26.5 |

a/Based on recent costs for these imports, the extra cost of metal imports over ore imports in 1977 was $78 million.

Table 10

Imports of Zinc Ore and Concentrate and Metal

| Year | Ore and concentrate | Metal | Metal as percent of total imports |
|---|---|---|---|
| | (000 short tons zinc content) | | |
| 1968 | 543 | 305 | 36.0 |
| 1970 | 526 | 270 | 34.0 |
| 1972 | 255 | 523 | 67.2 |
| 1974 | 240 | 540 | 69.2 |
| 1976 | 97 | 714 | 88.0 |
| 1977 (note a) | 123 | 577 | 82.4 |

a/The extra cost of metal imports over ore imports for 1977 totaled $172 million.

Table 11

Imports of Unrefined and Refined Copper

| Year | Unrefined copper | Refined copper | Refined copper as percent of total imports |
|---|---|---|---|
| | (000 short tons copper content) | | |
| 1969 | 277 | 131 | 32.1 |
| 1970 | 258 | 132 | 33.8 |
| 1972 | 212 | 192 | 47.5 |
| 1974 | 264 | 314 | 54.3 |
| 1976 | 133 | 370 | 73.6 |
| 1977 (note a) | 106 | 391 | 78.7 |

a/The extra cost of metal imports over ore imports for 1977 was $238 million.

In contrast to these metals, the shift away from aluminum ore (bauxite) to metal has not yet taken place. However, the United States has placed increased reliance on foreign-produced alumina (an intermediate, higher value product) to meet its increasing needs.

Imports of Bauxite, Alumina, and Aluminum Metal as Percent of Total Aluminum Imports

| Year | Bauxite | | Alumina | | Aluminum | |
|---|---|---|---|---|---|---|
| | Amount | Percent | Amount | Percent | Amount | Percent |
| 1968 | [a]3,041 | 67 | [a]686 | 15 | [a]793 | 18 |
| 1970 | 3,489 | 66 | 1,344 | 25 | 468 | 9 |
| 1972 | 3,231 | 59 | 1,485 | 27 | 794 | 14 |
| 1974 | 3,893 | 61 | 1,890 | 29 | 629 | 10 |
| 1976 | 3,314 | 56 | 1,880 | 32 | 749 | 12 |
| 1977 | 3,346 | 53 | 2,155 | 34 | 836 | 13 |

a/000 short tons aluminum content.

As the trend toward increasing reliance on foreign processed minerals accelerates, the significance of mineral imports in the balance of trade will continue to mount. The Bureau of Mines has projected that mineral imports, which total $21 billion today, could exceed $50 billion by the year 2000.

## INCREASED CONCERN ABOUT VULNERABILITY TO SUPPLY DISRUPTIONS

As the United States meets a greater portion of its mineral needs through imports, concerns about vulnerability to supply disruptions increase. In response to this concern, the United States has a longstanding policy of maintaining a national security stockpile of critical and strategic materials. However, as import dependency increases and the United States shifts from importing ores and concentrates to processed minerals, acquiring and maintaining stockpiles could become extremely expensive.

### Peacetime concern

A 1977 International Economic Studies Institue analysis of 27 important industrial raw materials concluded that supplies of bauxite/aluminum, chrome, platinum group metals, and copper over the next decade pose a potential threat to overall U.S. industrial production, employment, and inflation. Judgments involved assessments of each raw material for availability of reserves, possibility of substitution, vulnerability to producer action, ratios of imports to consumption, and the dollar cost represented.

The Institute's analysis, as well as a report by the National Commission on Supplies and Shortages, concluded

that supply disruptions because of worldwide exhaustion were unlikely but that, because some minerals were concentrated in only a few places in the world, short-term supply disruptions were possible. Although these reports concluded that neither mineral embargoes nor OPEC-like cartels were likely, they found that supply interruptions due to local hostilities have been and are continuing to threaten assured supply of raw materials. For example, a bottleneck resulting from the Angolan civil war impeded the supply of cobalt, which is critical to several defense applications, from Zaire in 1976. Then in 1978, during a period of already strong demand for and insufficient supply of cobalt, tribal warfare in Zaire itself resulted in shutdown of the mines for a short period. The price of cobalt then increased from about $6 to about $20 per pound in 1978 and to $25 in 1979.

Reliance on countries with centrally planned economies can also be uncertain. For example, the United States has historically imported substantial amounts of both chromium and platinum from the Soviet Union. In late 1977, the Soviets sharply reduced sales of platinum. This fact, along with the uncertainty of the U.S. dollar and other economic concerns, followed by the announcement of South Africa's plan to reduce output, spurred the price upward, from $180 an ounce in early 1978 to $300 an ounce in early 1979. The United States experienced a similar disruption in chromium and manganese shipments from the Soviet Union in the post-World War II period.

## Problems in meeting mobilization needs

Supply interruptions or cutoffs could also cause problems in supporting U.S. defense during a period of national mobilization or conflict. Because of this concern, a national stockpile of strategic and critical materials was established following World War II.

We discussed the national defense implications of increased reliance on foreign-processed minerals with officials of the Federal Preparedness Agency (FPA), which has primary responsibility for developing policy and establishing inventory goals for the strategic stockpile and for developing domestic sources of strategic and critical materials. We also talked with the Department of Defense (which advises FPA of defense needs for such materials) and the Department of Commerce (which, with the Department of the Interior, provides FPA with supply and consumption data for these materials).

The officials told us that the need for primary metal products to meet mobilization needs has been recognized and the FPA, in conjunction with various other agencies supports research projects (recycling, substitutions, new technology, etc.) to reduce import dependency. However, minimum levels of domestic primary metal capacity have not been determined.

To prevent a costly and dangerous dependence on foreign sources during an emergency, the United States has placed primary reliance on the strategic stockpile. FPA officials told us that as the United States increases its use of foreign processed minerals and domestic capacity declines, the stockpile is being increased and upgraded to assure that processed minerals, rather than ores and concentrates, will be available in the event they are needed.

While this may have provided some assurance of materials supply in the past, the continued loss of domestic metal-processing capacity may require increases in the number and quantities of items stockpiled and an upgrading of the type of stockpile materials to the extent that acquiring and maintaining the stockpile could be extremely costly. For example, if the United States lost its entire ferrochromium and ferromanganese capacities, the ores in the stockpile would logically have to be upgraded to alloys. If this was done for just these 2 of the 93 items in the stockpile, it would increase the market value of the stockpile by almost $670 million, as shown below.

| Stockpile item | Inventory amount (short tons) | Market value | | |
|---|---|---|---|---|
| | | Ore | a/Alloy | Difference |
| | | (millions) | | |
| Chromite, metallurgical grade | 1,956,382 | $256.8 | $442.7 | $185.9 |
| Manganese ore, metallurgical grade | 3,634,140 | $165.0 | $646.8 | 481.8 |
| Total | | $421.8 | $1,089.5 | $667.7 |

a/Value of alloy that could be produced from inventory ore.

