

INCO-URANIUM  
INDIA A002 (2)

# AIRGRAM

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TO : Department of State

INFO : BOMBAY, CALCUTTA, MADRAS

FROM : Amembassy, NEW DELHI

DATE: May 9, 1968

SUBJECT : Uranium Exploration, Development and Exploitation in India

DEPARTMENT OF STATE A/CDC/MR

REVIEWED by RUB DATE 8/11/91

REF : CA-7574; New Delhi

DECLASSIFY

( ) EXCISE ( ) DECLASSIFY in PART

( ) DENY ( ) Non-responsive info.

SUMMARY, EO or PA exemptions TS authority to:

( ) CLASSIFY as \_\_\_\_\_, OADR

( ) DOWNGRADING TO ( )

All uranium ore exploration, development and exploitation in India are conducted under the guidance of the government's public sector Atomic Energy Department with assistance from the Geological Survey of India and various state-level agencies. While certain information is released periodically through annual reports and other authorized publications of the Department of Atomic Energy, detailed technical data is withheld for purposes of security. Up-to-date (all-India) reserve estimates, for example, are unavailable. The overall scope of field exploration and development programs may only be assessed through interpretation from a variety of disconnected chemical analyses reported to be indicative of ores contained in certain areas under exploration, and from personal observation and verbal inquiries by Embassy staff personnel.

Currently "known" ore reserve tonnages are confined to the Singhbhum District of Bihar only, with estimates in the range of 20-25 million tons of ore containing 15,000 tons of eU<sub>3</sub>O<sub>8</sub> (e = equivalent) (New Delhi A-674, January 5, 1965). However, field programs elsewhere in India clearly have been intensified during the past two years and may be expected to

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continue at least at the same levels during 1968-69; India's first uranium ore concentration mill at Jaduguda, Singhbhum District, was recently observed in operation on a limited scale (following a totally unsuccessful start in July 1967 and subsequent equipment and flowsheet changes); plans are proceeding in preparation for the construction of the government's proposed "Nuclear Fuel Complex" at Hyderabad, Andhra Pradesh; and indications continue to suggest that revisions of earlier concepts as to what constitutes "uneconomic concentrations of  $eU_3O_8$ " (in India) are possibly in order.

### END SUMMARY

#### 1. Background and Setting

New Delhi A-674, dated January 5, 1965, refers to a paper presented at the 22nd Session of the International Geological Congress entitled "Radioactive Deposits in India" by Dr. K. L. Bhola, Superintending Mining Geologist, Department of Atomic Energy (India). That paper lists nine promising uranium-bearing deposits in the Singhbhum District of Bihar. Available estimated ore reserves and  $eU_3O_8$  (e = equivalent) values of individual deposits are presented, plus Dr. Bhola's overall assumption that (of the known deposits of this area) 20-25 million tons of ore containing 15,000 tons of  $eU_3O_8$  may exist.

While the total reserves of the area specifically described in A-674 remain as the best known overall estimate available, additional data have recently come to light as to certain of the included occurrences. Further, programs of geologic exploration now underway by the Atomic Minerals Division of the Atomic Energy Department, the Geological Survey of India, and various state-level agencies are beginning to reveal deposits of possible importance in areas other than the well-known Singhbhum District. Of even greater significance are growing indications suggesting revisions to earlier concepts of what constitutes "uneconomic concentrations of  $eU_3O_8$ " (in India).

Current information originates from three major sources: (1) recent

annual reports of the Department of Atomic Energy, (2) "Demands for Grants" by the Department of Atomic Energy, and (3) personal observation and inquiries by the Minerals and Petroleum Attache during a field inspection of the Singhbhum District April 19-20, 1968.

