

# THE INDIAN-RUSSIAN LIGHT WATER REACTOR DEAL

by R. Adam Moody

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The Indian-Russian deal to construct a light water reactor (LWR) has been in the making for almost two decades. It now finally appears close to consummation. Two Russian-supplied 1,000 megawatt (MW) nuclear power stations are scheduled to be constructed at Koodankulam in Tamil Nadu province, a subtropical region on India's southern coast.

This transaction highlights one of the principal challenges facing the international nonproliferation regime vis-à-vis the dissolution of the Soviet Union. Burdened by an economy with a large hard currency debt, Russia has expanded its military-industrial exports in general and its exports of nuclear-related technologies from the Russian Ministry of Atomic Energy (Minatom) in particular as a means of generating much-needed hard currency.

According to Minister of Atomic Energy Viktor Mikhailov, Minatom plans to increase its exports to \$3.5 billion per year by 2000 (up from about \$2 billion in 1995) by completing power plants in China, Iran, and India, and selling uranium to the United States. Minatom is also either considering or already pursuing nuclear power plant exports to Brazil, Indonesia, North Korea, South Korea, and Cuba.<sup>1</sup>

Some of these markets are relatively new to Russian military-industrial exports. But others, such as the Indian market, are traditional importers of Russian materials, technology, and services. These "friendly" markets are especially attractive to Russia in a period of economic crisis, and incentives to tap into them are very strong at

personal, organizational, and national levels. In addition, implementation of export controls in Russia remains tenuous. For example, senior decisionmakers within Minatom enjoy wide political support for their ability to generate revenues through exports. They are therefore less likely to be challenged, or if challenged, overruled, by governmental export control bodies on the basis that a particular transaction is suspect.<sup>2</sup>

Although the Russian government in all likelihood would not disregard international nonproliferation norms outright, domestic economic actors are more likely to rationalize or justify a questionable transaction in an environment characterized by economic crisis and social insecurity. Ongoing Minatom payment arrears to nuclear industry employees provide but one example of the kinds of incentives influencing current Russian behavior.

This overview places the Indian-Russian LWR transaction in the context of these nonproliferation concerns, India's nuclear power generation program, and the country's long-term objective of achieving nuclear self-sufficiency. The following chronology sets out the important events in the transaction.

## NONPROLIFERATION CONCERNS

The United States objects to the LWR deal on the basis that Russia is violating the (revised) 1992 Nuclear Suppliers Group's (NSG) "Guidelines for Transfers of Nuclear-Related Dual-Use Equipment, Material and Related Technology." These guidelines, to which Russia

is a party, specify that as a condition of importing dual-use nuclear materials, a non-nuclear weapon state (NNWS) must agree to full-scope safeguards, i.e., International Atomic Energy Agency (IAEA) safeguards on all source and fissionable material “in its *current* and *future* peaceful activities.” But these guidelines also specify that this comprehensive safeguards policy “does not apply to agreements or contracts drawn up on or prior to April 3, 1992.”<sup>3</sup>

Moreover, the “Principles and Objectives” agreed at the 1995 Treaty on the Non-Proliferation of Nuclear Weapons (NPT) Review and Extension Conference, specify only that “*new* supply arrangements” to NNWSs require as a precondition “acceptance of IAEA full-scope safeguards and internationally legally binding commitments not to acquire nuclear weapons or other nuclear explosive devices.”<sup>4</sup>

Moscow claims exemption from these full-scope safeguards clauses, pointing to the fact that Soviet General Secretary Mikhail Gorbachev and Indian Prime Minister Rajiv Gandhi signed the deal in late 1988, predating the 1992 NSG guidelines. Russia’s position is that its deal with India is a *past* or an *old* activity, and therefore is not covered by the language of the 1992 NSG guidelines.

Minatom has conceded, however, that the technology it is transferring to India is newer than what was originally promised under the 1988 agreement. This fact calls into question to what extent the agreement that was drawn up in 1988 would be exempt from NSG guidelines. In addition, not long after the political break-up of the Soviet Union in December 1991, India apparently abandoned the deal.<sup>5</sup>

If Moscow were to change its position and admit that the activity is *new*, it would be hard pressed to justify the transaction on the basis that India, a non-signatory to the NPT, does not have, and does not plan to acquire, “nuclear weapons or other nuclear explosive devices.” In any case, India would balk at the precondition that all its nuclear-related facilities be placed under IAEA full-scope safeguards.

