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Central Intelligence Agency, Directorate of Intelligence, 'India’s Nuclear Procurement Strategy: Implications for the United States'

Citation:

"Central Intelligence Agency, Directorate of Intelligence, 'India’s Nuclear Procurement Strategy: Implications for the United States'", December 1982, Wilson Center Digital Archive, CREST, National Archives. Obtained and contributed by William Burr and included in NPIHP Research Update #11.
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Summary:

This CIA report on India, “India’s Nuclear Procurement Strategy: Implications for the United States,” has comparatively few excisions. It discusses in some detail Indian efforts to support its nuclear power and nuclear weapons development program by circumventing international controls through purchases of sensitive technology on “gray markets.” The report depicts a “growing crisis in the Indian civil nuclear program,” which combined with meeting nuclear weapons development goals, was forcing India to expand imports of nuclear-related supplies. The purchasing activities posed a “direct challenge to longstanding US efforts to work with other supplier nations … for tighter export controls.”

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Original Language:

English

Contents:

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India's Nuclear Procurement Strategy: Implications for the United States

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A Research Paper

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India's Nuclear Procurement Strategy: Implications for the United States

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A Research Paper

The author of this paper is the Office of Near East–South Asia Analysis, with a contribution by of the Office of Central Reference. Comments and queries are welcome and may be addressed to the Chief, South Asia Division, NESA,

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This paper was coordinated with the National Intelligence Council and the Directorate of Operations.

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India's Nuclear Procurement Strategy: Implications for the United States

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India's nuclear procurement activities pose serious challenges to US-Indian relations, to US relations with nuclear-exporting countries, and to the global nuclear nonproliferation regime:

- Largely through the use of the international "grey market," India has been able to maintain a nuclear weapons capability without submitting to international safeguards or providing peaceful uses assurances. Maintenance of this capability holds all US-Indian relations partly hostage to nuclear nonproliferation concerns.

- Indian purchasing activities challenge US efforts to work with other nuclear supplier states for tighter export controls and demonstrate that the Nuclear Suppliers Guidelines and international safeguards system have serious weaknesses.

Despite a longstanding effort dating from the early 1960s to achieve nuclear self-sufficiency, India will increase its dependence on foreign suppliers for nuclear technology, components, and materials. New Delhi must rely on external suppliers to rescue its failing civil nuclear power program. India also needs imported equipment to improve its nuclear weapons capability in the face of a growing threat from Pakistan.

India has evaded Western supplier-state export and nonproliferation controls by avoiding government-to-government agreements and not importing complete nuclear facilities. Instead, India has established direct relations with foreign vendor firms, used intermediaries to disguise the end use of its purchases, and bought many components piecemeal.

This "grey market" strategy has enabled India to build complete nuclear facilities, but the highly visible technical and economic failings of the nuclear program have become a political albatross for the Gandhi government.

As long as it maintains its grey market procurement network, India will continue to resist supplier-state demands that it submit to international safeguards and provide assurances these imports will be put to peaceful uses.

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If the nuclear grey market tightens, the pace of India's weapons program quickens in response to Pakistan's pursuit of a weapons capability, or India's civil nuclear power program continues to flounder, New Delhi could turn to the Soviet Union, long a supplier of last resort and eager to increase nuclear trade with India. Although Moscow requires safeguards on what it sells, it has not required that India sign the nuclear Non-Proliferation Treaty or abandon its so-called peaceful nuclear explosions option. Soviet reactor technology is not compatible with existing Indian plants, and New Delhi has preferred to avoid a closer relationship with Moscow for political reasons. New supplies of Soviet heavy water would enable India to continue diverting indigenous, unsafeguarded heavy water to unsafeguarded research reactors capable of producing weapons-grade plutonium. This sort of Soviet supply link with India would strain US efforts to cooperate with the Soviet Union on nonproliferation questions and reduce US leverage over India's nuclear intentions.

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India's Nuclear Procurement Strategy: Implications for the United States

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India's so-called peaceful nuclear explosion in the Rajasthan desert on 18 May 1974 convinced foreign suppliers that restrictions on the export of nuclear materials and technology to India should be tightened. The resulting setback to India's drive for nuclear independence increased its reliance on foreign nuclear-exporting countries, contributed to a growing crisis in the civil nuclear power program, and changed India's approach to developing a weapons option. The continuing problems in the civil program, combined with the likelihood that India may soon respond to Pakistan's pursuit of a weapons capability with its own weapons program, heightens the risk that New Delhi will increasingly defy US nonproliferation concerns and that US relations with India and supplier states will be harmed accordingly.

Indigenization: Developments to 1974

India adopted its nuclear indigenization policy as part of its overall pursuit of economic and technological self-sufficiency. According to spokesmen for India's Department of Atomic Energy, indigenization is defined as the effort to achieve a full nuclear fuel cycle based on maximum national self-sufficiency in materials, fuels, equipment, manufacturing, technology, and advanced research (see figure 3, at back of report). In the early 1960s India chose to build Canadian-designed power reactors and all of the support facilities they would require as the cornerstone of its indigenization program.[1]

Prior to its nuclear test in 1974, India instituted a systematic plan for acquiring all technology needed to master a nuclear fuel cycle entirely independent of foreign suppliers. Atomic Energy Department publications and the writings of senior nuclear Indian officials describe the following elements of the plan:

- Hundreds of Indian nuclear scientists went to the United States, Canada, the United Kingdom, and Western Europe in the 1950s and 1960s for scientific and technical training.
- Canada trained Indian personnel in the manufacture and installation of complete reactors, provided direct assistance to Indian firms making parts for Canadian-designed reactors, and sold the Indians much of the special equipment needed for manufacturing them.
- India signed agreements with the United States, Canada, France, and West Germany in the mid-1960s and early 1970s for the construction of reactors and heavy water plants.

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According to *Nuclear India,* the monthly publication of the Atomic Energy Department, by late 1973 India was rapidly establishing a domestic nuclear power industry based on the replication of Canadian reactor technology and supported by foreign-designed and foreign-built heavy water plants. Almost every issue pointed to new examples of Indian industry's mastery of manufacturing techniques for reactor components and fuel cycle facilities.

