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DEPARTMENT OF ATOMIC ENERGY

PROGRAMME FOR SURVEYING, PROSPECTING AND DEVELOPMENT OF ATOMIC MINERALS DURING THE IVTH AND VTH PLAN PERIODS (1969-78).

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The Atomic Minerals Division of this Department is responsible for surveying, prospecting and exploratory development of atomic minerals. In areas where significant radioactivity is located, bore hole drilling is undertaken to ascertain the depth, extension and mineralisation for the estimation of the ore reserves. This is followed up by developmental mining where necessary. So far, the survey and prospecting work has been based on conventional radiometric surveys - aerial, jeep and foot - undertaken with the help of Geiger Counters/ Scintillometers. These surveys, however, help the location of only the surface and near-surface deposits and give no indication of deposits, even four or five feet below the ground, which would come to light only if deep bore holes were drilled and radiometric measurements undertaken with the help of loggingpprobes. New and improved techniques have, therefore, now to be deployed to supplement the conventional methods. These new techniques consist of establishing temperature gradients in mobile belts where uranium is likely to have been concentrated, isotopic measurements of radium, radon, etc. in ground waters and underground gas, geochemical, geobotanical and geohydrological techniques etc.

2. The demand for uranium is increasing at a fast rate and it is estimated that the present known world reserves are expected to last upto 1980 only. According to the current forecasts, it is expected that more than 50% of the new power generating capacity which will be added during 1970s will be based on atomic energy. In so far as India is concerned the requirements of uranium for nuclear power, which is the main plank of our programme for the peaceful uses of Atomic Energy, till the end of the Fourth Plan period (1973-74) will be adequately met by the mine at Jaduguda. But additional quantities of uranium would be required during the Fifth Plan period. The deposit at Narwapahar which has reserves (indicated and inferred) of 10,000 tonnes of uranium in 17 million tonne of ore of an average grade of 0.055% eU_3O_8 will have to be developed fast so as to be able to fill this gap and provide ore during the Fifth Plan.

3. The nuclear power programme drawn up by the Department and endorsed by the Sub-Committee of the Working Group on Power Planning of Planning Commission envisages the establishment of 3000-3500 MWe nuclear power by the end of the Fifth Plan period of which at least 2600 MWe will be based on natural uranium fuelled reactors. In order to provide necessary uranium to support this programme, not only will the Narwapahar mine be required to yield ore by 1975 but towards the later part of the Plan uranium from reservies in prospects in areas other than Narwapahar in S.T.B. and also that available as by-product from copper bearing ores, would have to be secured. Even today, the major

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deposits of uranium in the Singhbhum Thrust Belt are capable of yielding ore of grades much lower than the average world grade. Efforts to locate better and richer deposits will, therefore, have to be continued. Besides, uranium, other atomic minerals would also be required in the years to come, in much larger quantities.

4. In the context of the needs outlined in the preceding para, the extent and scope of the programme of work to be undertaken by the Atomic Minerals Division during the next ten years will increase considerably and inter alia will include:

(i) reconnaissance surveys in areas not yet covered in various states of India;

(ii) re-checking of some of the areas where earlier reconnaissance surveys have indicated radioactive anomalies; and

(iii) detailed investigations in localities where definite indications of atomic minerals including uranium have been found.

The last mentioned item of work would particularly pertain to more extensive and thorough investigations of the Singhbhum Thrust Belt which extends to over a length of about 150 KM. Moreover, surveys would have to be undertaken now by using more recent and improved techniques developed abroad which are being introduced in the Division to enable location of deposits in favourable areas where the surface measurement may not be encouraging.

5. Keeping these factors in mind, the nature and extent of work during the next ten years in respect of the major atomic minerals is discussed mineral-wise in the subsequent paragraphs.

(i) Uranium

(a) Singhbhum Thrust Belt Area of Bihar: This is the only area in the country where large deposits of uranium, even though of low-grade as compared to world standards, have been located. The major proved source of uranium ore so far is the mine at Jaduguda which has already been developed and regular mining of the ore on a commercial scale is being done by the Uranium Corporation of India Ltd.

Exploratory mining is in hand at Narwapahar which is a much bigger deposit than Jaduguda, though the average grade of the ore is slightly lower. This work of exploratory mining will be continued for the next few years so that the mine is capable of yielding 1000 to 2000 tonnes ore per day by 1975. The details of the programme regarding development of this mine will be worked

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out in the light of the results of the exploratory work in hand, in consultation with the Uranium Corporation of India Ltd., who will take it over ultimately for commercial exploitation.

The ores at Jaduguda have been found to improve in their uranium content in depth. Consequently, a programme of deep drilling has been initiated to explore the nature and extent of reserves at depths upto 1500 metres. The current development programme of the Jaduguda Mine envisages the sinking of the shaft upto a depth of 600 metres only. Later this programme of deep drilling is proposed to be extended to the Narwapahar deposit also.

Encouraging results have been obtained as a result of bore holes drilled in the westerly extensions of the Bhatin Mine where exploratory development work is nearing completion. The work in the main mine is expected to be completed during 1969-70. Its continuance especially in the westerly direction will be reviewed, basing on the results of the assay of the cores and the nature and extent of the ore and other by-products like nickel, molybdenum, etc. available in the mine.