The comprehensive safeguards provision inherent in the 1992 NSG guidelines, and the mandate that members adhere to this standard, was a major breakthrough for the NSG. Disagreement over the extent to which recipient countries should apply safeguards predated the original 1978 guidelines. By 1990, fewer than 10 countries had unilaterally adopted and implemented a full-scope

safeguards policy regarding dual-use nuclear exports.<sup>6</sup>

Although the application of full-scope safeguards became the accepted norm for all NSG members following the April 1992 meeting, the guidelines were also intended to place the duty to exercise good judgment squarely on the shoulders of the nuclear suppliers themselves. The guidelines:

...call for caution in granting licenses, and specify a whole series of criteria which could trigger this. These criteria include whether the state is a party to the NPT..., or whether it has entered into equivalent non-proliferation commitments and accepted full-scope safeguards. In this way, the guidelines come close to making full-scope safeguards a condition of supply but still grant the exporter a degree of flexibility.<sup>7</sup>

Russia’s apparent attempt to apply a “degree of flexibility” to the LWR deal may overstate the intent of NSG guidelines. Under paragraph 4(d) of the guidelines, application of facility-specific (as compared to full-scope) safeguards is permissible for “agreements or contracts drawn up on or prior to April 3, 1992.” But the unqualified expectation is that the supplier “undertakes to strive for the earliest possible implementation of the policy referred to in paragraph 4(a) [i.e., full-scope safeguards] under such agreements.”

The accepted norm, at least among Western members of the NSG, is the application of full-scope safeguards as a precondition of supplying dual-use nuclear materials and technologies. If the LWR deal is not in conflict with the language of NSG guidelines as Moscow asserts, it certainly seems to push the limits of propriety where the spirit and intent of NSG guidelines are concerned.

Although Moscow has given guarantees, and New Delhi has given its consent, that the reactors at Koodankulam will be placed under IAEA facility-specific safeguards, the precedent Russia is setting appears to be one of subordinating nonproliferation imperatives to profit-making (or debt elimination). Recent legislation (Government Resolution No. 574, May 8, 1996) supports this view by grandfathering all nuclear contracts signed before 1992, explicitly exempting them from the revised NSG guidelines. In the words of Minatom Minister Viktor Mikhailov: “We must expand our exports.... We will use the export earnings to repay our debts.”<sup>8</sup>

## INDIA'S NUCLEAR POWER PROGRAM

New Delhi's ongoing interest in the LWRs seems to be driven primarily by India's energy crisis and its limited nuclear power production capability. To maximize the use of India's limited uranium reserves, the Indian Department of Atomic Energy (DAE) has followed a long-term, three-stage program, formally presented by Dr. Homi Bhabha in New Delhi at the 1954 Atomic Energy Conference.<sup>9</sup>

The first stage of the plan envisaged the use of natural uranium in pressurized heavy water reactors (PHWRs), which yield about twice as much plutonium in spent fuel as conventional LWRs. Eight of India's 10 currently operating commercial reactors are PHWRs of the Canadian deuterium-uranium (CANDU) design. Although it has an extensive heavy water production industry, India has imported heavy water from the Soviet Union, Canada (prior to 1974), and other countries to compensate for production shortfalls and persistent problems with heavy water leakage from PHWRs.

In the second stage, so-called "non-weapons-grade" plutonium extracted from spent fuel accumulated in the first stage would be used in fast breeder reactors (FBRs), which produce additional plutonium as well as uranium-233 from thorium, a natural resource of which India has the largest reserves in the world. It follows, therefore, that India has developed an industrial capability to reprocess spent fuel for plutonium extraction, but has built only a very limited infrastructure to enrich uranium.

The third stage envisaged the use of the uranium-233 in FBRs, thorium breeder reactors, and advanced thermal reactors. The fact that India has only one 40 MW experimental FBR, at Kalpakkam in the Tamil Nadu province, suggests that it is still well within the early stages of its three-part nuclear power program.

In addition to this three-stage program, India has been pursuing the highly ambitious goal of achieving 10,000 MW of installed nuclear power-generating capacity by the turn of the century (this amounts to 10 percent of India's total power-generating capacity).<sup>10</sup> However, in 1996, this objective was reduced to 3,200 MW by 2004. At the close of 1996, India's eight commercial PHWRs and two LWRs (boiling water type) were generating 1,695 MW of power.<sup>11</sup> If one includes the six PHWRs currently under construction, four of which should achieve initial criticality in 1998, India will have achieved just over one-third of its original goal of 10,000 MW by the turn of

the century.

Although its conception and implementation began nearly 45 years ago, India's three-stage plan for nuclear self-sufficiency is still far from completion. High-level Indian sources attribute the shortfall to insufficient funds.

Indeed, disagreement over how the Indian-Russian deal would be financed has stalled negotiations. The dearth of hard currency in Russia's struggling economy has motivated Moscow to demand that 80 percent of the low-interest loan it has offered New Delhi be repaid in hard currency, with the remainder repaid through Indian exports. However, India has balked at the proposal, countering with a 50-50 arrangement in February 1997. Additionally, New Delhi has not accepted guarantees from Russian commercial banks, which would be necessary under the terms of the loan. Although the installation agreement signed in November 1988 stipulated that the Soviet Union would supply the reactors on a "turnkey" basis, it now appears that India will build the power plants using Russian technology and equipment.

From the perspective of some Indian government officials, completion of the two LWRs at Koodankulam is a vital component of the DAE's objective of increasing the country's power generating capacity, which continues to fall short of consumer and industrial needs. Indian dissent (especially prior to 1987) has been based in part on the argument that LWRs, which use low-enriched uranium (LEU), do not fit into India's three-stage nuclear power plan. Two administrative shake-ups in the Indian Atomic Energy Commission (1987 and 1990) played important roles in first advancing, then slowing, the reactor deal.