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Nuclear India also called attention to the Atomic Energy Department's expanding research facilities. The Bhabha Atomic Research Center (BARC) acquired impressive laboratories filled with foreign equipment and instruments. Canada gave BARC the CIRUS research reactor, asking only that India pledge to use it for peaceful purposes. CIRUS supplied the plutonium used in the test explosion of 1974.

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[1] The sole exception to this plan was the Tarapur Atomic Power Station, built solely by General Electric under a bilateral agreement signed with the United States in 1963. According to Homi Sethna, Chairman of the Indian Atomic Energy Commission, Tarapur was designed to demonstrate the commercial viability of nuclear power in India in the shortest possible time.

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Table 1
India's Formal Bilateral Agreements for Cooperation in Nuclear Energy

Partner Country	Date Signed	Subject Areas
Iran	1982, 1977	Joint commission on cooperation, Indian aid in power plant construction
Egypt	1981, 1976	Fellowships, training, scientific visits, joint research
Indonesia	1981	Unknown
Argentina	1980, 1974	Fellowships, training, scientific research, joint research
Syria	1980	Cooperation in all phases of nuclear energy
Yugoslavia	1979	Technical exchange
USSR	1979, 1973, 1968, 1961	Technical cooperation on fast reactors, general cooperation
Vietnam	1978	Fellowships, technical cooperation, training
Libya	1978	Possible cooperation in sensitive areas, but no evidence agreement has been implemented
Iraq	1977	Scientific visits, training
Poland	1977	Information exchanges, fellowships, lease and sale of equipment and materials
East Germany	1974	Environmental protection, reactor construction, medical applications, food preservation
Romania	1971	Technical exchange
West Germany	1971	General nuclear cooperation
Czechoslovakia	1966	Technical exchange
Afghanistan	1965	Fellowships, training, joint research
Belgium	1965	Data exchanges, fellowships, training, help in planning nuclear facilities (lapsed)
Canada	1965	General nuclear cooperation (canceled by Canada)
France	1965	Breeder reactor cooperation
Spain	1965	Breeder reactor cooperation (lapsed)
United States	1963	Construction and fueling of Tarapur reactors
Hungary	1961	Technical exchange
Algeria	Unknown	Unknown
Brazil	Unknown	Unknown (probably canceled after 1974)
Bangladesh	Unknown	Fellowships, training, scientific visits, joint research (lapsed)
Italy	Unknown	Research and technical exchange
United Kingdom	Unknown	Unknown

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The Aftermath of the Rajasthan Test Explosion

Foreign reactions to the nuclear test ended most of the flow of new nuclear technology to India and forced India to modify its strategy for establishing a self-sufficient nuclear industry:

- Canada terminated all nuclear cooperation with India within two weeks of the blast. Subsequent Indian-Canadian negotiations to restore ties broke down in 1975 when India refused to provide assurances that it would accept safeguards on all of its nuclear facilities and would not explode any more "peaceful nuclear devices."
- The United States and West European nuclear supplier nations declined to sign new formal bilateral agreements for cooperation or major agreements for the transfer of technology. France and West Germany did allow private and state-owned firms to complete projects already under construction, and the United States continued to ship fuel for the Tarapur reactors while warning India of tighter nonproliferation controls.
- The United States promoted the Nuclear Suppliers Guidelines, a set of understandings among the

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United States, the Soviet Union, Japan, and the major West European nuclear-exporting countries. The guidelines established a list of exports requiring safeguards and called for participating countries to exercise restraint in transfers of enrichment or reprocessing plants. Members of the suppliers group applied progressively tighter restrictions on exports and demanded that consumer states, including India, provide assurances that nothing transferred would be used to make nuclear explosive devices.

- Only the Soviet Union failed to restrict its nuclear offers to India. The Soviet Union has continued to offer nuclear reactors and reactor technology, nuclear fuel, and heavy water to India, albeit within the general provisions of the suppliers' guidelines. India, however, has avoided a closer relationship with Moscow for political reasons. Soviet technology is also incompatible with existing Indian nuclear plants.

The Indian Policy Response

In the wake of what it regarded as a clear threat to its nuclear independence, India officially reaffirmed the policy of indigenization in Atomic Energy Department publications and in statements to the press,

- Indian Atomic Energy Commission Chairman Homi Sethna leads the policymaking group that argues that nuclear self-sufficiency is attainable at reasonable cost and in a reasonable time. This faction currently carries the most weight in Indian nuclear decisionmaking. Reflecting Sethna's views, the Atomic Energy Department's Annual Report for 1982 reaffirms the goal of maximum indigenization and claims that India has "built a sound infrastructure which enables it to undertake all processes involved in the nuclear fuel cycle."

- M. R. Srinivasan, Sethna's subordinate and the Chief of the Power Projects Engineering Division of the Atomic Energy Department, which has responsibility for building nuclear power reactors, opposes the indigenization policy. According to the press he leads a faction within the department and the Foreign Ministry that believes India must improve its access to foreign nuclear technology, components, and materials. US and Canadian negotiators who have dealt with Indian officials on nuclear issues, conclude that Foreign Ministry officials have generally been more willing than senior nuclear officials to make concessions on safeguards and no-explosives-use assurances in order to assure the flow of nuclear imports.

- BARC Director Raja Ramanna waivers in his support of the indigenization policy. He has remained aloof from the dispute with the Atomic Energy Department.

Although members of the Srinivasan group have direct responsibility for conducting most Indian nuclear diplomacy and operational aspects of the Indian nuclear program, they currently lack the political clout of Sethna's faction. Nonetheless, Srinivasan continues to lead a daring assault on the indigenization policy in his statements to the press and in published articles. In 1978 he told the press that "lacking indigenous know-how and capital resources, and also the ability to import know-how, the Atomic Energy Department fell between two stools: complete dependence on semiobsolescent US and Canadian know-how in the short run and the aim to become self-sufficient in the long run, with no viable bridges from one to the other." His other public attacks on the failings of indigenization have been equally scathing.

