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Directorate of Intelligence

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India's Potential To Build A Nuclear Weapon [redacted]

An Intelligence Assessment

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July 1988

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Directorate of Intelligence

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India's Potential To Build a Nuclear Weapon [redacted]

An Intelligence Assessment

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India's Potential To Build a Nuclear Weapon [redacted]

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Introduction

India demonstrated a capability to build a nuclear device on 18 May 1974, when it successfully detonated one in the Thar Desert [redacted]

India initially showed an interest in developing a nuclear device in early 1961. At that time, Dr. Homi J. Bhabha, then chairman of India's Atomic Energy Commission (AEC), told newsmen in New Delhi that India could make an atomic bomb in two years if it decided to do so. According to Indian open sources, a clandestine project to develop a nuclear device was begun in 1965. The project entered a period of dormancy from 1967 through 1971 because of opposition by Dr. Vikram Sarabhai, the new chairman of the AEC. The project was revitalized by his successor, Dr. H. N. Sethna, in 1972. It then progressed rapidly, and India successfully detonated a nuclear explosive device two years later. [redacted]

Nuclear-Weapons-Related R&D

[redacted]

[redacted] 1 [redacted]

[redacted]

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[redacted]

Nuclear Diagnostic Equipment

In designing nuclear devices, it is extremely helpful to know precisely how various molecular fluids, such as the reaction products of detonated high explosives (deuterium, nitrogen, water, and air), will react at very high temperatures (up to several thousand Kelvins) and high pressures (up to several hundred kilobars). [a] *The equipment used to gather this data includes light-gas guns and streak and framing cameras.* [redacted]

Light-gas guns, used exclusively for high-pressure, shock-wave studies, help the nuclear weapons designer study the characteristics of materials under high pressure—the sort of conditions encountered in an implosion. The characteristics are put in a mathematical form describing the behavior of the material, the so-called equation of state (EOS). In a gas gun, a gas (usually helium) accelerates a projectile down a barrel and drives it into a target. The resulting collision produces a shock wave in the target that permits collection of EOS data on the target material. [redacted]

[redacted]

Streak and framing cameras are used to record the events that occur in the high-explosives components of a nuclear weapon after detonation begins. These cameras take a series of submicrosecond-exposure, high-quality photographs. The streak camera is used to record only a finite portion of the event. The framing camera is used to record sequential frames of a larger portion of the event. [redacted]

Recently developed streak cameras consist of an imaging optics system, a streak tube consisting of a photocathode, a focus cone, an anode, and a recording device (such as a film pack). Older streak cameras consisted of several lenses and a rotating mirror. Frame cameras consist of a mirror rotating at several thousand revolutions per second, a relay lens, and a film plane to record a series of frames of the event, much like a movie camera [redacted]

[a] *Kelvin is an absolute scale of temperature in which degree intervals are equal to those of Celsius (Centigrade) and in which 0 degree equals −273 degrees Celsius or −460 degrees Fahrenheit. Kilobar is a unit of pressure equal to 14,500 pounds per square inch* [redacted]

[redacted]

[redacted]

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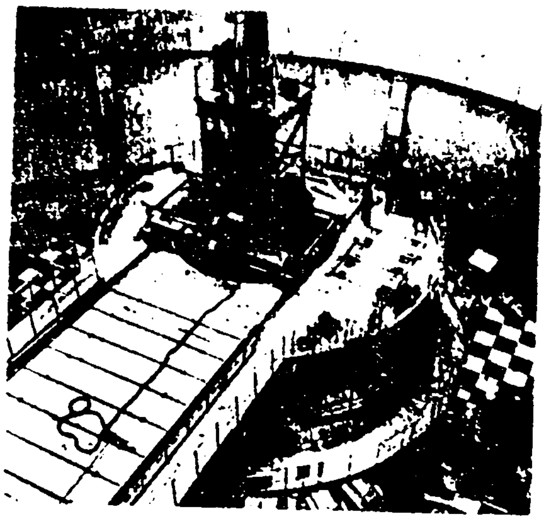
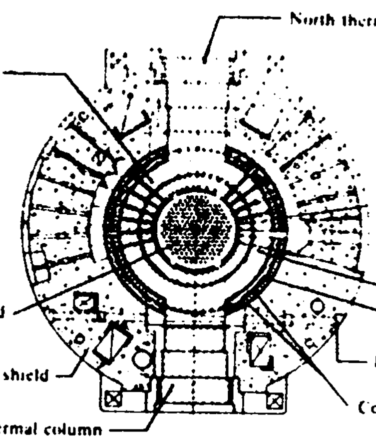
[redacted]