Source: GAO analysis of data contained in Stockpile Report to the Congress, Apr. 1978.

A value increase of similar magnitude could affect the stockpile requirement upon a switch from bauxite to alumina. Even for metals for which the United States has extensive ore reserves (zinc and copper), the processing shift could affect the stockpile. If domestic processing capacity is reduced, an increase in stockpile goals will be needed. In addition, items which are not now stockpiled may have to be added to the list of stockpile items because, as domestic processing gives way to imports, the United States also loses byproduct production of other metals.

The officials with whom we discussed the possibilities had not explored the cost of maintaining an upgraded stockpile, but we believe this could be an expensive alternative in light of the accelerated shift to reliance on foreign-processed minerals.

In addition to cost, relying on the stockpile to meet domestic production shortfalls has another weakness. Historically, stockpile goals and inventories have not been in harmony. Because of purchasing restrictions (FPA has interpreted the Strategic and Critical Materials Stock Piling Act as requiring that market disruptions be minimized when purchasing materials), the stockpile is not up to goal and may not be for many years. Our July 1978 report "The Strategic and Critical Materials Stockpile Will Be Deficient For Many Years" (EMD-78-82), concluded that planned procurement of materials to satisfy goals for such commodities as bauxite, cadmium, cobalt, and ferrovanadium may require more than 25 years.

FPA, by simply assuming that the current processing capacity is the minimum required and avoiding capacity constraints by upgrading the stockpile, is unable to take advantage of some opportunities for avoiding capacity reductions. For instance, the Occupational Safety and Health Act of 1970 allows the Secretary of Labor to

> "* * * make such rules and regulations allowing reasonable variations, tolerances, and exemptions to and from any or all provisions of this Act as he may find necessary and proper to avoid serious impairment of the national defense."

An OSHA official stated that, without established minimum production levels, granting relief under this provision would be difficult.

## LOSS OF BYPRODUCT METALS

When domestic mineral production is cut back or eliminated, the United States also loses domestic access to byproduct metals. The consequences of such losses are similar to those for primary metals. Revenues and profits from sales of these metals are lost; the trade deficit is adversely affected as consumers use imports to replace the lost production, or prices are driven up because the supply is reduced. Further, national stockpile goals may be affected because byproduct metals often have defense applications.

The number and proportion of byproducts varies by type of metal and mine location, but nearly all ores, when processed, yield valuable byproduct metals. Copper ores, for example, can yield gold, silver, nickel, molybdenum, sulfur, arsenic, selenium, tellurium, rhenium, palladium, platinum, and cobalt. Zinc ores may contain lead, cadmium, germanium, indium, silver, and thallium.

The recent decline of U.S. zinc and copper production has had various effects on byproduct metals. For example, even though U.S. cadmium consumption declined during 1973-77, imports increased by over 42 percent, from 1,948 to 2,770 tons. The Bureau of Mines attributes this 822-ton increase to the decline of the U.S. zinc industry, which recovers cadmium as a smelter byproduct. The increase represents almost $5 million worth of imports.

Similarly, copper production cutbacks have reduced domestic silver production (two-thirds of U.S silver production is a byproduct of other mining activity, especially copper). The Bureau of Mines reported in both 1976 and 1977 that byproduct silver recovery decreased due to reduced production of base metals (e.g., copper). As a result, additional reliance is placed on imports to meet the U.S. silver demand, which in 1978 exceeded production fourfold.

Molybdenum output was also affected by copper production cutbacks. Two-thirds of molybdenum comes from primary ore, and one third is recovered as a byproduct of copper ore. The drop in byproduct molybdenum output has not led to increased imports because the United States is the major world producer. Rather, prices have increased in response to the world demand, which exceeds world production. In response to this price competition, the American Iron and Steel Institute has asked the Department of Commerce to monitor exports as a first step toward possible export regulation.

While byproduct use often is not significant in terms of tons used, some byproduct metals have critical defense applications. Molybdenum is used in alloy steels for manufacturing aircraft and space systems and in high temperature alloys used in jet engines and aerospace propulsion devices. Silver is essential for photography and has critical electronics applications. Cadmium is used in nuclear controls, special plating applications, and bearing alloys for high-speed machinery.

## CONCLUSIONS

The trend toward increased reliance by U.S. manufacturers on foreign processed minerals has

--caused the loss of jobs and job opportunities in the minerals industry;

--aggravated an already high deficit trade balance; and

--increased the cost of protecting the Nation from supply disruptions.

The implications discussed in this chapter highlight the need for the United States to keep abreast of developments in its mineral industry, to be aware of the costs associated with actions detrimental to the industry, and to minimize or mitigate the effects of policy conflicts in order to optimize the industry's contribution to the Nation's well-being.

# CHAPTER 6

## DIFFICULTIES IN COORDINATING GOVERNMENT ACTIONS

To bolster the domestic mining and minerals-processing industry, the Congress enacted the Mining and Minerals Policy Act of 1970 (Public Law 91-631). However, the mineral industry has continued to decline and the U.S. Government has not established a mechanism to identify and resolve conflicts that arise between goals in the mineral area and those associated with environment and other national concerns.

### THE MINING AND MINERALS POLICY ACT OF 1970

The Congress and the Nation have long considered the development and maintenance of a sound domestic mining and minerals industry essential to the U.S. economy. This concern has served as the basic thrust for much of the legislation and many of the Federal programs dealing with U.S. natural resources and mineral industries. However, until enactment of the Mining and Minerals Policy Act in 1970, legislation and programs were individually directed toward different aspects of mineral industry problems; nothing that could be view as a national mining and minerals policy existed.

According to a House Committee on Interior and Insular Affairs report, the Congress did not expect the act to be a cure-all for the mineral industry but hoped it might focus attention on the industry and the need for long-range planning and objectives. The Congress expected that, because of the act, questions would be answered regarding the permissible degree of dependence on foreign supplies, import and export of minerals, stockpiling for emergency situations, taxation, manpower, health and safety and environmental quality, and U.S. capability to supply its domestic needs.