The New Procurement Program

The Strategy: Working the "Grey Market." We believe that India's present strategy for acquiring nuclear technology and equipment represents a modus vivendi between the proindigenization faction led by

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Homi N. Sethna

Chairman, Atomic Energy Commission; Principal Secretary, Department of Atomic Energy

Sethna heads India's two most important atomic energy bodies and is the most important official involved in determining both domestic and foreign nuclear policy. He seeks complete self-sufficiency for India in the nuclear field and opposes import of foreign technology. 25X1

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Highly intelligent and forceful, Sethna, 59, is a chemical engineer with an M.S. degree from the University of Michigan and has eight honorary doctoral degrees. 25X1

M. R. Srinivasan

Director, Power Projects Engineering Division
Department of Atomic Energy

As head of the most important Atomic Energy Department division after Bharat Atomic Research Center, Srinivasan automatically commands an important position. He is responsible for the construction and operation for all of India's nuclear power plants. A severe public critic of the Indian policy of indigenization of its nuclear program, he advocates obtaining advanced technology from abroad. Srinivasan has little or no access to Prime Minister Gandhi. Srinivasan, 52, is a mechanical engineer with a Ph.D. from McGill University and a member of the Board of Directors of Bharat Heavy Electricals, Ltd. 25X1

Raja Ramanna

Director, Bhabha Atomic Research Center (BARC), Department of Atomic Energy; Secretary, Department of Atomic Energy

Ramanna is highly 25X1
regarded among scientists and the India elite. After Homi Sethna, he is the most important Atomic Energy Department official, responsible for all research and development. In his position he can exert substantial influence over Indian nuclear policy. He appears to waiver in his support for Sethna's indigenization policies. Reappointed in 1981 as BARC director after a two-year absence, it was a personal triumph over Sethna. 25X1

He is 57 and a nuclear physicist with 25X1
a doctoral degree. 25X1

Sethna and the beleaguered technocrats in the Foreign Ministry and operating divisions of the Atomic Energy Department that have M. R. Srinivasan as their spokesman:

- New Delhi has not signed any new formal bilateral agreements for cooperation or nuclear trade with supplier countries in order to avoid having to give assurances that it will apply safeguards to its facilities or that it will not use its purchases for making nuclear explosives.
- The Atomic Energy Department has cultivated procurement channels in the nuclear "grey market" by establishing direct ties with foreign nuclear

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vendor firms or by using Indian state-owned or private companies as its representatives in making nuclear purchases.

The term nuclear "grey market" refers to transactions that do not violate the letter of supplier-state export controls but appear to violate the spirit of host-state policy. Such transactions allow the sale of nuclear facilities on a component-by-component or subsystem-by-subsystem basis that would be strictly regulated and subject to safeguards and peaceful uses assurances if transferred under a single agreement. In practice, states allowing grey market trade require safeguards on the sale, for example, of complete power or research reactors or enrichment plants but do not regulate the sale of specialized components such as pumps, valves, vessels, control instruments, or machined metal parts.

We believe that Bharat Heavy Electricals, Ltd., a state-owned electrical equipment manufacturer originally organized under Atomic Energy Department auspices, has played a key role in this process by purchasing equipment for nuclear plants under cover of its longstanding nonnuclear procurement and licensing arrangements with foreign firms. Our survey of recent transactions shows that vendors' host governments have not asked India to apply safeguards or give no-explosives-use assurances in connection with most such sales.

- India has shifted from efforts to buy complete nuclear facilities to importing components [redacted] In general, nuclear-exporting countries apply the most stringent export controls to complete nuclear facilities and to explicitly nuclear items and the least stringent controls to items that are less clearly identifiable as parts of nuclear facilities unless their end use is considered. [redacted]

The Results. Our analysis shows that India used imported components and materials to build the most sophisticated and critical portions of nearly all of its reactors and fuel cycle facilities (table 2). The Atomic Energy Department procured some of this equipment under contracts signed before 1974 and bought the balance through the grey market. All Indian power reactors,[2] the CIRUS and R-5 research reactors, the heavy water plants, and most of the Hyderabad Nuclear Fuel Complex are foreign designed or are copies of designs supplied prior to India's nuclear test in 1974 [redacted] 25X1 25X1

The Weapons Option: Modest Successes. The Indian strategy since 1974 for dealing with foreign nuclear suppliers has served New Delhi's nuclear national security objectives by assisting in the creation of a research, development, and limited production complex capable of making nuclear weapons free of any international obligations. [redacted] 25X1 25X1

[redacted] 25X1

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[2] Power reactors: Rajasthan (RAPP I and II)—operating; Madras I (MAPP I) needs heavy water to be commissioned; and MAPP II and Narora (NAPP I and II)—under construction. India refers to its reactors by the first initial of the location and the abbreviation "APP" which stands for atomic power plant. [redacted]

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Table 2
Indian Acquisitions From Foreign Nuclear Suppliers [a]

Supplier/Import	Research Reactors	Power Reactors	Heavy Water Plants	Fuel Fabrication Equipment and Materials	Possible Weapons-Usable Tools, Equipment Materials	Heavy Water	Enriched Uranium
United States		Complete turnkey project and components (1960-70s)			Indians sought calcium metal and equipment (1980s)	Small quantity (1960s)	None until 1980
Canada	CIRUS—as turnkey project; (1960s) R-5 built as copy by Indians (1980s)	Design technology, training, manufacturing equipment used for all Indian heavy water power reactors (1960-70s)	Design, technology, equipment, technical assistance (1960s)	Fuel and technical assistance until 1974			
France	Design, technology, equipment, technical assistance (1960-70s)		Design, technology, equipment, construction and engineering services (1970s)	Equipment and technical assistance offered (1980s)	Equipment offered (1980s)		Fueled research reactor (1960s) but withdrew offer to fuel fast breeder test reactor (1970s)
West Germany	Components (1980s); instrumentation (1980s)	Design, technology, equipment, construction and engineering services (1980s) speciality materials (1980s)	Technical assistance (1980s)	Zirconium (1970s)			
Italy	Components (1980s)	Possible aid in establishing component manufacturing capability (1980s); components (1980s)	Unspecified aid (1960s); construction and engineering services; components (1980s)	Equipment (1980s)	Equipment (1970-80s); Indians sought calcium metal (1980s)		Offered (1980s)
Japan	Components (1980s); specialty materials (1980s)	Components (1980s); specialty materials (1980s)	Components (1970-80s); specialty materials (1980s)	Equipment (1980s); specialty materials (1980s)	Indian bid for calcium metal rejected (1980s)		
USSR		Technology and technical assistance for generators (1970s)		Equipment (1970s)		India's sole supplier since 1976	Offers (1979-81)
Sweden				Refused Indian bid for zirconium (1980s)	Equipment (1970s)		

