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Scientific Intelligence Report

Indian Nuclear Energy Program

[redacted]

6 November 1964

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INDIAN NUCLEAR ENERGY PROGRAM

Summary and Conclusions

The Indian nuclear energy program, which was initiated in 1954, has thus far been limited to peaceful purposes. However, India now has three research reactors in operation, one of which can produce plutonium suitable for weapons and is not subject to stringent safeguards. In addition, India has sufficient uranium to provide reactor fuel and has a plutonium separation plant. Construction of a plant for plutonium metal producton, which is necessary for weapon manufacture, is now under way and planned for operation in 1966; should the Indians so decide, it could be in operation in the fall of 1965.

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Three nuclear power stations with an installed electric power capacity of about 830 megawatts (electrical) are planned for operation in the next decade. One station, using two US-supplied reactors, is now under construction. Two of the stations are subject to safeguards. Only the third might supply plutonium for weapons as its safeguard features are not known.

Discussion

The Indian nuclear energy program was initiated in 1954 and led to the establishment of the Atomic Energy Establishment at Trombay (AEET) as its principal facility. The AEET is the site of a uranium metals plant, fuel fabrication facilities, three research reactors, a plutonium separation plant, and the usual research, administrative, and support facilities.

The three research reactors are the APSARA, a 1 megawatt (MW) swimming pool-type reactor, which went into operation in August 1956; the Canada India Reactor (CIR), a 40 MW heavy-water-mod-

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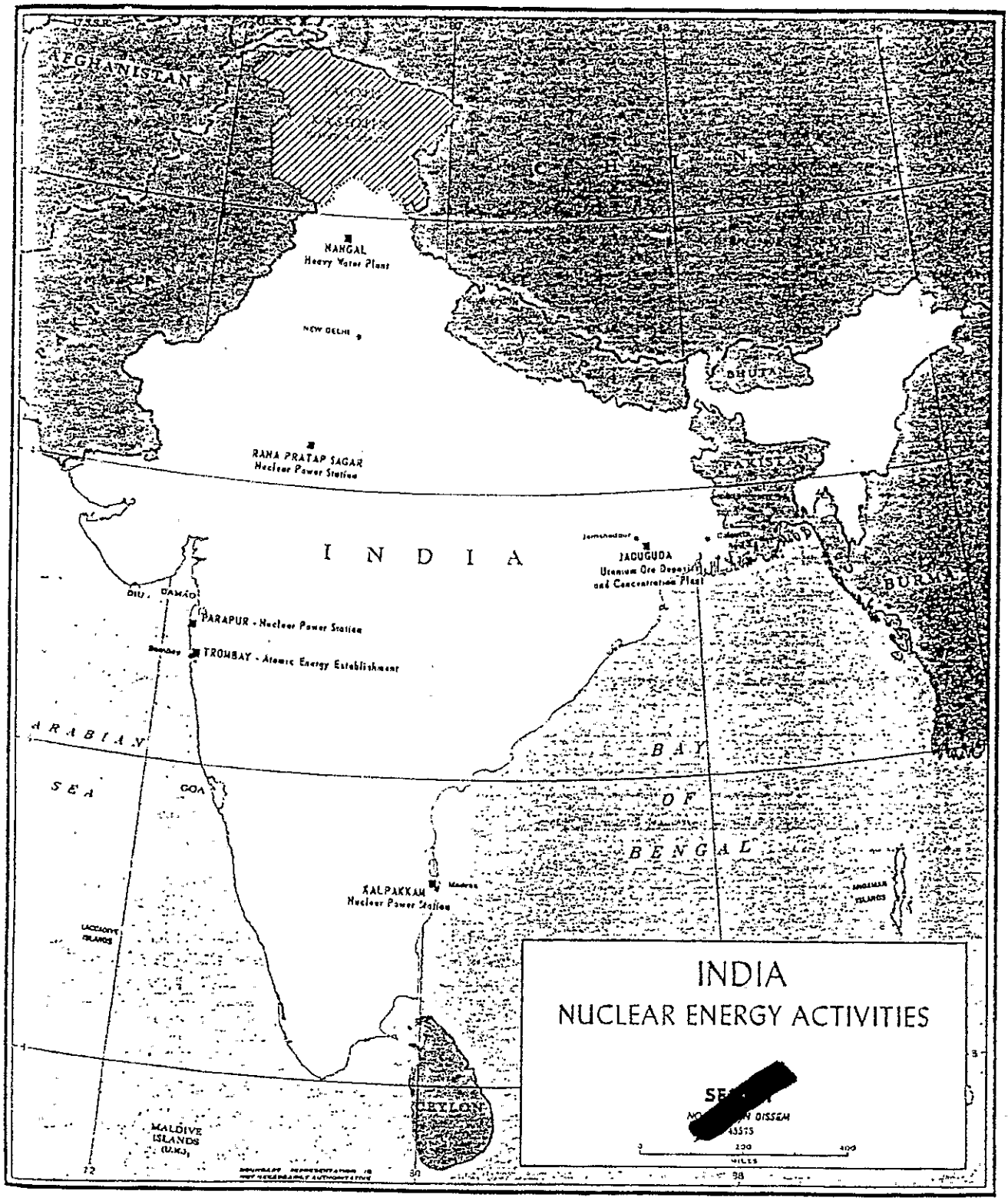