2. Exploration and Development - Singhbhum District, Bihar

The newly-completed, but not yet fully operative, uranium ore concentration mill (India's first) at Jaduguda, Singhbhum District, Bihar, warrants particular attention. Under construction since 1964, the mill first began "commissioning trials" in July 1967. Mechanical difficulties brought about an immediate shutdown for modifications, and all subsequent activities were conducted entirely without explanation or publicity. It was generally believed that trial runs had not yet resumed. However, the mill was observed in operation by the Minerals Attache during his recent visit to the area (en route to the Hindustan Copper Limited's Rakha Copper Project, nearby) and activity in the vicinity of the adjoining Jaduguda uranium mine indicated that at least limited tonnages are being mined at the present time. Reliable sources in the area claimed that mill design and equipment changes were completed in February 1968 and that the installation is currently operating at an input rate of approximately 200 tons daily from available stocks (quality range: 0.15-0.20 per cent  $eU_3O_8$ ). GOI security measures would not permit an inspection of the mill or of the underground mine workings, though all observed surface facilities are clearly of a modern design and of a size that should ultimately permit the 1,000-ton per day feed publicly stated to be this plant's rated capacity (interior flowsheet and quality of equipment permitting). While construction of the uranium ore concentrator unit within the plant is said to be completed at this time (unconfirmed), work remains on such facilities as the mill's-by-product sulfuric acid line, raw material reclamation, surge storage, and certain (undefined) shop and office structures. Visible mine-run ore stockpiles (segregated, presumably, by grade of ore) appeared to total approximately 5,000 tons. The rock types observed were granular chlorite-biotite schists and quartz-chlorite-biotite schists with notable quantities of contained sulfides (i.e., pyrite, pyrrhotite, chalcopyrite). Reportedly uranium occurs as a minor constituent largely in the form of uraninite ( $UO_2$ ).

All segments of the Jaduguda uranium mine and mill became the responsibility of the Uranium Corporation of India Private Ltd. (UCIL)

(a Government of India undertaking) on October 17, 1967 (Managing Director: T.B. Malhotra). Total assets in the amount of Rs.11.52 crores (\$15.3 million) are to be transferred to the new company during 1968-69. Authorized capital is quoted at Rs.15 crores (\$20.0 million), to be subscribed entirely by the Government of India and a matching loan. Prior to the formation of UCIL, mine development and mill construction had been directed by the Indian Rare Earths Limited, a public sector agency of the Department of Atomic Energy.

The mill (designed, engineered and erected by the Chemical Engineering Division of the Bhabha Atomic Research Center, Trombay) is an ore concentrator only, incapable of further processing. Thus, if previously announced plans are to be carried forth, all concentrates produced would be transported to the proposed "Nuclear Fuel Complex" (India's planned fuel source for the Tarapur Atomic Power Station and the CANDU type reactors to be established under the GOI's nuclear power program) to be constructed at Hyderabad, Andhra Pradesh. The mill concentrates would first be fed to a ceramic grade uranium oxide plant (initial capacity: 125 tons annually; projected capacity: 250 tons annually), and thence to a ceramic fuel fabrication facility (initial capacity: 100 tons of fabricated fuel elements per year; projected capacity: 300 tons per year). The complex would also include a zirconium plant (50 tons per year), enriched uranium oxide plant (30 tons), enriched uranium oxide fuel fabrication facility (30 tons), special materials plant and a zircaloy diversification plant.

The Jaduguda Mine is not yet fully developed, though underground work has been in progress since 1956, and indications suggest it is by no means ready for an output of the magnitude that would be demanded by the mill -- if the mill were operating at a maximum capacity (1,000 tons per day). Current production is reportedly on the order of 100 tons daily, or half of the mill's present consumption. The main ore haulage (inclined) shaft was completed late in 1967 to a planned depth of 315 meters, and development of the central ore body is said to be completed to the 165-meter level. Several reports confirm a "proved" ore reserve of 2.8 million tons, at an average grade of 0.076 per cent  $eU_3O_8$ , plus recently discovered "indicated" reserves sufficient to substantially exceed the original estimate of 4.0 million tons (A-674). In addition, another possible source of ore exists at the Rakha Copper Project of the Hindustan Copper Private Ltd. (a Government of India undertaking) two miles west of Jaduguda and in the same belt of mineralization.

In 1966, the GOI announced that Rakha would become the public sector's first copper mining and processing venture to be attempted without foreign technical assistance or collaboration (report titled "Rakha Copper Project - A Technical and Economic Feasibility Study"; NMDC; Malhotra, T.B; presented to the Technical Expert Committee October 10, 1966 -- available in the Bureau of Mines, per February 2, 1967 informal letter to Mr. J. A. West, Division of International Activities, and in AmEmbassy New Delhi files). While the presence of uranium in the Rakha copper ore was admitted, little importance was outwardly given to it. This policy to conceal the presence of uranium continues. However, some information, as follows, was gained by the Minerals Attache.