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Table 2
Indian Acquisitions From Foreign Nuclear Suppliers [a] (continued)

Supplier/Import	Research Reactors	Power Reactors	Heavy Water Plants	Fuel Fabrication Equipment and Materials	Possible Weapons-Usable Tools, Equipment Materials	Heavy Water	Enriched Uranium
Switzerland			Technology, construction, and engineering services (1970s); components (?)				
Netherlands	Instrumentation (1980s)						
Spain		Specialty materials (1980s)					
Denmark			Components (1980s)				
Norway			Refused to sell (1980s)				
China			Unsuccessful Indian bid (1980s)				

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The Civil Power Program: Slipping Schedules and Declining Public Support. In contrast to the modest successes in weapons-related projects, our analysis shows that the procurement strategy used since 1974 has badly disrupted the civil nuclear power program. We believe that India has failed to create a domestic nuclear power industry based on an independent technical capability that can make and deliver nuclear components on a timely basis to internationally recognized standards of quality. Srinivasan and some of his subordinates such as K. S. Kati, chief engineer of the PPED, have told the Indian press that the Atomic Energy Department has failed to improve on the original power reactor technology obtained before 1974. Specifically, they claim that the Department has been unable to design more economical or larger power reactors to replace those based on the original Canadian design. The Indian press has reported that many department technicians question the ability of the twin reactor station being built at Narora—an Indian version of the Canadian design used at Rajasthan—to withstand the area's frequent severe earthquakes.

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The civil nuclear power program is the target of increasing public criticism for its failure to deliver cheap, reliable electricity on a timely basis, for its frequent failures and expensive repairs, and for its slipping construction schedule and escalating costs.

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the program could soon become totally discredited unless its

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technical, economic, and morale problems are overcome. Prime Minister Gandhi, in our view, will be eager to avoid permanent political damage to a program that has long been a symbol of Indian science and technology and a source of prestige among developing countries.

Trends in Relations With Foreign Suppliers

We believe that the persistent difficulties in the civil nuclear power program and the desire of the nuclear establishment to maintain and develop its weapons option explain the increase in India's activity in the foreign nuclear market since 1974. Our analysis shows that the volume and composition of India's imports of nuclear products from Western Europe and Japan from 1974 to 1980, the last year for which data on all suppliers are available, reflect this growing activity (see figure 2).[4] During this period the value of imports increased 25 percent in real terms and represented tens of millions of dollars. Zirconium metal in the form of reactor parts and tubes for nuclear fuel elements was the largest item by value, followed by other components for nuclear reactors and fuel cycle facilities. By 1980 Japan had replaced West Germany as India's largest supplier.[5]

Highlights of current Indian supply arrangements on the grey market include:

- Italian firms supplying engineering services for the Thal heavy water plant, according to an Indian publication on the nuclear program.

- India negotiating with the French to minimize the application of safeguards to French-supplied low enriched-uranium fuel for the Tarapur reactors, according to the US Embassy in New Delhi.

[4] Appendix A explains the methodology used to compile this information.

[5] Appendix B discusses India's relations with major supplier countries.

The Soviet Union: The Ardent Suitor

While other countries have clamped down on officially sanctioned trade with India since 1974, the Soviet Union has wooed New Delhi with promises of nuclear cooperation. Analysis of Soviet-Indian trade agreements shows that, despite Moscow's ardor, India has limited cooperation with the Soviets to those areas of the fuel cycle that would not lead to extensive technological dependence. These include:

- Technical exchange in breeder reactors.
- Purchases of instrumentation for laboratories at the Bhabha Atomic Research Center and fuel fabrication equipment for the Hyderabad nuclear fuel complex.
- Production of Soviet-designed turbogenerators for nuclear plants under the direction of Soviet nationals in facilities owned by Indian state firms.
- Agreements to buy heavy water to overcome domestic shortages in 1976 and 1980.

India rejected Soviet offers of power reactors and associated manufacturing technology during Premier Kosygin's visit to New Delhi in June 1979 and again during Prime Minister Gandhi's visit to Moscow last September. advocates of indigenization did not want to introduce a new technology dependent on foreign fuel supply. The Indian press said that Gandhi postponed a reply to the most recent offer for the same reasons.[6]

We believe that Gandhi was also reluctant to conclude a major new agreement with Moscow because of the possible adverse effects on relations with the United States. Her visit to Washington last July, in our opinion, demonstrated New Delhi's interest in

[6] According to the US Embassy in Moscow, the Soviets offered pressurized water reactors, which would give India its third reactor technology. India is building natural uranium-fueled, heavy water moderated reactors of Canadian design and has two US-designed boiling water reactors at Tarapur.

