significant years for uranium

Two meetings held in Vienna during April have underlined the need for further exploration and for the development of the world's resources of uranium to provide fuel for burgeoning nuclear power demands.
Present capacity will meet requirements only until the 1980's and careful planning is necessary to ensure medium and long-term supplies of economically acceptable uranium fuel.

The first meeting was of a joint working party of the European Nuclear Energy Agency (ENEA) and of the Agency, who met to review world resources and production capacity of uranium and thorium. In time, their efforts will produce a revised edition of a report produced first in 1965 and re-issued, taking account of new knowledge, in 1967 and again last year.

Dr. Bernard Spinrad, Director of the Division of Nuclear Power and Reactors, pointed out that nuclear power production at present accounted for world-wide electrical generating capacity of around 18 000 megawatts; by 1980 this figure might be between 230 000 and 330 000 megawatts. Because of the need for a reliable measure of the uranium available to fuel these reactors, whatever information was published as a result of the meetings "would be something of a bible for the next few years".

The working party, consisting of 20 participants from 13 countries representing the principal producers and consumers of uranium in the western world, is forming its assessments on the basis of resource information supplied by each country and on projections of nuclear power requirements. Revised uranium reserve figures showed an increase from the previous assessment made in 1967, but closer estimating of the availability of these reserves indicated that it will still be necessary to try to discover and develop a minimum of a million tons of additional uranium oxide by 1985. By 1977, annual requirements for the nuclear power industry are likely to exceed the presently estimated production capability and thereafter increased production capacity must be developed.

Immediately after the meeting of the working party, an Agency panel meeting dealt with the central problem faced by the uranium mining industry; the assessment of where new low-cost uranium ore bodies are to be found. The objective defined was "to formulate world-wide geological favourability criteria for the occurrence of uranium and define guidelines for future exploration." This meeting was attended by more than 40 uranium geologists from many parts of the world, including many directors or senior geologists of national nuclear raw materials organizations.

Many of the 23 papers which were presented described the world's principal deposits of uranium. Others dealt with origins of uranium ore and the identification of the most favourable parts of the world for future uranium exploration, particularly areas in developing countries.

The chairman of the panel, Dr. Robert D. Nininger (USA), stated the position when he opened the meeting in this way: "Known world low-cost reserves — that is, reserves which can be exploited and delivered to the world market, excluding those in the People's Republic of China, USSR and Eastern Europe, at prices of $10 or less per pound — are approximately one-third of the estimated requirements through the remainder of this century... Much remains to be done in the exploration for and development of additional supplies within a relatively short time span. It is the timing and not the magnitude of the demand which is critical, for there appears to be little doubt of the existence of adequate quantities of uranium, even reasonably low-cost uranium, within the earth's crust."

Resources expected to be available

If known resources can be developed, mined and processed during the coming 30 years, they will make up all but a third of the expected short-fall in the uranium supply. If other resources, which are excluded from immediate consideration because their cost seems likely to be higher are included the target is probably well within range.

Four countries — Canada, France, South Africa and the United States — have between 85 and 90 percent of the known low-cost uranium reserves; eleven other countries have the remainder. If one takes into consideration the estimated additional low-cost reserves, only Canada and the United States, on the basis of present estimates, seem likely to be able to make large additions. If the higher-priced resources are included in the assessment, Canada and the US again figure, and Sweden becomes a third possible major supplier.

Economic assessments tend to show that, on the basis of the present value of uranium oxide in dollar terms, the base price is unlikely to exceed $ 10 a pound before the 1980's, and even then possibly not until the second half of the decade. Uranium geologists are thus faced with the fact that there will be little incentive to identify and develop additional resources in the $10 to $15 category for some time. As a