Other good indications of uranium occurences have also been found at Bagjata, Purandungri, Rajgaon and Kanyaluka. Based on the results of the survey and bore hole drilling, underground development work may have to be undertaken in one or more of these occurrences. The rest of the Belt has also to be intensively surveyed through radiation jeep and foot surveys, emanometry survey and geophysical and geochemical methods followed by detailed structural mapping, grid checking etc. and eventually bore hole drilling where necessary. Efforts are in hand to evolve efficient and cheap methods for extraction of low-grade ores available at shallow depths. If such methods of treatment are developed, quarrying may have to be taken in hand for such deposits.

(b) Areas other than S.T.B. - It is proposed to undertake reconnaissance surveys in States like Jammu and Kashmir, Haryana, Assam and in Bhutan, North Sikkim, etc. where no major surveys have so far been attempted. Some of these areas like Assam are particularly expected to yield good results. Further, the work in the Himalayan Range, where so far very small but relatively better grade deposits have been found in the Himachal Pradesh and UP areas, is proposed to be intensified to enable a study of the belt and the nature of the occurrences along with the entire length and to locate any possible large deposits which might be considered suitable for exploitation. Investigations in the Motur-Gondwana sandstones where the conditions appear to be favourable for uranium mineralization and in some districts of Madras, especially the Neyveli occurrences, are likely to be continued. Annexure A to this note gives information regarding uranium reserves in India.

(ii) Thorium and other associated heavy minerals:

At present the thorium deposits in the coastal sands of Madras and Kerala are being exploited. With the development of technology

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regarding utilisation of thorium in power reactors, this minerals is expected to gain significant importance. It will, therefore, be necessary to continue the work of estimating the thorium deposits systematically. Besides thorium, the beach sands contain other valuable heavy minerals like ilmenite, rutile, aircon etc. which are also of considerable importance to our atomic energy programme. Besides the coastal sands, the inland monazite-bearing placer deposits of Ranchi (Bihar) and Puralia (West Bengal) have also shown the presence of substantial reserves of heavy minerals. As the heavy mineral sands are carfied back and forth between the sea and coastal tracks, their reserves are likely to vary over a period of time. It is, therefore, necessary to re-assess these reserves periodically i.e. after five to ten years. In view of this, the work on the coastal sands and the inland placer deposits will be continued during the next ten years to be able to keep in readiness for provision of data for any commercial exploitation that may be planned. The Jurrassic sandstones on the Kathiawar Peninsula and in Kutch have also shown high monazite content and therefore require detailed investigations.

(iii) Beryl:

Beryl is the source material for the production of Beryllium metal which has the following industrial applications:-

(i) As alloying component in beryllium-copper; beryllium-aluminium, etc.

(ii) Age-hardening beryllium-copper alloys used in springs, bellows, electrical contact, aircraft engine parts, etc.

(iii) High conductivity beryllium-copper alloys in electronics and electrical engineering.

(iv) High beryllium alloys as structural material in aircraft and space vehicles.

(v) Requirements of beryllium in present day reactor designs

Beryl has so far been found to occur mainly in pegmatites in Rajasthan and Bihar, the latter being the main source even today. Investigations to locate further reserves of this mineral will be continued in the Bihar Mical Belt where many of the pegmatites have been found to be covered with overburden. In Andhra Pradesh, Madras, Mysore and Maharashtra where some beryl has been found in the past, investigations to locate any new and big deposits are being continued. This mineral has been exported mainly to the United States in the past, but in view of the requirements within the country during the years to come and the sporadic nature of its occurrence, this mineralsshould be stock-piled and not exported unless new major sources are located and production vastly increases.

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(iv) Columbium-Tantalum:

Columbium and Tantalum are other important minerals which have extensive uses in the electronics and aircraft/space industries. Columbium is also mainly used as addition to stainless steel for stabilization. These ores, however, have been found so far to occur in very small quantities and their occurrences are rather sporadic. In view of their importance, the survey for these ores has to be intensified. These ores have also been found to occur in carbonatites. Investigations are, therefore, proposed to be undertaken especially in carbonatities in Rajasthan, Andhra Pradesh, Madras, Madhya Pradesh and Gujarat.

During the investigations for uranium, etc. the Survey Parties are likely to come across other associated and scarce minerals like Germanium, Gallium, Rubidium, Yittrium, etc. Though the exploration of these minerals will not be undertaken as a major activity, these will not be ignored if found during the course of investigations for atomic minerals.

(v) Lithium:

Ores containing higher grades of this mineral namely Spodumene and Amblygonite are not available in large quantities. In order to locate new finds of the above minerals, surveys work for this will also be continued.

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ANNEXURE 'A'

Details of Uranium Reserves of India

			In tonnes of U_3O_8		Total
Singhbhum Thrust Belt	(0.07% U_3O_8)	Jaduguda (Proved)	2,800	3,600	Some 25 million tonnes of ore.
		" (Possible extensions in depth)	800		
	Of around 0.05% U_3O_8 grade	Other deposits	10,000	10,000	
	Low grade 0.02 to 0.049% U_3O_8	Ram-Rakha Mine - Tamapahar	18,200	52,200	Some 200 million tonnes of ore.
		Other areas	34,000		
		New discoveries & additional (*)	1,800	1,800	
Monazite sands	..	.. ..	15,000	15,000	82,600 tonnes of U_3O_8

(*) Bagjata, Purandungri, Bagaon, etc.