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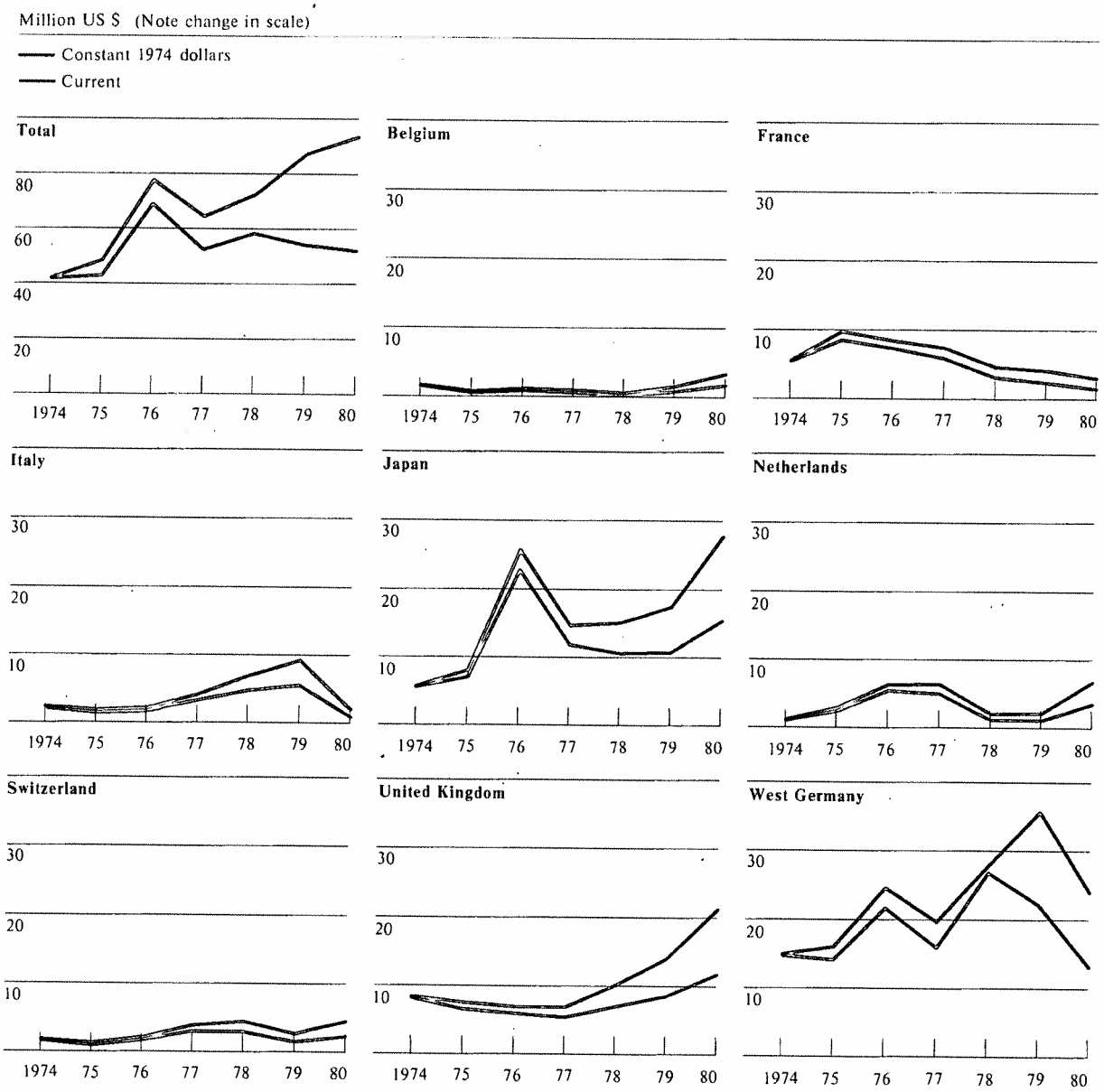
Figure 2
India's Imports of Nuclear Products



Note: See Annex I for discussion of data compilation methodology.

Note: Canada supplied less than one million US dollars of nuclear products to India in 1974. By 1979, Canadian supplies were negligible.

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easing tensions with the United States over the supply of fuel for the Tarapur reactors, in promoting greater US understanding of Indian views on the Pakistani nuclear weapons program, and in establishing closer commercial and financial ties. A comprehensive reactor purchase agreement with the Soviet Union would be inconsistent with the Indian-US understanding that France supply low enriched uranium for Tarapur.

We believe that India would consider strengthening its nuclear ties to the Soviet Union if its access to the grey market in Western Europe and Japan were threatened, if the pace of the Indian nuclear program were to accelerate significantly, or if continued failure in the civil nuclear program increasingly embarrasses the Gandhi government.

As the outcome of the Gandhi visit to Moscow indicates, the Sethna group in the nuclear power establishment is still dominant in its support of indigenization. In our view, however, changed international conditions or enhanced nuclear program–related political pressures might reverse the Indian position. The renewal of the Soviet offer also shows that an opportunistic Moscow is aware of the prospects for a change in New Delhi's policies and is willing to be India's supplier of last resort

Outlook

We believe that the growing crisis in the Indian civil nuclear program, combined with India's desire to maintain and improve a nuclear weapons option in the face of a growing threat from Pakistan, will force India to continue relaxing its indigenization policy by expanding its imports of nuclear-related materials, components, and technology. Based on our knowledge of the shortcomings of the Indian nuclear program and India's established foreign procurement network, we believe that Indian priorities and sources for such imports will be:

- Consulting and engineering services for heavy water plants—the key element in reducing India's dependence on foreign suppliers for critical materials. Given past associations and aid patterns, India most likely will turn to Italian and West German companies for assistance, equipment, and materials. Shortfalls in indigenous heavy water production have made this need particularly acute.

- Consulting and engineering services for Indian-built power reactors. The poor operating records of the Rajasthan reactors are a growing political albatross for the Indian nuclear program and the Gandhi government. Foreign consultants have not assisted with these reactors before, but we believe the failure of the domestic technical establishment to make them work will provide a strong incentive to seek foreign help. The KWU consortium of West Germany, which already has a joint venture relationship with Bharat Heavy Electricals Limited, is a probable source of aid because it has built heavy water power reactors in West Germany and Argentina.

- Continued acquisition of precision equipment and specialty materials for facilities essential to a possible nuclear weapons program. We believe that the Indian nuclear establishment will maintain this option by updating and enhancing its technical capabilities. Because of the highly sensitive nature of many of the items being sought, India will buy them as opportunity allows.