The act did not suggest that other national policies should not affect the minerals industry, but the Congress did intend that the individual and collective effects of these other policies on the industry be objectively considered when tradeoffs were being made or other alternatives considered.

The act did not, however, provide any new authority or funding nor call for establishing any organizational mechanism for achieving its objectives. Although the act established policy for the entire Federal Government, it specifi-

cally directed the Secretary of the Interior to carry out the policy in accordance with other statutes authorizing such programs and to make an annual report to the Congress showing the state of domestic mining and mineral industries, trends in use and depletion or resources, and recommended legislative programs.

PROBLEMS IN IMPLEMENTING THE ACT

The expectations of the Congress have not been met, and many of its questions and concerns still exist. Effective implementation of the Mining and Minerals Policy Act of 1970 has been hindered by lack of coordinated comprehensive guidance for planning and executing programs and lack of organizational arrangements within Government to identify and balance conflicting policies or programs.

The Department of the Interior has continued to develop strategies and programs to help ensure the uninterrupted supply of minerals. These programs, which include research and development; geological investigation; and the collection, analysis, and dissemination of mineral data and participation in mineral-related policy reviews; are being carried out in accordance with Interior's historic authorities.

The Secretary of the Interior recognized in his first annual report under the act in 1972, that comprehensive guidelines were needed if the fundamental intent of the act was to be achieved. He stated, however, that the development of such guidelines was beyond the authority of the Department of the Interior under this and other statutes.

> "The broad spectrum of laws lodged in numerous agencies compounds problems in the development of constructive mineral policies. If the Nation's future national resources requirements are to be met through the wisest conservation and management of available resources, there is a positive need for integration of natural resources plans and programs, a need for consistency of treatment by the Federal Government of natural resources programs, and planning and management for the most effective use and productivity of all natural resources."

The achievement of the fundamental intent of the Mining and Minerals Policy Act is also hindered by the lack of institutional mechanisms for identifying and balancing conflicts among national policies, programs, and regulations.

The Secretary of the Interior's report also expressed concern about this organizational weakness.

> "Conflicts often arise between existing statutes in their requirements as to mineral*** development and operations. Conflicts also arise between existing statutes and appropriations measures which sometimes deny fund usage for the purposes necessary to proper administation of other laws."

* * * * *

"Many Federal laws directly affecting the mining, mineral, metal, and mineral reclamation industries confer authority on other agencies of the Executive Branch. The total breadth and impact of such authority is substantially greater than that conferred upon the Secretary of the Interior. Several examples illustrate this point:

"The Federal Water Pollution Control Act, the Clean Air Act, the National Environmental Policy Act, the Environmental Quality Improvement Act, and many other items of legislation dealing with environmental enhancement have direct impact on the mineral industry which is among the Nation's major users of water for processing and, along with power generation (largely based on minerals), one of the Nation's major sources of emissions.

"The Occupational Health and Safey Act provides for safety in many facilities of the mineral industry not covered under the specific mine safety statutes.

"The Internal Revenue Code governs, among other important matters, expensing of costs involved in exploration and in research and development, allowances for depletable mineral assets, amortization and depreciation of facilities; and valuation of inventories.

"The Tariff Acts, the Trade Agreement Acts, and the Anti-Dumping Acts govern questions of import regulation significant to the mineral industries.

"A wide variety of laws governing consumer protection, antitrust action, and the regulation of exchanges directly affect the mineral industry."

* * * * *

"The above authorities * * * confer a broad assortment of powers. However, the Secretary of the Interior is constrained to operate only within the bounds of the authority conferred and also within the appropriations available for specific programs."

In 1974 the Congress established the National Commission on Supplies and Shortages, consisting of representatives from the Congress, executive branch, and private industry. One objective of the Commission was to determine the institutional adjustments needed to analyze economic needs for resources on a permanent basis. In this regard, the 1976 Commission observed that:

"IF THE EXPERIENCES of recent years teach us anything, it is that Government policies developed and implemented without an understanding of how they affect specific industries and interact with other policies often create more problems than they solve. This is particularly true of policies affecting the key materials-producing industries. * * *"

* * * * *

"These industries require relatively long lead times to expand their productive capacity substantially. Once installed, this productive capacity is long-lived. The high capital-intensity of many materials production processes means that operating them at levels much below those for which they were designed drives up unit costs sharply. This combined with the fact that demand for materials is particularly sensitive to shifts in the level of aggregate demand, means that profits are likely to be volatile. Thus, these industries are especially vulnerable to abrupt policy shifts."

* * * * *

"Understanding the impacts and interactions of proposed policies is not easy.*** Some means must be found to integrate the improved information produced by the agencies and departments into a comprehensive picture of how Government policies combine to affect basic industry, and, beyond that, the broad national interest. Means also must be found to alert high-level decisionmakers to the possible consequences of events which separately may be of little concern, but together can foreshadow major problems."

There is currently no formal mechanism for resolving conflicts between the Mining and Minerals Policy Act and other national policies, programs, or regulations, but tradeoffs are sometimes made informally. The Bureau of Mines comments on the effect of specific Government actions on the mineral industry when it is aware of them and, when asked, provides data on the sensitivity of the industry to certain actions. Current procedures, however, do not guarantee that such data be provided or, if it is provided, that it is considered in the overall interest of the United States.

# CHAPTER 7

## CONCLUSIONS AND MATTERS FOR THE CONGRESS

Assured access to mineral resources at prices established in competitive markets is an important concern to the Nation. Resource availability and the extent to which the United States should rely on foreign mineral resources are very complex considerations. To a large extent, traditional economic factors, such as the remoteness of projects, ore grade, facilities and equipment needed, and access to capital are important influences on trends in the domestic and international mineral industries.

Fortunately, compared with most nations, the United States is rich in mineral resources. Domestic smelters and refineries using foreign ores and concentrates to supplement domestic mine production have provided U.S. manufacturers with the majority of their mineral needs.

In recent years, however, several U.S. Government actions have reduced the profitability of domestic mineral projects, making investment in such projects less attractive than they otherwise would have been. These actions and the efforts of foreign governments to encourage development of their minerals production have contributed to the failure of investment in domestic mineral production to keep pace with growth in U.S. demand. Consequently, U.S. manufacturers are having to rely more and more on foreign processed minerals to meet their needs.

Investment decisions involve complex assessments of many variables. Investors, in their attempt to obtain the highest return on their investments, assess a project's expected development and operating costs and sales revenues. Making such assessments in the mineral industry is difficult because of the generally long payback period, cyclical nature of mineral prices, and general uncertainty about many of the cost elements involved.

