Separating Indian Military and Civilian Nuclear Facilities

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The agreement announced on July 18, 2005 by President George Bush and Prime Minister Manmohan Singh regarding the establishment of a U.S.-India "global partnership" will require changes to U.S. non-proliferation laws and policies and could dramatically increase nuclear and nuclear-related commerce with India. Part of this agreement is an Indian commitment to separate its civil and military nuclear programs and put declared civil facilities under international safeguards.

Safeguards should apply in perpetuity, with minor, standard exceptions that do not include use in nuclear explosives or weapons. In addition, safeguarded nuclear material should not co-mingle with unsafeguarded nuclear material in any facility, unless this unsafeguarded nuclear material also comes under safeguards. This latter condition is an example of "contamination," a key principle of safeguards. Although these conditions do not appear to have been accepted by India, they are necessary to prevent civil nuclear cooperation from benefiting India's nuclear weapons program.

To accomplish these goals, India needs to place all its nuclear facilities not directly associated with nuclear weapons production or deployment under safeguards. India has many civil nuclear facilities in this category.

In addition, India should place its nuclear facilities associated with its naval nuclear fuel cycle under international safeguards. Exempting such naval-related facilities from safeguards would undermine efforts to safeguard such facilities in non-nuclear weapon states party to the Nuclear Non-Proliferation Treaty. Brazil accepted safeguards on its prototype naval reactor and its enrichment plants at Aramar dedicated to the production of naval reactor fuel. Safeguards applied in India should be consistent with the IAEA's approach in Brazil.

To better understand and illustrate a meaningful separation and safeguarding of Indian nuclear facilities, the following tables divide the major Indian nuclear facilities into three groups.

Group 1 covers facilities that all states consider civilian in nature and that have no known connection to India's nuclear weapons program. Facilities in this group would be declared as civil and would be safeguarded. They would include power reactors, spent fuel reprocessing plants, and breeder reactors, which would all produce or utilize civil plutonium.

Group 2 shows facilities that are associated with India's nuclear weapons production complex. Most of these facilities would be declared as military facilities that would not be subject to safeguards. One exception is the Cirus reactor, which was purchased from Canada under a peaceful use pledge. If India declares this reactor as military, it would directly violate its commitment to Canada. The Rare Materials Project (RMP), India's main uranium

enrichment plant, may produce a limited amount of highly enriched uranium for nuclear weapons, although the main purpose of the plant appears to be to make enriched uranium for naval reactors and possibly a small amount of enriched uranium for civil research reactors (see below).

Group 3 lists known nuclear facilities in the naval fuel cycle. As discussed above, this group of facilities should be placed under safeguards. In particular, India should place its prototype naval reactor and the Rare Materials Project under safeguards and commit them to non-nuclear explosive purposes. Under such an arrangement, India would not use RMP to produce any enriched uranium for nuclear weapons, although it could use enriched uranium in both the naval and civil fuel cycles.

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Group 1. Civil Nuclear Facilities

Major Fuel Fabrication Plants

Name	Location	Type	tHM/yr	Start Date	Function
Enriched Fuel Fabrication Plant	Hyderabad	BWR	25	1974	Makes LWR fuel assemblies Safeguarded
New Uranium Oxide Fuel Plant	Hyderabad	PHWR	300	1998	Makes PHWR pellets
PHWR Fuel Fabrication Plant	Hyderabad	PHWR	300	1974	Makes PHWR fuel bundles Safeguards apply occasionally
Advanced Fuel Fabrication Facility	Tarapur	Unknown	20	≈1990	Makes MOX fuel for PFBR, BWRs, PHWRs Research & development
New Uranium Fuel Assembly Plant	Hyderabad	PHWR	600	Unknown	Under construction Safeguarded if fabricating fuel rods from imported nuclear fuel
MOX Breeder Fuel Fabrication	Kalpakkam	Pilot scale	Unknown	Unknown	Makes MOX fuel

Power Reactors

Name	Location	Type	MW	Start Date	Function
Advanced Heavy Water Reactor (AWHR)	Trombay	HWR	300	Unknown	Prototype reactor to be used in 3rd stage of thorium energy program
Kaiga 1	Kaiga	PWHR	220	1999	
Kaiga 2	Kaiga	PWHR	220	2000	
Kaiga 3	Kaiga	PWHR	220	(2007)	Under construction
Kaiga 4	Kaiga	PWHR	220	(2007)	Under construction
Kaiga 5	Kaiga	PWHR	220	(2007)	Planned
Kaiga 6	Kaiga	PWHR	220	(2007)	Planned
KAPS 1	Kakrapar	PWHR	220	1993	
KAPS 2	Kakrapar	PWHR	220	1995	
Kundankulam 1	Kundankulam	PWR	1000	(2007)	Safeguarded; PWR from Russia
Kundankulam 2	Kundankulam	PWR	1000	(2008)	Safeguarded; PWR from Russia
MAPS 1	Madras	PWHR	170	1984	
MAPS 2	Madras	PWHR	170	1986	
NAPS 1	Narora	PWHR	220	1991	
NAPS 2	Narora	PWHR	220	1992	
RAPS 1[1]	Rajasthan	PWHR	100	1972	Safeguarded; CANDU from Canada
RAPS 2	Rajasthan	PWHR	200	1981	Safeguarded; CANDU from Canada

[1,2] The Away From Reactor Facility at Tarapur stores spent fuel from RAPS 1 & 2 and TAPS 1 & 2.

