

The manufacture of usable minerals by artificially duplicating the conditions that result in their occurrence in nature is still another means of extending mineral supplies. We must also work harder to extend the useful life of the materials in which minerals are used. This will mean developing new substances or techniques that can reduce corrosion, oxidation, abrasion, and fatigue in mineral and metal products. Additional approaches to material supplies include using several different minerals to supply a particular commodity need, and improving materials engineering so as to provide new substances with unusual properties thereby reducing overall material requirements.

VII. EMPLOYING THE LATENT POTENTIAL

Many mineral-forming elements and aggregations occur in such abundance and are so readily accessible and widely distributed that regardless of demand they are essentially inexhaustible. Nevertheless, there are technologic problems or prevailing economic disadvantages that preclude their widespread industrial use as substitutes for mineral commodities in lesser abundance. Of equal significance are mineralized zones or sources which, like oil shale for example, are of such magnitude as to insure the accommodation of large-scale demands for a long time.

I am firmly convinced that the nation's industrial and resource base can be broadened with attendant economic, employment, and national-income benefits. This can be accomplished by directing appropriate technologic and economic investigations into the advantages to be derived through creating new demands or markets for materials in superabundance like magnesium, boron, and the more common elements in the earth's crust, or for byproducts that are surplus to current demands by virtue of their presence in substances processed primarily for other materials, like many of the rare-earth elements.

The research emphasis should be on new applications for these plentiful materials rather than on their utilization as substitutes in competition with traditional materials in established markets.

VIII. RESOLVING RESOURCE CONFLICTS

Accompanying the foreseeable demand for more minerals is an increasing recognition that these materials must be provided without destroying the environment of the society that needs them. As never before in the history of our country, people are becoming increasingly aware of the need for true multiple land use. As a nation, we have come to recognize the need to preserve the precarious balance between material requirements and natural resources, and at the same time, to improve the bountiful heritage of the land. This awareness includes, but also extends beyond, problems of surface disturbance, air and water pollution, and waste disposal that are common to the processes used in extracting minerals from the earth. And it poses a host of stimulating challenges in the minerals and fuels sector of our economy—challenges that must be met with an immensely improved minerals technology.

We must develop new techniques for the ultimate disposal of the mineral-based products that have no further value or are not otherwise recoverable for reuse. A better technology is needed for controlling the surface subsidence that can result from underground mining. We must develop suitable methods for eliminating stream pollution that is associated with mining activity and for restoring land that has been damaged by surface mining. Finally, we must improve mine-fire control technology to prevent the needless waste of coal resources, the destruction of property, and the formation of noxious gases that menace humans, animals, and plant life.

Attaining these objectives will not, of course, provide direct economic gains to industry. On the contrary, they will frequently add costs that will probably have to be passed on to consumers in one form or another. Nevertheless, the problems that arise in meeting the nation's demands for minerals and metals cannot be treated apart from environmental threats that stem from the mining, treatment, or use of any mineral substance and we must seek to minimize the cost of erasing such threats. For the remainder of this century, as never before, we must apply technology wisely and efficiently so that the mineral needs of our industrial economy can be supplied while maintaining the quality of our environment.