Although traditional economic factors influence investment decisions, more and more U.S. and foreign governments' actions are tending to distort these factors, influencing the relative profitability of projects and thereby their locations.

In general, compared with other countries, U.S. Government actions have tended to do more to discourage and less to stimulate investment in domestic mineral projects through:

--Restricting the use of Federal lands for mineral exploration; some countries are actively encouraging or sponsoring such efforts.

--Imposing strict environmental requirements; some countries are either more lenient in their standards or enforcement or provide assistance to help defray their costs.

--Restricting the use of joint ventures to pool resources; some countries not only encourage joint ventures but actually participate in financing projects through loans, grants, loan guarantees, or direct equity purchases.

--Adding to labor costs by establishing worker health and safety requirements; some countries are either more lenient in their standards or enforcement or provide assistance to help defray their costs.

In addition, the absence of a clear Government energy policy and the existence of restrictions which delay or halt construction of power-generating facilities have created much uncertainty about the future availability of energy supplies needed for the mineral industry. Government programs, such as land reclamation requirements, are also contributing to the increasing cost of energy.

The decline of the U.S. mining and mineral-processing industry has resulted in lost jobs and job opportunities in the industry, adversely affected the U.S. balance of trade, and increased concerns about U.S. vulnerability to mineral supply disruptions.

We recognize that U.S. Government efforts in the above areas are in response to legitimate public concerns and national policies. And, we recognize the merits of congressional concerns and efforts to address these issues. However, the purpose of this report is to point out that the response to these concerns has adversely affected the competitiveness of the domestic mineral industry, particularly in view of the actions of foreign governments, and to point out the need for a mechanism for (1) objectively considering the consequences of Government actions and (2) resolving conflicts between national policies to assure tradeoffs or alternatives are made in the overall best interest of the Nation.

We believe the attention of Congressional committees concerned with these problems should immediately focus on developing such a mechanism.

## AGENCY COMMENTS

The Department of the Interior agreed with many of the basic points in our report. For example:

- --There is a definite trend toward processed versus raw material imports and, as shown by estimates, this trend is likely to continue in the future.
- --Changes in U.S. Government policies over the last 10 years have increased the costs of mining and processing minerals in the United States.
- --Some governments are attempting to increase mining and mineral-processing capacity in their countries.
- --Some improvements may be appropriate in considering the consequences of Government actions and for resolving conflicts between policies to assure that the overall national interest is served.

However, Interior expressed some concern with the lack of quantitative analysis and the apparent reliance on interviews with industry officials. Also, that no attempt was made to prioritize or quantify the various factors analyzed in the report.

We agree that quantification of the effect of each factor on the declining trends in the mineral industry would be useful; however, the amount of work necessary to compile such data was far beyond the scope of this report and, in our opinion, not necessary to conclude that the Government should become more aware of the affect of its actions on the mineral industry.

We did interview corporate officials and reviewed various corporate records and reports; however, our conclusions were also based on substantial corroboration from academicians, investment analysts, banking officials, U.S. Government officials (including those of regulatory agencies), and officials of foreign governments and corporations.

Interior stated that a major gap in our report is the omission of discussion concerning ore quality (quantity, grade, depth, and other physical characteristics). We recog-

nized that ore quality is a factor in the relative position of the U.S. mining and mineral-processing industry and noted that the United States ranks first in ore reserves for copper, lead, molybdenum, cadmium, and silver and ranks high in many others. However, our report stressed those factors that are most significantly affected by Government actions:

--Economic access to minerals.

--Development and financing costs.

--Opportunity to pool resources.

--Labor costs.

--Energy availability and price.

Discussions with industry analysts and bankers and our comparison of proprietory data on production costs for U.S. and foreign projects indicates that these factors can make enough difference in production costs to influence the viability of projects and, thereby, influence investment in U.S. mineral production.

Interior agreed that access to Federal lands for mineral exploration and development is important and needs further policy examination, but it questioned the high priority given to the problems, particularly in the absence of any quantitative evidence that land withdrawals and restrictions on land use have had any impact on mineral exploration and development or on the level of mineral production in the United States. Data on expenditures for domestic mineral exploration is not available; however, considering that (1) several companies identified during our work have cut back on domestic exploration and (2) the amount of land with restricted access has grown considerably during the last decade, there is little doubt that a relationship exists.

As for the impact of land restrictions and withdrawals on mineral production, because current operations are using mineral resources identified many years ago, current cutbacks in mineral exploration will not show up in reductions in mineral production for several years.

Interior asserted that the availability of Federal lands for mineral development is substantially determined by specific congressional mandates. While we agree that the Congress did provide legislative authority for restricting access to Federal lands, the Secretaries of Agriculture and