Name	Location	Type	MW	Start Date	Function
RAPS 3	Rajasthan	PWHR	220	2000	
RAPS 4	Rajasthan	PWHR	220	2000	
RAPS 5	Rajasthan	PWHR	450	(2007)	Under construction
RAPS 6	Rajasthan	PWHR	450	(2007)	Under construction
RAPS 7	Rajasthan	PWHR	500	(2011)	Planned
RAPS 8	Rajasthan	PWHR	500	(2011)	Planned
TAPS 1[2]	Tarapur	BWR	160	1969	Safeguarded; BWR from US
TAPS 2	Tarapur	BWR	160	1969	Safeguarded; BWR from US
TAPS 3	Tarapur	PWHR	490	(2006)	Under construction
TAPS 4	Tarapur	PWHR	540	2005	

Breeder Reactors

Name	Location	Type	MW	Start Date	Function
Fast Breeder Test Reactor (FBTR)	Kalpakkam	Fast breeder test reactor	40	1998	Prototype fast breeder Research & development
Prototype Fast Breeder Reactor (PFBR)	Kalpakkam	Prototype reactor	500	(2010)	Demonstrate electricity production Research & development of fast reactors

Reprocessing Plants

Name	Location	Type	tHM/yr	Start Date	Function
Power Reactor Fuel Reprocessing Plant (PREFRE)	Tarapur	Industrial scale	100	1977	Safeguarded if fuel is safeguarded Reprocessed Cirus, Dhruva, PHWR fuel Provide fuel for FBTR and AFFF, Tarapur
Kalpakkam Reprocessing Plant (KARP)	Kalpakkam	Industrial scale	100	1997	Reprocess MAPS, Kalpakkam, FBTR fuel Provide fuel for PFBR 2nd line planned for 2008
Fast Reactor Fuel Reprocessing Plant (FRFRP)	Kalpakkam	Full scale	Unknown	Future	Reprocess FBTR spent fuel May provide fuel for PFBR
Lead Minicell Facility	Kalpakkam	Demonstration	Unknown	2003	Reprocess FBTR spent fuel Planned to reprocess PFBR fuel

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Enrichment Facilities

Name	Location	Type	Start Date	Function
Center for Advanced Technology	Indore	Laser enrichment	1993	Research
Rare Materials Project[3]	Mysore	-	-	Research reactor fuel?
Laser Enrichment Plant	Trombay	Laser enrichment	1993	Research
Uranium Enrichment Plant	Trombay	Pilot scale Ultracentrifuge	1985	Research & development

Research Reactors

Name	Location	Type	MW	Start Date	Function
Andhra University	Vishakhapatnam	Low power	.1	Unknown	Planned; Research
Apsara	Trombay	LWR	1	1956	
Purnima 1	Trombay	Crit. Assembly	-	1989	Decommissioned
Purnima 2	Trombay	LWR	-	1984	Decommissioned
Purnima 3	Trombay	LWR	-	1994	Uses U-233
Zerlina	Trombay	PHWR	100 W	1961	Decommissioned
Compact High Temperature Reactor	Trombay	Small reactor	.1	(2010)	Will use U-Th and U-233 to produce hydrogen
Kamini	Kalpakkam	Test reactor	.03	1996	Uses U-233

Other Facilities

Name	Location	Type	Function
Away From Reactor Facility	Tarapur	Wet spent storage	Store safeguarded fuel at RAPS and TAPS
Nuclear Fuel Complex (NFC)	Hyderabad	Zirconium tubing	Partially safeguarded
Uranium Corp of India Ltd. Uranium Recovery Plants	Many locations	Mining, milling	Receives tailings Recovers uranium for Jaduguda and NFC

Heavy Water Production Plants (Not subject to traditional safeguards in NPT states)

Name/Location	Start Date
Baroda	1980
Hazira	1991
Kota	1981
Manuguru	1991
Nangal	1962
Talcher	1985
Thal-Vaishet	1991
Trombay	Unknown
Tuticorin	1978

[3] RMP, Mysore is also included in Groups 2 and 3.

Group 2. Fissile Material Production for Nuclear Weapons

Plutonium Production[4]

Name	Location	Type	Start Date	Function
Cirus[5]	Trombay	40MW HWR research reactor	1960	Supplied by Canada Produces weapon-grade plutonium
Dhruva	Trombay	100MW HWR research reactor	1985	Produces weapon-grade plutonium
Fuel Fabrication Plant	Trombay	135 tHM/yr	1982	Makes natural uranium metal fuel for Cirus and Dhruva
Plutonium Separation Plant	Trombay	30-50 tHM/yr	1964	Processes fuel from Cirus and Dhruva primarily for nuclear weapons
Plutonium Weapon Component Facility	Trombay	Unknown scale	Unknown	Plutonium components for nuclear weapons

HEU Production

Name	Location	Type	Function
Rare Materials Project (RMP)	Mysore	Gas centrifuge plant	May enrich uranium for nuclear weapons
Uranium Weapon Component Facility	Unknown	Unknown scale	Uranium components for nuclear weapons

Storage & Testing

Name	Location	Type
Nuclear Weapon Storage Site	Unknown	Vaults, bunkers
Pokaran Nuclear Test Site	Rajasthan Desert	Test site

Group 3. Naval Reactor Program

Name	Location	Type	Primary Function
Advanced Technology Reactor Program	Kalpakkam	Prototype naval reactor; PWR	Uses fuel from RMP
Rare Materials Project (RMP)	Mysore	Gas centrifuge plant	Produce enriched uranium for naval reactor
Nuclear Submarine Reactors	Unknown	Unknown	Provide power to submarines

[4] See David Albright, "India's Military Plutonium Inventory, End 2004," ISIS website, May 7, 2005.
[5] This reactor was supplied by Canada in the 1950s and is pledged to peaceful use.