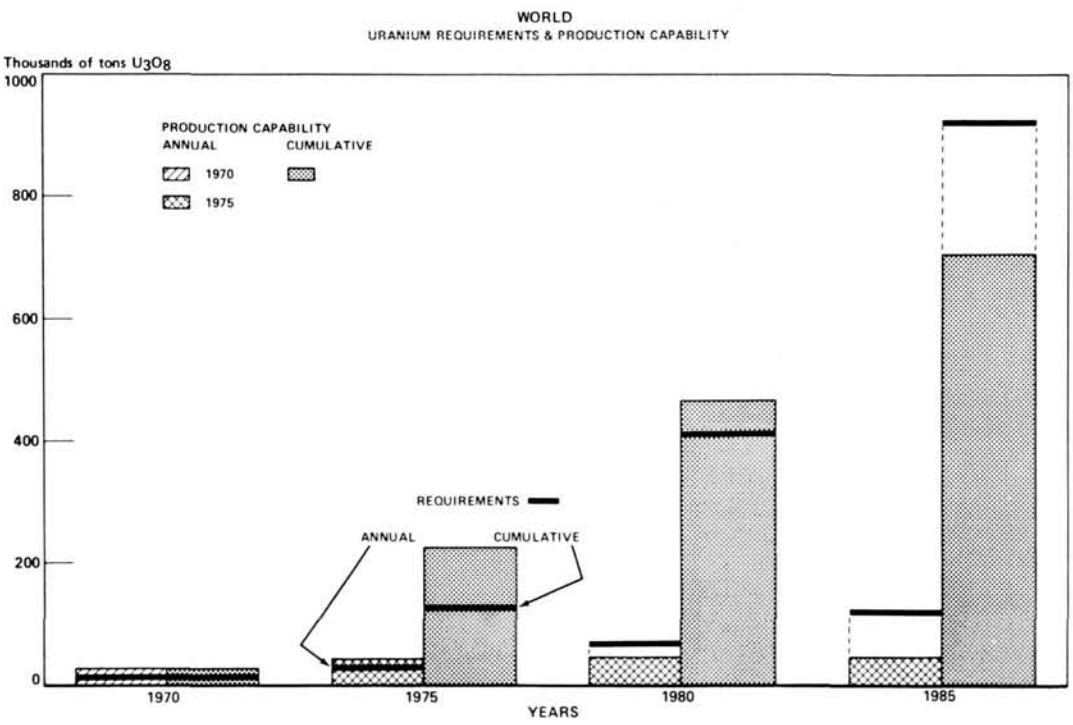
Somali technicians taking readings with an instrument for measuring magnetic properties of minerals. The Somali Government and the United Nations Development Programme are continuing work on a survey under which uranium and thorium reserves were earlier discovered. Photo: UN/Rice jr.

result, there could be a substantial escalation of price after the 1980's, when known low-cost resources approach depletion — unless new, easily mined, sources are found.

Other sources

Resources might be swelled if what is known as "by-product" uranium production can be developed at a reasonable price. Uranium is already produced economically as a by-product from gold mining and processing in South Africa, and it might be produced from phosphoric acid production and copper leaching in the United States. There are very large quantities of phosphate containing between 50 and 150 parts per million of uranium in other parts of the world, especially in North Africa, the Middle East and Latin America — but production of uranium from these sources would require a breakthrough in new process development or very large triple super-phosphate plants which do not now exist and are unlikely to be built in sufficient numbers and size to make up the shortfall for many years. Thus the price may remain high.

Uranium can also be extracted from seawater. If a cheap process to do this can be developed, world uranium resources could be reckoned to be virtually unlimited. At present, however, the cost of extraction brings the price to $ 30 a pound or more. It seems unlikely that uranium from this source will be extracted on any scale before the advent of fast breeder reactors leads to a decline in the rate of growth of the requirement for uranium.



The critical years

Dr. Nininger presented a chart to illustrate the situation between now and 1985 (see Fig.). In each pair of columns the left-hand side shows annual world production capacity and the right-hand side cumulative production capacity. The horizontal bar in each column denotes estimated requirements. The "cumulative" production figures are calculated on the basis that annual production will not exceed that which is expected to be reached in 1975; he could see no good basis for estimating higher levels. On this assumption, the requirement for uranium will exceed production capacity before 1980.

Developing countries could play an important role during the next 30 years. Vast areas in their territories have not yet been adequately explored and it could be that many new deposits will be found.

Considerable effort is already being made. In the United States alone, it has been estimated that in the next ten years the cost of prospecting for and assessing new finds is likely to be about $50 000 000 a year. In the general case, it takes from three to five years from the start of exploration to the proving of a reserve, and another three to five years may pass before such a proven reserve can be brought into production.

Discoveries reported

This was the background against which some of the new or recent uranium discoveries and the hopes for the future were presented. Dr. A. Gangloff (France) presented a paper dealing with uranium deposits in France, some of the discoveries made in Africa in Niger, Gabon and the Central African Republic over the last ten years and future possibilities in these areas.

Another important paper, by Dr. J.W. von Backstrom (South Africa), gave geological news of what may be a possible major uranium deposit at Rössing, in Namibia (South West Africa). The recently discovered uranium deposit in the Republic of Somalia was described by J. Cameron, of the Agency. Major low grade deposits in Greenland were described by Prof. Sorensen, of Denmark.

P.N. Stipanicić examined geological features of deposits in Argentina and related them to the rest of South America and Sh. Hayashi spoke of the occurrence of uranium in small sedimentary basins in Japan. There were also reports on areas in Italy (M. Mittempergher), Spain (J.A. Fernandez Polo), Portugal (J.M. Matos Dias) and Yugoslavia (V. Jokanovic), and general statistical surveys by S.H.U. Bowie (UK) and J. Patterson (USA). Information which could serve as a guide to exploration was presented by H.W. Little and D.S. Robertson (Canada), H.C.M. Whiteside (South Africa) dealt with uranium gold conglomerates, J.W. Gabelman and H.H. Adler with aspects and indications of uranium distribution, and D. Ostle (UK) with geological reasoning leading to choice of areas for prospecting.

In general discussions it was considered that the meeting had been instrumental in providing a guide for future exploration anywhere in the world by integrating some of the ideas and theories of uranium occurrence.