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[redacted] 25X1

We expect New Delhi to continue to resort to the grey market to avoid safeguards and peaceful-use assurances. Past experience has shown the Indians they can buy major nuclear facilities piecemeal without triggering foreign export controls or submitting to nonproliferation requirements. [redacted] 25X1

Implications for the United States

We believe that India's nuclear procurement activities will adversely affect US-Indian relations, US relations with key European nuclear supplier countries and Japan, and US efforts to work with the Soviet Union on nuclear nonproliferation matters of common concern. [redacted]

On the bilateral level, India's nuclear procurement strategy allows New Delhi to continue developing its nuclear fuel cycle with critical facilities and activities outside of safeguards, thus maintaining a nuclear weapons option. A weapons option links all cooperation between the United States and India directly to nuclear nonproliferation concerns. These concerns, and a resultant threat to US-Indian relations, may arise over the next year or so as Pakistan's nuclear program places growing pressure on India to respond with a second nuclear test, a nuclear weapons program, or even with military action against Pakistan's nuclear facilities. We believe that India will maintain its weapons capability and continue related procurement efforts at current levels even if relations with Pakistan improve. [redacted] 25X1

India's nuclear procurement activities pose a direct challenge to longstanding US efforts to work with other supplier nations, particularly in Western Europe and Japan, for tighter export controls. US efforts to encourage the supplier nations to impose stronger controls over exports of dual- and multiple-purpose equipment and components of larger nuclear facilities have so far had little success. We expect the European exporting countries and Japan to continue to resist US efforts to curb their nuclear exports by arguing that they will be replaced by the Soviets in the Indian market if they are curtailed. [redacted] 25X1

If the United States does succeed in persuading other supplier nations to eliminate the export control loophole that makes India's grey market successes possible, we believe that it would lead to fundamental disagreements between the United States and India:

- India would be likely to blame the United States if its domestic nuclear program suffered even more from a constriction of grey market sales.
- Indian nuclear officials and political leaders would be likely to point to any US successes in multilateral export control as fresh examples of industrialized nations prolonging dependency of developing nations and denying them legitimate access to advanced technology.
- India would show even less willingness to maintain existing international safeguards arrangements on its facilities or to acquiesce in US efforts to build international support for safeguards on nuclear facilities not currently covered.
- The United States might be able to lessen Indian reaction to tightened export controls by concentrating on potentially weapons-related equipment and materials and putting less pressure on acquisitions for power reactors. [redacted] 25X1

US success in constricting the West European–Japanese grey market could turn India to the Soviet Union as a nuclear supplier of last resort that, in turn, could create a US-Soviet disagreement over nonproliferation questions and reduce US leverage over India's nuclear directions. The Soviet Union could decide, as it has in the past, to sell heavy water and possibly reactors to India under safeguards covering only the items exported. India would then be able to build new power reactors more easily but without submitting its indigenous fuel cycle facilities to safeguards. India would then be able to shift its indigenous heavy water into the R-5 reactor and later into the MAPP II power reactor, which would allow both facilities to remain free of international safeguards and thus available to supply plutonium for a future nuclear weapons program. Soviet supply of heavy water has 25X1

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already, in our opinion, stiffened India's resolve to remain free of more extensive nonproliferation limitations that might otherwise be required as part of its nuclear trade with Western Europe and Japan. Without Soviet heavy water India would have been forced to choose between delaying commissioning of power reactors or accepting Western nonproliferation requirements.

25X1

Our analysis shows that India's nuclear procurement activities demonstrate serious weaknesses in the global nonproliferation regime:

- The Suppliers Guidelines, for example, do not specify in enough detail the exported items that should be subject to safeguards in order to restrict Indian grey market purchases.

- New Delhi's traditional refusal to revise its existing safeguards agreements will pose a major obstacle to any US efforts to promote a revision in the standards for such arrangements to take the technology replication problem into account. Most international safeguards agreements do not contain provisions to cover the extension of safeguards to facilities that replicate the design and technology of the original safeguarded facilities. India's agreements leave it free to copy Canadian reactor designs and heavy water technology from a number of countries.

- India's success in procuring nuclear equipment and materials and in maintaining a nuclear weapons option despite the application of nonproliferation controls sets an example for other would-be nuclear proliferation countries.

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Appendix A

India's Imports of Nuclear Products—Methodology for Graphing

Data Selection

The data used to compile the graph on India's nuclear imports (p. 10) are the values of exports of a select group of nuclear products to India by its major European suppliers and Japan, as reported to the United Nations in Version I of the Standard International Trade Classification (SITC). The 44 product groups included within the definition of "nuclear products" contain items that are used predominantly or exclusively in the construction or operation of nuclear facilities.

Version II of the SITC separates nuclear and nonnuclear products more completely than Version I, but the data were not available for the entire period covered in this research paper. As a check on the accuracy of Version I data, we compared figures for Version I and Version II for 1980, the only year for which information in both systems is available.

Differences in the methodologies of Versions I and II should be taken into account in interpreting the graph. In our comparison of the two we found that Version II reported approximately 5 percent less in the value of nuclear imports by India than Version I. Variation between figures for individual exporting countries was random. We believe that the differences between figures for the two versions reflect changes in product definitions and the inclusion of more nonnuclear trade within the categories used for Version I.

Exporting-country data rather than Indian import data were selected in the compilation of the graph for two reasons:

- Indian import data for the period covered in the research paper were incomplete.
- Use of exporting-country figures reduces uncertainties by allowing comparisons between the nuclear imports of a number of developing countries.

Correction for Inflation

Constant dollar figures[7] for the graph were compiled using the United Nations Index of Prices of Developed-Country Exports of Manufactured Products.

Uncertainties

The trend lines in the graph should be interpreted as indicators of flows of Indian nuclear imports and orders of magnitude and not as precise dollar values because of two major uncertainties:

- The product categories remain broad even after careful selection so that some nonnuclear trade is included in the totals.

- No correction has been made for exchange rate variations, changes in product definitions or national reporting practices, or possible attempts by exporters to conceal nuclear trade.

[7] Dollars adjusted for inflation from a base year—in this case, 1974.

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Appendix B

India's Relations With Major Nuclear Supplier Countries

France

France's longtime role as a major supplier to India's nuclear program has declined in recent years because India will not accept France's safeguards requirements. According to our analysis, total French sales of nuclear products to India declined in constant dollars from 1974 to 1980; exports of machinery and equipment increased in comparison to exports of materials more directly identified as nuclear such as zirconium.