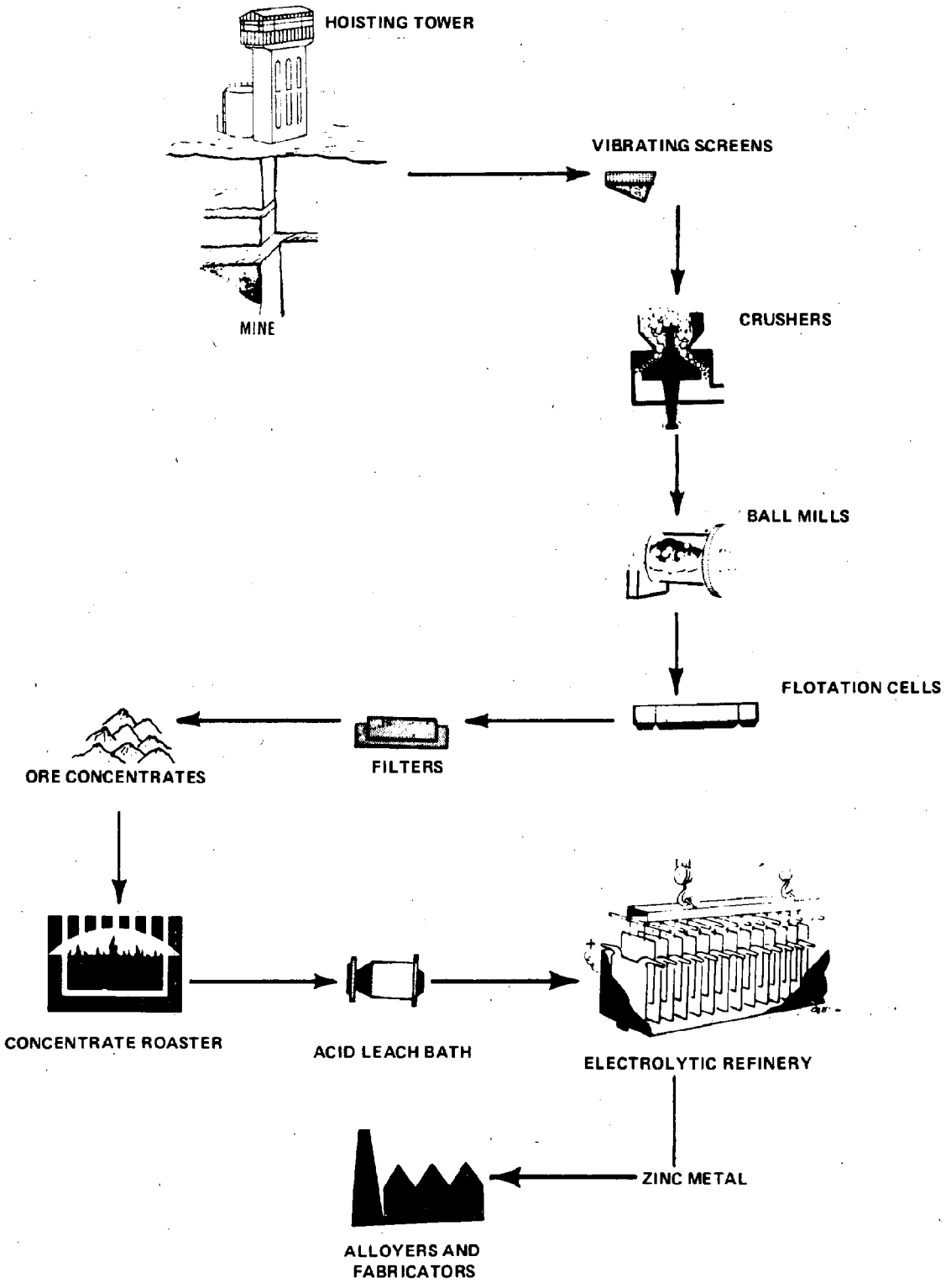
the Interior exercise considerable administrative discretion in identifying areas to be withdrawn or restricted. Unfortunately, as stated in the report and according to the Department of the Interior Task Force on Availability of Federally-Owned Minerals Lands, inadequate mineral information is available for analyzing the overall mineral capabilities of Federal lands and for determining which lands should be withdrawn.

Concern was also expressed that the report indicated that the Department of the Interior is solely responsible for implementing the Mining and Minerals Policy Act of 1970. Interior stated that any Federal agency which has an impact on minerals has respnsibility for carrying out the act. Although this is true, the act gives the Department of the Interior prime responsibility for implementation. Specifically, the Congress expected that Interior would answer questions regarding the impact of Government actions concerning taxation, worker health and safety, environmental quality, and the capability of the United States to supply domestic mineral needs.

We noted, however, that Interior and other agencies whose actions have adversely affected the mineral industry have largely ignored the 1970 Mining and Minerals Policy Act. And, currently there is no mechanism for objectively considering the consequences of Government actions and for resolving conflicts between national policies to assure that tradeoffs or alternatives are made in the overall best interest of the United States.