Staff personnel revealed chemical analyses of the Rakha ore with copper qualities in the range of 1.00-2.50 Cu and  $eU_3O_8$  values varying between 0.04-0.20 per cent. Also, "complete" analyses of the neighboring Jaduguda uranium mine are said to contain copper values up to 1.00 per cent Cu. Both mines appear to contain at least limited quantities of ore suitable to the other and their close proximity to one another suggests that little difficulty should be encountered in the trade of usable ores or concentrates. Thus, at least one explanation seems to exist as to why the GOI prefers to develop Rakha without outside assistance -- even though such a plan may be expected to be time-consuming, excessively high in cost and not in keeping with India's urgent need to develop an indigenous copper industry in the shortest possible time.

Elsewhere in the Singhbhum District, exploration drilling has been recently intensified at Narwapahar, Singridungri, Banadungri, Garadih, Bhatin, Kanyaluka, Bijay West, Simulbera and Western Rangamatia. Underground development is currently in progress at Keruadungri, Bhatin and Narwapahar. Indicated ore reserves for the Narwapahar area including the Banadungri Block are now estimated at 3.418 million tons of an average grade of 0.055 per cent  $eU_3O_8$ ; Kanyaluka reserves are reported to be about 0.5 million tons of 0.045-0.050  $eU_3O_8$ .

### 3. Exploration - Other States

Exploratory mining at the Chhinjra deposit in the Kulu District of Punjab and Himachal Pradesh is understood to have produced about 400 tons of ore averaging 0.374 per cent  $eU_3O_8$  during 1967. Total reserves are not available, but drilling and underground test mining is continuing. A similar program is underway at Pat-Sherandogri, Himachal Pradesh, with 25 tons of ore now in stockpile (average grade:

1.40 per cent  $eU_3O_8$ ). Field exploration has been intensified in Uttar Pradesh following recent preliminary reports of radioactivity in the areas of Tunji-Suneragarh, Siraupani-Nandparag-Dharkot-Kalsir (Chamoli District) and in quartzites at Balcha (Uttar Kashi District). The mineralization of the Chamoli District appears to be uraninite in schists with analyses in the range of 0.10-0.20 per cent  $eU_3O_8$ . At Dungar and Bagarkhal in the Pokhri-Tunji area of the Chamoli District, two radioactive bands, 213 and 45 meters long respectively, have been delineated each at an average grade of 0.06 per cent  $eU_3O_8$ . In Madhya Pradesh, 83 anomalies identified by airborne surveys are currently being checked on the ground, and preliminary samples of the Lower Gondwana Motur sandstone from parts of the Betul District have chemically analyzed 0.03-0.09 per cent  $eU_3O_8$ . Elsewhere in India (i.e., West Bengal, Maharashtra and Andhra Pradesh) truck-mounted scintillometer surveys are continuing at a significant pace. An average of approximately 4,000 route miles have been studied annually, since 1966, with some degree of preliminary success. There is every indication to suggest that these programs, together with drilling and exploratory mining, will be pursued through 1968-69 at least at the levels recently maintained.

#### 4. Economic Considerations

All uranium exploration, development and exploitation programs in India have been conducted under the guidance of the Atomic Energy Department. All are "public sector undertakings," and except for disconnected reports of analyses and occasional broad-brush statements of progress, all findings are withheld under a cloak of security. There is no reliable method available by which either total recoverable uranium reserves may be prognosticated, or within which an economic cost/profit break-off can be estimated. "Economic feasibility" as interpreted for most mineral commodities in India, and particularly those included on the classified list (uranium, thorium, columbium, tantalum and beryllium) assumes a non-profit operation; plus additional cost allowances when significant foreign exchange savings may be realized. Thus, in the case of uranium-bearing ores, extremely low-grade materials (by western standards) must be considered minable and suitable for further processing if at all amenable to metallurgical treatment. Excessive operating costs (by western standards) would be permissible and are therefore not dictatorial economic factors, competition between local mining and processing companies is nonexistent, and comparative prices of imported nuclear fuels and products are only of minor importance

wherever foreign exchange savings appear possible. The intensive efforts of the Department of Atomic Energy, its Bhabha Atomic Research Center, and other contributing agencies of the GOI are of such a magnitude as to suggest that all current work is being directed toward the establishment of a near self-sufficiency, at least in so far as indigenous ores are concerned. Even if, in the final analysis, only low-grade ores exist in quantity in India, they are likely to be mined and processed, though straight-line economics may suggest otherwise.

WEATHERSBY