Indian-French nuclear relations began through informal contacts among scientists in the 1950s but reached their peak prior to the Indian nuclear test. French nuclear companies built two heavy water plants under contracts signed in 1969 and 1971. Just prior to the test, the Indian and French Governments agreed to build a copy of a French experimental breeder reactor at Kalpakkam. France was to supply all critical equipment, technology, training, and technical assistance. This reactor, which is expected to be completed in 1985, is to be the centerpiece in India's long-range nuclear strategy for achieving self-sufficiency in the production of nuclear fuel. In 1975, after India refused to accept French safeguards conditions for the sale of high enriched-uranium fuel, a weapons-usable material for the fueling of the Kalpakkam reactor, intergovernmental relations all but ended in the nuclear field.

In November 1982, shortly before the visit of French President Mitterrand, India and France agreed on the supply of French fuel for the Tarapur reactors. Pursuant to a US-Indian understanding reached during Prime Minister Gandhi's visit to Washington, France consented to replace the United States as fuel vendor. India initially took a hard line on accepting French safeguards requirements but compromised, we believe, because of its dependence on French assistance with the Kalpakkam reactor and because of a more general desire to continue developing direct relations with French nuclear firms.

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We believe that India is likely to avoid intergovernmental agreements with France other than the fuel agreement for Tarapur, thus avoiding further French demands for safeguards and assurances of peaceful use.

25X1

West Germany

After Canada cut off all governmental and private nuclear aid in 1974, West Germany became India's most important source of nuclear equipment and technology. India and West Germany signed a general agreement on cooperation in 1971, but, after the Indian nuclear test, progressively more stringent German export controls and nonproliferation policies all but ended New Delhi's interest in new formal arrangements. Indian nuclear energy organizations, however, have successfully cultivated direct ties with German industry.

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We believe that West German nuclear exports to India from 1974 to 1980 consisted largely of equipment for heavy water plants and some reactor components. Prior to 1974 German firms contracted to build heavy water plants in India. Our analysis shows that sales of equipment and components increased even

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though total nuclear exports as measured in constant dollars failed to grow. Total German sales in constant dollars declined slightly after 1978, when India refused to accept Bonn's safeguards requirements for the transfer of compressors designed for use in a heavy water plant. We believe that this event intensified the shift of Indian activity from dealings with the West German Government toward direct contact with German companies.

We believe that India will continue to rely on German companies to assist it in building and operating heavy water plants and in securing reactor components. India's difficulties in producing a domestic supply of heavy water provide a particularly strong incentive to cultivate relations with the German companies that built the heavy water plants and to seek their aid for new projects.

Italy

Aside from a small research agreement, India and Italy have never signed a formal bilateral agreement for cooperation. Our analysis, however, of Italian exports shows that Italy has become an important supplier to India for highly specialized components for nuclear reactors and other fuel cycle facilities. We expect these supply arrangements to continue. We believe that the relatively modest dollar volume of trade reflects India's concentration on purchases of a limited number of high-value, precision components direct from Italian manufacturers.

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According to Indian publications, Italian firms provided engineering and construction services in 1981 for the Thal heavy water plant.

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Japan

As with Italy, the lack of a formal bilateral agreement for cooperation in nuclear energy between India and Japan has not prevented close nuclear trade ties. Indian nuclear energy organizations have succeeded through informal arrangements in acquiring nuclear reactor components and specialty materials for use in nuclear facilities from Japanese firms. According to our analysis of Japanese nuclear exports, sales of equipment constitute the fastest growing category.

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The US Embassy in Tokyo has reported that Tokyo intends to restrict nuclear transactions between Japanese firms and India. It has in a number of instances prevented Japanese companies from selling equipment or offering their services as brokers or technical consultants. We believe such efforts will restrict the growth of Japanese nuclear exports to India but will not prevent Indian authorities from making new attempts to exploit the multinational business and manufacturing contacts of Japanese firms.

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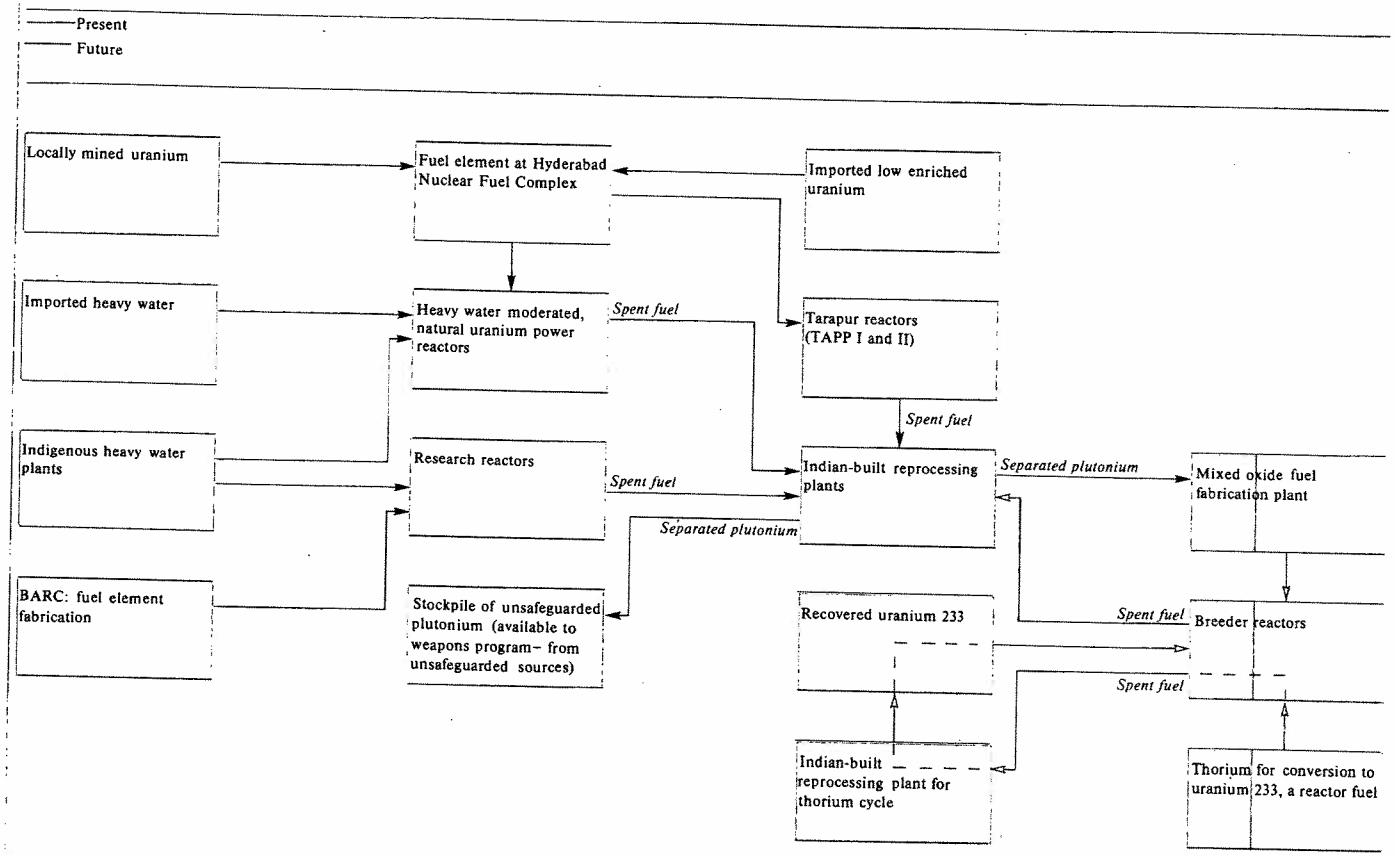
Figure 3
The Indian Nuclear Fuel Cycle