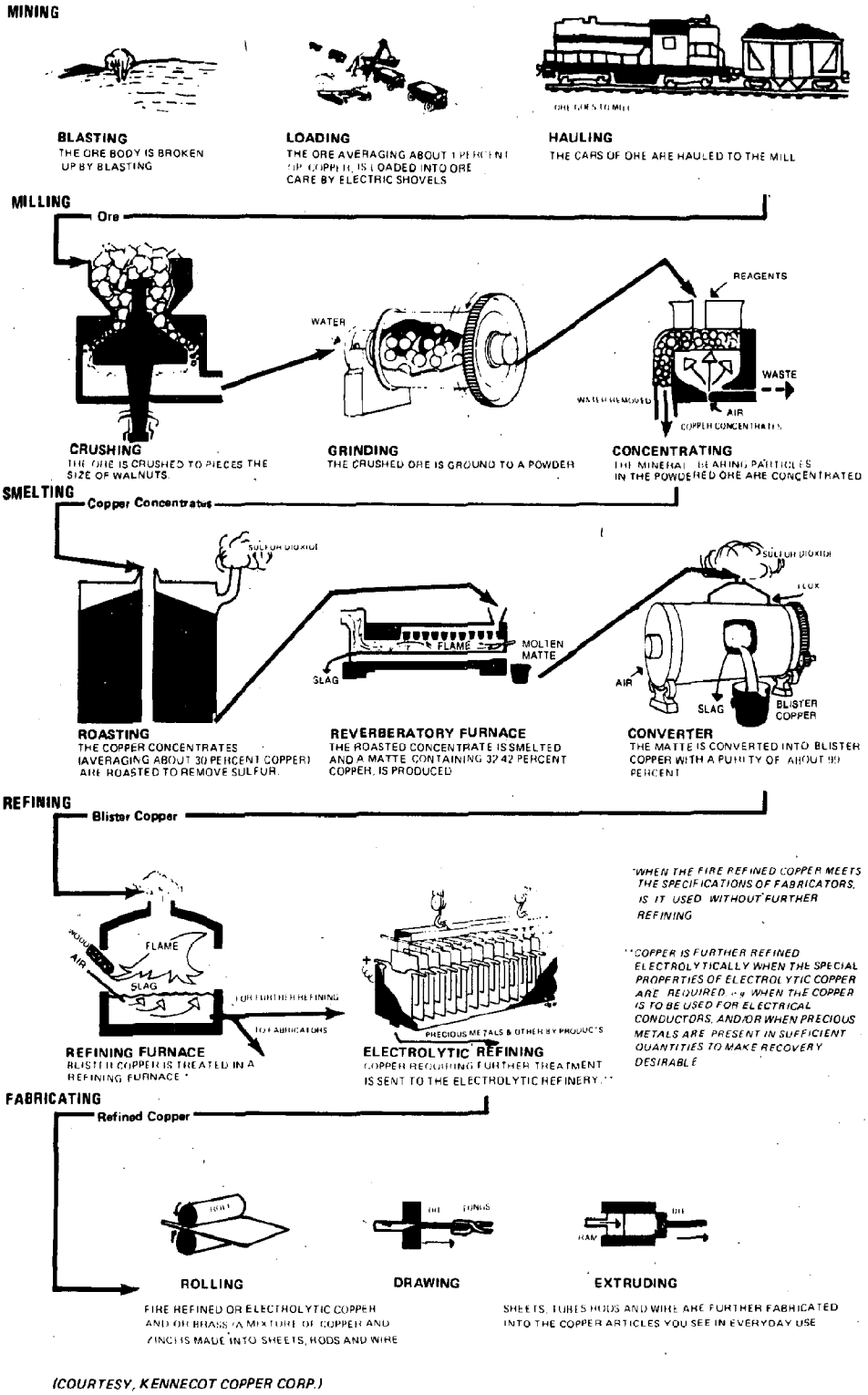
APPENDIX I

## ZINC PROCESS FLOWSHEET



APPENDIX I

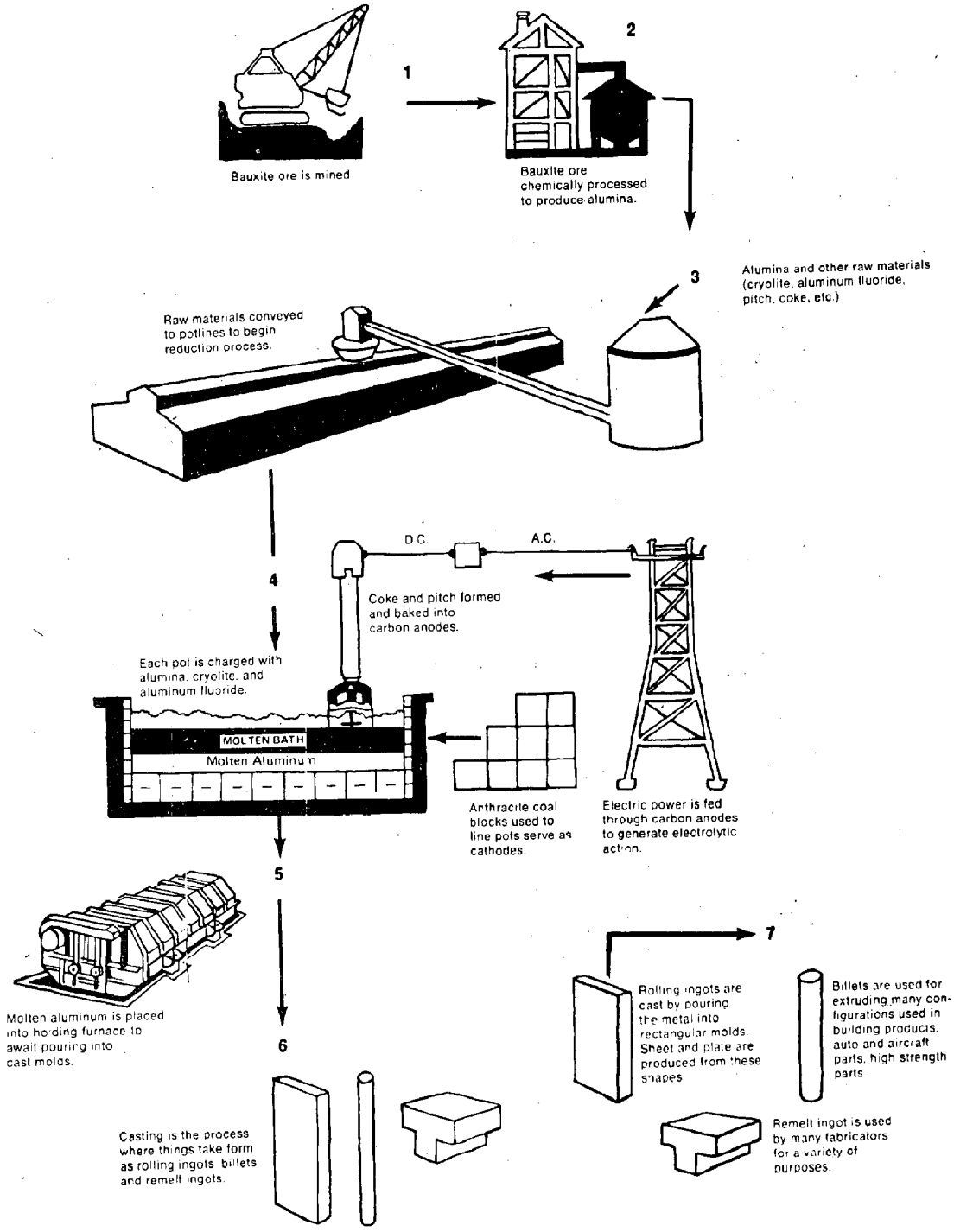
## COPPER PROCESS FLOWSHEET




*(COURTESY, KENNECOT COPPER CORP.)*

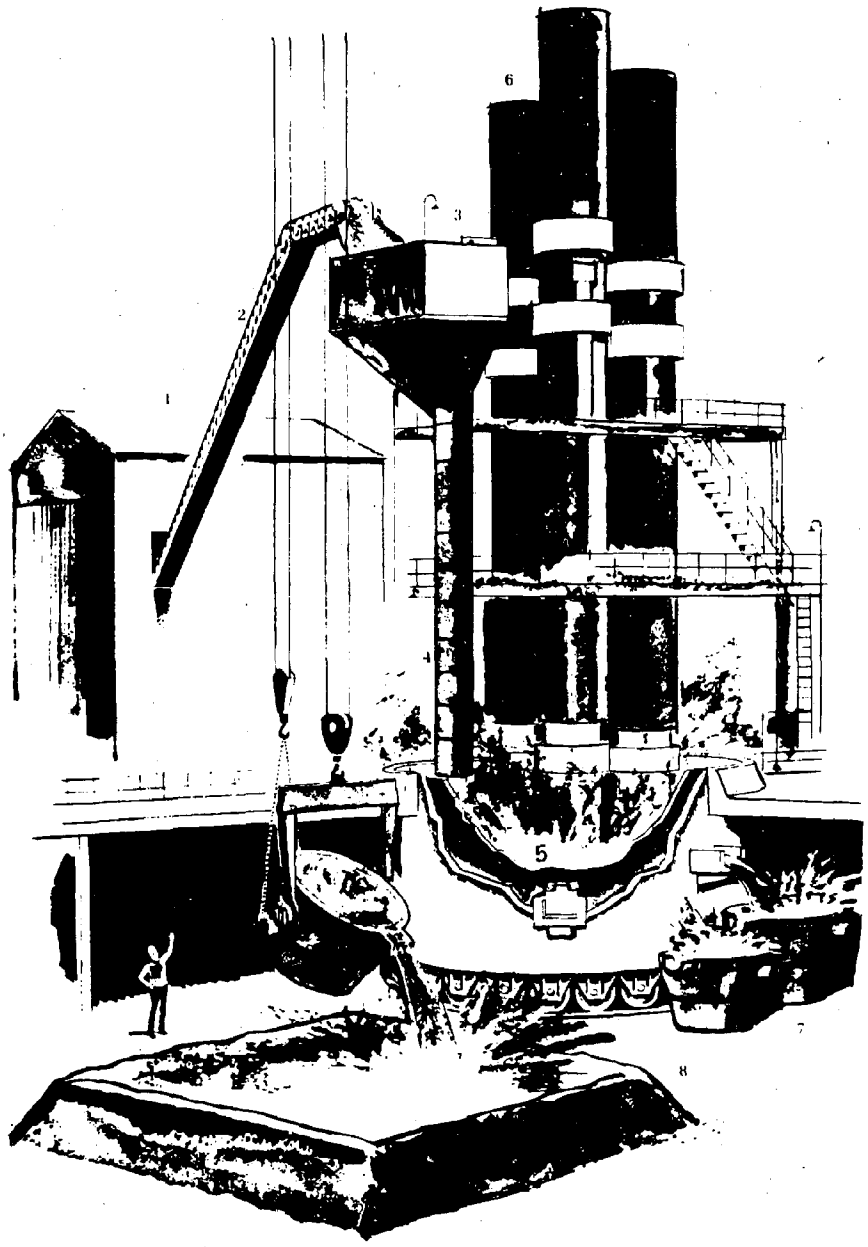
APPENDIX I

## THE ALUMINUM PRODUCTION PROCESS



APPENDIX I

## THE MAKING OF FERROALLOYS




THE FERROALLOY MANUFACTURING PROCESS BEGINS IN THE MIX HOUSE (1) WHERE RAW MATERIALS–ORE, COKE AND OTHER PROCESS INGREDIENTS–ARE PRECISELY WEIGHED AND MIXED. A CONVEYOR (2) CARRIES THIS MIXTURE TO MIX BINS (3) WHICH STORE THE RAW MATERIALS UNTIL THE FURNACE OPERATOR RELEASES THEM THROUGH CHUTES (4) TO THE FURNACE (5). CARBON ELECTRODES (6), WHICH EXTEND INTO THE FURNACE, CARRY THE ELECTRICITY REQUIRED TO PRODUCE THE EXTREMELY HIGH TEMPERATURES (6000° F) NECESSARY TO CARRY OUT THE FERROALLOY PRODUCTION PROCESS. FINISHED FERROALLOY, IN THE MOLTEN STATE, IS TAPPED INTO A LADLE (7) AND POURED INTO MOLDS (8) FOR COOLING. AFTER SOLIDIFYING, THE FERROALLOY IS CRUSHED, SCREENED ACCORDING TO DESIRED SIZE, AND SHIPPED TO THE CUSTOMER.

APPENDIX II

# United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

JUL 12 1979

Mr. J. Dexter Peach
Director
Energy and Minerals Division
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

This responds to your request for comments on the draft Comptroller General Report to Congress, "The Declining U.S. Mining and Mineral Processing Industry: An Analysis of Trends, Causes, and Implications." We appreciate the difficulty of addressing this complex subject. This GAO report describes a decline in U.S. mining and minerals processing in recent years as characterized by U.S. production and imports of four metals: zinc, ferroalloys, copper, and aluminum. We agree with the conclusion that there is a definite trend toward increasing processed versus raw material imports and that, as shown by estimates, this trend is likely to continue in the future. GAO found that, while traditional economic factors are important in determining the location of production capacity, U.S. and foreign government actions play increasing roles in minerals investment decisions.

The report singles out a number of U.S. Government policies and actions which the authors feel are contributing to a decline in domestic industry "competitiveness." Unlike the discussion of import trends which is supported in the report by factual information, the treatment of these policies is generally subjective, apparently based in substantial part on interviews with industry officials. There is no attempt made to prioritize the various policy factors nor, as the report notes, to quantify them.

We can agree that changes in U.S. Government policies over the last 10 years have increased the cost of mining and processing minerals in the U.S. It is also true that some other governments are attempting to increase mining and processing in their countries. There are also some that are discouraging investment. What is not known is, if these policies had not changed, whether investment decisions would have been different.