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erated, natural-uranium-fueled reactor, which went into operation in July 1960; and ZERLINA, a zero energy critical assembly, which went into operation in January 1961. Both APSARA and ZERLINA are subject to safeguards. APSARA uses enriched uranium fuel supplied by the United Kingdom under safeguards and ZERLINA uses heavy water leased from the United States with safeguards. CIR was constructed under a Canadian-Indian agreement which included a provision to ensure that the reactor and its products would be used only for peaceful purposes. However, operating reports and inspection rights were placed only on the fuel supplied by Canada, i.e. half of the first loading. The Indians now supply their own reactor fuel. The heavy water used for moderation was purchased from the United States without safeguards.

India has more than adequate uranium reserves to provide reactor fuel. It has been processing domestic monazite deposits to extract uranium for a number of years and has purchased uranium concentrate from France [redacted] Belgium [redacted] and Spain [redacted] without safeguards. In addition, the domestic production of uranium is being increased. Mining has begun near Jaduguda in the state of Bihar where large deposits of uranium ore have been found, and a concentration plant to process 1,000 tons of ore per day, with the production of two to three tons of uranium per day, is expected to be in operation in 1965. The capacity of the uranium metal plant and fuel fabrication facility at AEET is being expanded to handle about 200 tons of uranium concentrate per year.

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India has had a heavy water plant in operation at Nangal since August 1962, which has a capacity of about 15 tons of heavy water per year. [redacted]

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The CIR is the only reactor in operation in India which could be operated for the production of plutonium. It went critical in July 1960, and reached full power operation in October 1963, but only after considerable difficulty. The first fuel loading of the CIR was removed after very low burn-up due to technical difficulties, and at least four subsequent Indian fuel loadings have been removed after a burn-up of only 500 megawatt-days per ton. This is approximately half the design burn-up level for this reactor.

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A plutonium separation plant, named Project Phoenix, went into initial operation at AEET in March 1964 using unirradiated uranium to test the facility. Discussions at the 1964 Geneva Conference revealed that the Indian plutonium separation plant had finished processing 40 tons of uranium from the CIR in late August 1964. This amount of irradiated uranium does not include the Canadian safeguarded half of the first fuel loading. The Indian-owned half of this first loading would have contributed less than a kilogram of plutonium if in fact it has been processed. At present, India has about 20 kilograms of plutonium (in the form of plutonium nitrate solution) separated from the irradiated fuel. The plant to reduce the solution to plutonium metal is under construction, but is not expected to be in operation until about mid-1966. Should India so decide, construction of this plant could be given a higher priority, and it could be in operation in about one year.

The last reactor discharge which could have been included in the 40 tons of irradiated fuel already processed probably occurred in early 1964. This date is based on the stated Indian practice of cooling the fuel for six months. [redacted]

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India presently plans to have three nuclear power stations in operation within the next decade. The first nuclear power station, at Tarapur about 60 miles north of Bombay, is now under construction and is expected to be in operation by 1968 with an installed electric power capacity of 380 MWe. The Tarapur station will consist of two US-supplied boiling water reactors using slightly enriched uranium provided by the United States.

The second nuclear power station will be constructed at Rana Pratap Sagar, Rajasthan, with Canadian assistance. This station will have a natural-uranium-fueled, heavy-water-moderated reactor identical to the 200 MWe Canadian CANDU reactor and is expected to be in operation in 1969-70. Both of these power stations will be subject to safeguard controls and will not contribute to an Indian nuclear weapon capability unless they violate their agreements.

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A third nuclear power station is planned for construction at Kalpakkam, Madras, to be in operation about 1972. This station originally was planned to be similar to the Rajasthan Nuclear Power Station and to be constructed as a native effort. However, India requested Swedish assistance in designing a pressurized heavy-water reactor having an installed electric power capacity in the range of 200 to 300 MWe. A feasibility study is now being conducted by a joint Swedish-Indian team, but a contract for the construction of the station is not expected to be concluded for at least a year. The safeguard arrangements, if any, under which this reactor will be operated are not known.

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