Research reactors
CIRUS–operating
R-5–under construction
(Neither is safeguarded)

Natural uranium reactors:
RAPP I and II (safeguarded)
MAPP I (complete, not commissioned)
MAPP II (under construction)
NAPP I and II (under construction)

India's Canadian designed power reactors run on natural uranium moderated by heavy water and thus do not require foreign enrichment services. Fuel from these reactors can be reprocessed to recover plutonium formed during irradiation. The recovered plutonium could be used to refuel the Tarapur power reactors in place of enriched uranium, or, more importantly, to start up breeder reactors that will make more fissile material than they consume: either additional plutonium from uranium put around the core, or uranium-233 from thorium put around the core.

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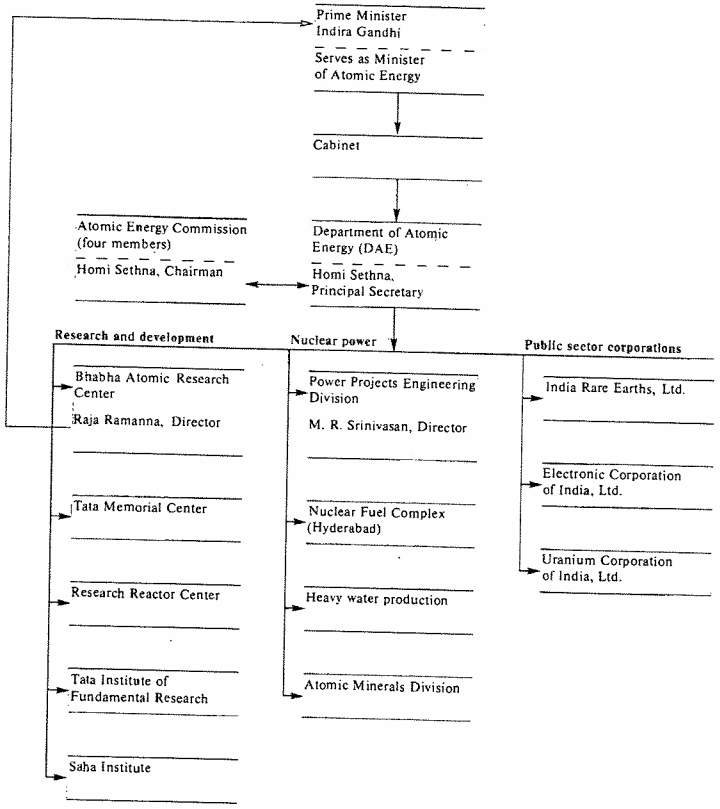
Figure 4
India's Nuclear Policy Establishment



Raja Ramanna
Director, Bhabha Atomic Research Center (BARC), Department of Atomic Energy
Secretary, Department of Atomic Energy

[redacted] 25X1

highly regarded among scientists and the Indian elite.
. . . after Homi Sethna, the most important DAE official . . . responsible for all research and development.
. . . occupies position where he can exert substantial influence over Indian nuclear policy . . . appears to waiver in his support for Sethna's indigenization policies.
. . . reappointment in 1981 as BARC director after two-year absence was personal triumph over Sethna . . .

[redacted] 25X1

. . . fifty-seven years old . . . nuclear physicist with doctorate degree.

Homi N. Sethna
Chairman, Atomic Energy Commission
Principal Secretary, Department of Atomic Energy

. . . head of India's two most important atomic energy bodies and the most important official involved in determining both domestic and foreign nuclear policy.
. . . seeks complete self-sufficiency for India in the nuclear field . . . opposes import of foreign technology.

[redacted] 25X1

. . . fifty-nine years old . . . highly intelligent and forceful . . . chemical engineer with an M.S. degree from the University of Michigan and eight honorary doctoral degrees.

M. R. Srinivasan
Director, Power Projects Engineering Division (PPED)
Department of Atomic Energy

. . . as head of most important DAE division after Bharat Atomic Research Center, Srinivasan automatically commands important position.
. . . is responsible for construction and operation for all of India's nuclear power plants.
. . . a severe public critic of Indian policy of indigenization of its nuclear program . . . an advocate of obtaining advanced technology from abroad.
. . . [redacted]
. . . a member of the Board of Directors of Bharat Heavy Electricals, Ltd.
. . . fifty-two years old . . . mechanical engineer with Ph.D. degree from McGill University.

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