Most of the policy factors discussed are the responsibility of agencies other than the Interior Department. While we provide some general reactions to some of these, to provide a credible review and report, it is essential that the following agencies have the opportunity to respond to the criticisms of their programs and policies: [1]

Department of Treasury: Tax and Investment-related policies.

Department of Energy and Tennessee Valley Authority: Allegations that Federal energy policies pose major constraints to the domestic minerals industry.

Environmental Protection Agency and Occupational Safety and Health Administration: Effects of environmental health and safety laws.

General Services Administration: Adverse effects of stockpile policies.

Department of Commerce and the Office of the Special Trade Negotiator: Trade policy, quotas, and tariffs.

Council on Wage and Price Stability: Impacts of wage and price guidelines.

The GAO report expresses concern that minerals production is declining and imports are increasing. In this regard, the report would benefit from a definition of competitiveness and a discussion of its importance. There are no well defined national goals or policies which call for maximizing production and minimizing imports without consideration of other national priorities. There are, of course, national policies concerning air and water pollution, health and safety, trade relief and restrictions, and other factors cited as contributing to increased domestic costs. These policies have been established by the Congress, and the concerns expressed in the report should be related to the specific, established national goals. The Mining and Minerals Policy Act of 1970, while it does declare a continuing policy to foster and encourage a sound and stable domestic minerals industry, does not express concern about reliance on imports.[2] (This Act, contrary to the statement on page 96,[3] is directed at all Federal agencies, not just the Interior Department.)

[1]A draft (or pertinent portion thereof) of the report was provided to the Departments of Energy, Treasury, Defense, and State; EPA, OSHA, and General Services Administration and their comments and perspectives were considered in the final report.

[2]The Senate report on the Act states that "As we permit our Nation to become more and more dependent upon foreign sources for minerals * * * we tend * * * encumber our foreign policy and limit our freedom of movement within the family of nations." Therefore, concern about growing import dependency was an impetus to the legislation although it was not specifically mentioned in the Act.

[3]Page 68 in the final report.

Neither does the Act suggest that other national policies should not affect the minerals industry. There will always be trade-offs when new policies are established; they cannot be avoided. Particularly when domestic resources are limited or nonexistent, or foreign sources of ore or processed minerals are substantially less costly, the state of domestic production is just one factor that must be considered in arriving at the most acceptable domestic policy.