Figure 4
CIRUS and DHRUVA Research Reactors,
Bhabha Atomic Research Center

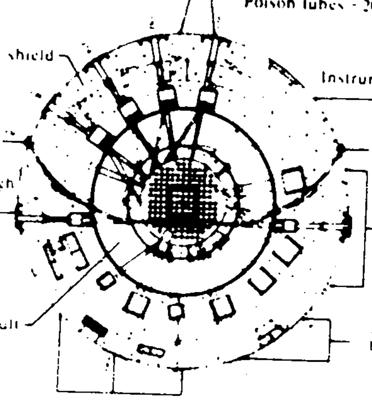
CIRUS Reactor Top With Fueling Machine



CIRUS Cross Section



DHRUVA Cross Section



DHRUVA Reactor

[redacted]

[redacted]

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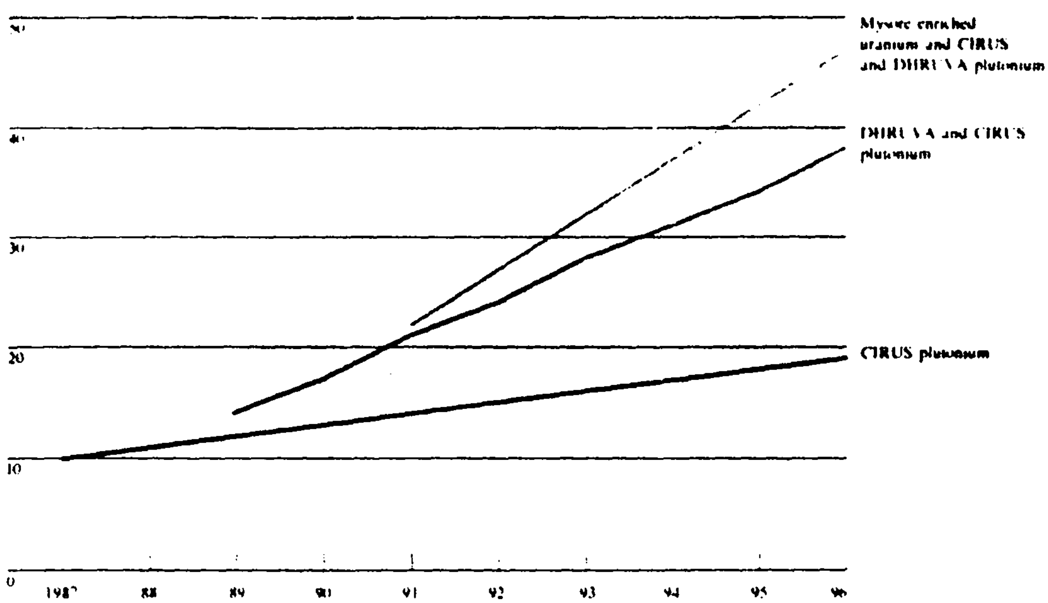
Figure 6
India's Potential Nuclear Weapons Production