The report would also benefit from a clarification of how corporate decisions are made in this area. Emphasis should be given to the fact that many factors tend to be company-specific and variable. It also should indicate that there is a trend in U.S. minerals industries to invest overseas, and that this is based on a number of considerations made by individual companies.[4]

In considering investment decisions, there is a major gap in the report. Ore quality, perhaps the most significant single factor involved in the relative position of the U.S. domestic production, is completely omitted from the discussion.[5] The following is a listing of policy and economic factors of primary importance in considering the relative position of domestic production:

Economic Factors

- Ore Quality
- Labor Costs
- Energy Costs
- Technology
- Water Costs/Availability
- Transportation Costs
- Capital Availability

Policy Factors

- Tax Policies
- Environmental/Health/Safety Regulations
- Federal Land Policies
- Antitrust Policies
- Governmental Subsidies and Promotional Policies
- Nationalization and Other Foreign Government Restrictions
- Political Instability.

[4]As Government actions add costs or increase risks, the attractiveness of investment in domestic projects is reduced; this contributes to the trend toward investment in overseas mineral projects.

[5]These points are discussed in chapter 7.

While many of these are considered in the draft report, discussion of others is notably absent.[6] In addition to ore quality, there is little mention of Federal policies and other factors which might assist the domestic industry. Discussion of trade policy is particularly confusing. Quotas and tariffs designed to protect the domestic extraction industry appear to be singled out for their adverse effect on the domestic industry, apparently because of perceived impacts on the processing industry.[7]

The question of access to Federal lands for mineral exploration and development is important and needs further policy examination; but we fail to see why it is given such high priority by GAO, particularly in the absence of any quantitative evidence. We have not been able to acquire evaluations from industry showing substantial reductions over time in exploration expenditures on the public lands; nor is there evidence presented that land availability restrictions have had a significant impact on the levels of domestic production for any specific commodity. The availability of Federal lands for minerals activity is substantially determined by specific Congressional mandates for special status such as parks, wilderness, and for land use planning. It is also affected by actions of the Agriculture Department. The report should note that Federal land policies as they affect domestic production present a mixed picture. By providing free access to the public lands for most minerals under the Mining Law of 1872 and its predecessors, the Federal Government has provided a major incentive and subsidy to domestic production. The international survey fails to note that few, if any, foreign governments provide this type of free access. GAO noted this lack of return to the Treasury in its recent report on the 1872 mining law. [8]

The complexity and mixed picture of the Federal lands issue is thoroughly analyzed in the recent Office of Technology Assessment Report, "Management of Fuel and Nonfuel Minerals in Federal Land." It notes the land management difficulties inherent in the 1872 Mining Law and how this has been the source of many mineral access restrictions. The figure used on page 30[9] that 68 percent of the public lands are totally withheld from mineral entry, appears to be too high. A range of 40 percent highly restricted to 65 percent totally and partially restricted would be more accurate, although any hard numbers must be used with caution. (See the "1977 Annual Report of the Secretary of the Interior Under the Mining and Minerals Policy Act of 1970," pages 89-107.) [8]

[6]Our report centers on the influence of Government actions on investment decisions, so we focused on those factors upon which such influence was strongest.
[7]We agree that this point was not clear, and it was deleted from the report.
[8]These points are discussed in chapter 7.
[9]Page 19 of the final report.

We offer the following additional comments:[10]

- Conclusions of the report with respect to the influence of government actions on development costs and access to capital fail to note that one of the objectives of the Export-Import Bank, O.P.I.C., A.I.D., Western Hemisphere trading corporations, and the depletion allowance for foreign minerals is to help domestic producers and consumers obtain access to foreign minerals for U.S. processing facilities.

- There is only a limited understanding of the impact of U.S. antitrust laws, and whether the type of cooperative industry ventures the report suggests are in the national interest.

- Energy availability limitations may not be as severe and they may not alone affect expansion and development as much as indicated in the GAO report. However, a factor affecting investment decisions is the uncertainty of future energy cost increases.

- The analysis of copper import trends may be somewhat distorted by the short term chosen (1974-1978) when there were world surpluses.

- The GAO on pages iv and 81[11] states that the U.S. nonfuel mineral trade deficit is $10.6 billion, whereas the Bureau of Mines, considering inorganic chemicals and plastics as detailed in the enclosed chart, arrives at about $8 billion. Excluding plastics, the deficit is $9 billion.

- With reference to the Mining and Minerals Policy[12] Act of 1970, discussed on pages vi, 2, and 95-100, it is important to note that the Department of the Interior is not solely responsible for implementing that Act. The Act states "...that it is the continuing policy of the Federal Government (underlining supplied) in the national interest to foster and encourage private enterprise in...." Thus, any Federal agency impacting upon minerals has responsibility for carrying out the Act. The Department of the Interior, through the Geological Survey and the Bureau of Mines, has long been active in helping to alleviate mineral problems

[10]The report was modified to incorporate these comments.
[11]This reference was deleted from the digest and p. 81 is now p. 58 in report.
[12]Pages iii, 2, and 68 of report.

APPENDIX II

through research and other programs. The 1979 fiscal year appropriated funds of the Geological Survey amounted to $640 million for mineral surveys, investigations, and research. The Bureau of Mines appropriation was $148 million for mine health and safety research, nonfuel mine productivity research, metallurgy programs, and mineral information systems. The Bureau of Mines was instrumental in formulating the 3-year strategic stockpile goal in 1976, which was reaffirmed by the current Administration in 1977, and the Bureau of Mines has also recommended programs under the Defense Production Act for research work on strategic and critical minerals. The Bureau and other Departmental offices participate in a number of minerals-related policy reviews.[13]

We would close by emphasizing our concern that many of the points raised in the report are subjective. It is difficult to assess the importance and priority of all these factors to the trends seen in the industry without some quantitative analysis. The report does recommend the establishment of a mechanism for objectively considering the consequences of government actions and for resolving conflicts between policies to assure that the overall national interest is best served. Some improvements may be appropriate and will be considered as part of the Nonfuel Minerals Policy Review.

We will honor your request that, because this report is subject to revision, it be appropriately safeguarded to prevent premature or unauthorized disclosure. I would note, however, that members of your study team testified in detail on the report and its conclusions before the House Subcommittee on Mines and Mining on June 12, 1979. Therefore, the study's conclusions are a matter of public record.

Some technical comments on specific pages are enclosed and we would be pleased to discuss our comments with you in more detail.

Sincerely,

Larry E. Meierotto
Assistant Secretary
Policy, Budget, and Administration

[13]These points are discussed in chapter 7.

(482940)



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