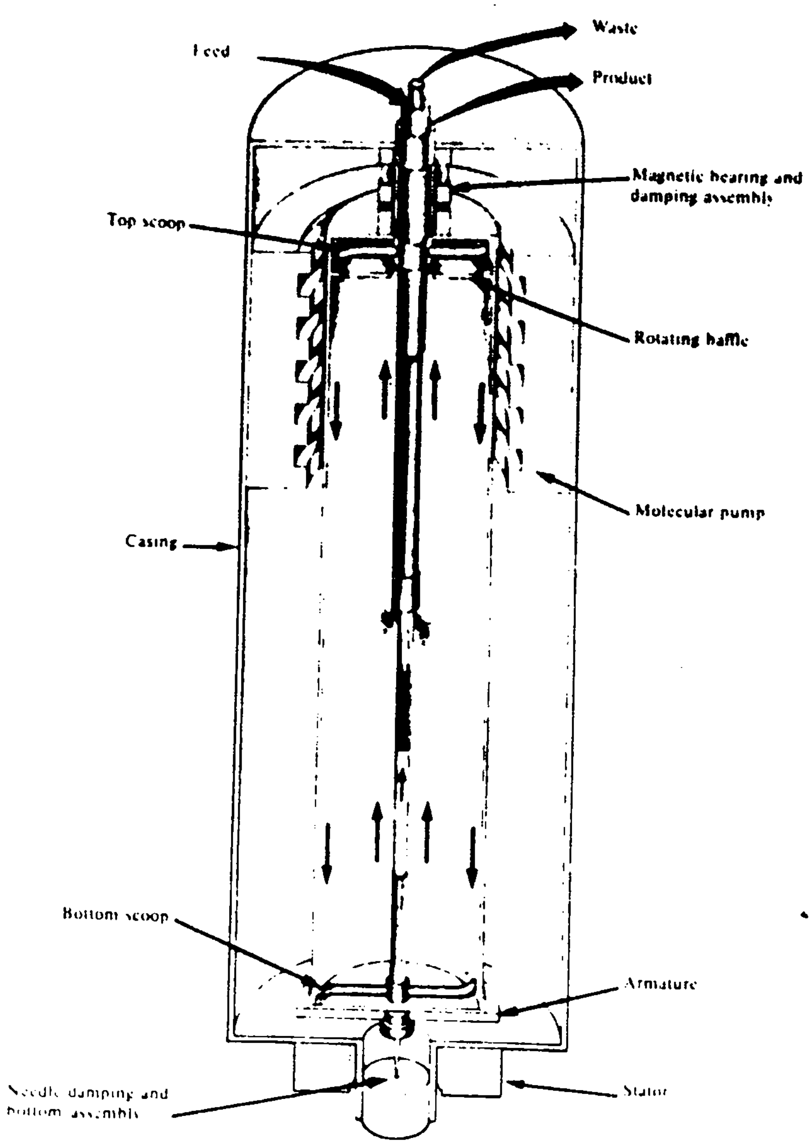


[redacted]

India has only two operational spent fuel reprocessing plants, both currently unsafeguarded. The one at BARC [redacted] is used only for reprocessing spent fuel from the research reactors at BARC. The other, at Tarapur, is referred to as the power reactor fuel reprocessing (PREFRE) plant. It has a capacity of 100 mt per year and is used for processing spent fuel from the nuclear power reactors. [redacted] A third reprocessing plant, under construction in the Indira Gandhi Center for Atomic Research, will have a capacity of 100 mt per year. The Indian Department of Atomic Energy (DAE) is planning to reprocess the spent fuel from Madras and the fast breeder test reactor at the Indira Gandhi Center at this third plant, possibly beginning by 1991. [redacted]

[redacted]

Figure 7
Zippe Centrifuge



[redacted] [redacted]

[redacted]

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Enriched Uranium

[redacted] In November 1986, the DAE chairman, Dr. Raja Ramanna, stated that BARC scientists had mastered the enrichment process using "an experimental centrifuge," [redacted]

[redacted]

[redacted]

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Appendix

India's Principal Nuclear-Weapons-Related Facilities

Thar Desert Nuclear Test Site

Background
The Thar Desert nuclear test site was the location of India's nuclear explosion in May 1974 [redacted]

The geology of the area surrounding the test site comprises mostly alluvial gravels, medium-soft sandstones, and fractured shales, which form the southern edge of a large sedimentary basin. Below these sediments are the much harder Malani Igneous Suite of Precambrian rhyolite or gneiss (granite-type basement rocks) [redacted]

[redacted]

Chandigarh Terminal Ballistic Research Laboratory

Background
The Chandigarh Terminal Ballistic Research Laboratory (TBRL) is a major research facility subordinate to the Armaments Division of the Research and Development Organization of the MOD. The laboratory consists of a main headquarters facility and a field test range. It was built in the mid-1960s to meet India's need for a facility capable of conducting basic and applied research in all areas related to the development and improvement of explosive munitions. It began operation in 1968. [redacted]

[redacted]

[redacted]

Bhabha Atomic Research Center

The Bhabha Atomic Research Center (BARC) is India's leading institution for nuclear R&D. Much of the research at the center is aimed at developing reactor systems and fuel-cycle capabilities for India's civilian nuclear power program. [redacted]

The 40-MWt CIRUS reactor is natural uranium fueled and heavy water moderated. It was completed in 1960 with Canadian assistance. The 100-MWt DHRUVA reactor is also natural uranium fueled and heavy water moderated. The reactor core consists of an aluminum-clad, metallic uranium fuel and operates at a high neutron flux. [redacted]

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[redacted]

The unsafeguarded BARC reprocessing plant, which uses the PUREX solvent extraction process, became operational in 1964. Built for reprocessing spent fuel from CIRUS, it was shut down in 1976 to facilitate needed decontamination and to be modified fo, coping with an expected increase in spent fuel with the completion of the DHRUVA reactor [redacted]

[redacted]

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