But the fact that India does not have the capability to produce nuclear reactors with generating capacities larger than 500 MW, two of which are currently under construction at Tarapur, has tipped the scales in favor of larger foreign reactors, which are more cost-efficient. (Per unit cost of electricity is inversely proportional to the unit size of the reactor.)

India's institutional memory of foreign supplier arrangements gone awry has added to the tensions arising from this deal. In 1980, six years after India's detonation of a nuclear explosive device at Pokhran, the United States ceased supplies of LEU to the reactors it had provided India in 1971 under a 20-year agreement. Fortuitously for India, France filled the gap by continuing to supply LEU after several years of off-again-on-again deliver-

ies. From India's perspective, a contract had been broken, notwithstanding pronounced international suspicion that the 1974 detonation at Pokhran was a weapons test, rather than a "peaceful nuclear explosion" as India had claimed.

Thus, as far as India has been concerned, its contract with the (former) Soviet Union to supply LEU should involve more than merely written assurances that fuel supplies will continue uninterrupted. Although India announced in late 1986 that it had acquired limited uranium enrichment capability, the Soviet Union offered to supply India with enrichment technology in 1987 in an effort to allay India's concerns over fuel supplies. While LEU deliveries to India now appear certain, reports concerning the final disposition and ownership of spent fuel have been conflicting.<sup>12</sup>

## CONCLUSION

The possibility that additional spent reactor fuel will be available to India at all highlights one of the United States' primary objections to the deal. India's proven reprocessing capability makes the deal suspect: although India and Russia say that the reactors will not contribute to the Indian nuclear weapons program, the United States points to the spent fuel from which plutonium can be extracted for weapons purposes.

Not that India needs the plutonium. Its unsafeguarded PHWRs provide more than sufficient quantities of spent fuel, with a higher plutonium content than what is produced in LWRs, to keep its nuclear weapons program supplied. But U.S. objections strike at the heart and underlying premise of the 1992 NSG guidelines: without the application of comprehensive IAEA safeguards, a country intent on pursuing (or continuing to pursue) a nuclear weapons option will be far less constrained in its ability to divert and/or acquire dual-use nuclear material and technology for non-peaceful purposes.

Russia's behavior in implementing the deal with India, in the context of its similar efforts with Iran, will both test the nonproliferation regime and provide a clearer picture of Moscow's own willingness to ensure that no materials are diverted from their purported peaceful uses.

## CHRONOLOGY

**12/79\***

During a visit of Indian Prime Minister Morarji Desai to Moscow, Soviet Prime Minister Aleksei Kosygin makes an offer to supply India with a 1,000 MW nuclear power plant.<sup>13</sup>

**1981**

The USSR reiterates its offer to set up a 1,000 MW nuclear power plant in India.<sup>14</sup>

**9/82**

During a visit by Indian Prime Minister Indira Gandhi to Moscow, the Soviet government of Leonid Brezhnev offers to cooperate with India on a nuclear energy utilization program. The Soviet Union reiterates its offer of a 1,000 MW nuclear power plant.<sup>15</sup>

**Late 1/83**

Chairman of India's Atomic Energy Commission (AEC) Homi N. Sethna visits Moscow to continue talks on the Soviet supply of a 1,000 MW nuclear power plant.<sup>16</sup>

**Late 1983**

The USSR accepts an Indian suggestion to negotiate for two 440 MW units, rather than a 1,000 MW LWR, which the Soviet Union originally offered.<sup>17</sup>

**12/83**

Chairman of India's AEC Raja Ramanna leads a five-man delegation to Moscow to meet with officials from the Soviet economic, energy, and scientific communities to discuss the offer to supply India with a nuclear power station.<sup>18</sup>

**1984**

Indian and Soviet teams make three reciprocal visits to discuss the Soviet Union's offer to supply India with a nuclear power plant.<sup>19</sup>

**1985**

During a visit to Moscow, Indian Prime Minister Rajiv Gandhi renews discussions of the possible supply of a nuclear power plant to India.<sup>20</sup>

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*Note: An "\*" indicates that the event was reported on that date. This chronology relies principally on materials drawn from the nuclear database of the Monitoring Proliferation Threats Project.*

**7/4/85\***

The issue of safeguards appears to be the stumbling block to the consummation of the USSR offer to supply India with two 440 MW or one 1,000 MW nuclear reactor and power station.<sup>21</sup>

**8/23/86\***

India's DAE denies reports that it has turned down the Soviet offer to supply two 440 MW reactors to India.<sup>22</sup>

**10/26/86\***

The USSR presses India to accept its nuclear power plant offer so it can announce the deal as a notable example of increased Indian-Soviet economic cooperation during Mikhail Gorbachev's visit in November 1986.<sup>23</sup>

**11/86**

Chairman of India's AEC Raja Ramanna announces creation of the Nuclear Power Corporation (NPC), a financial organization that will raise funds from capital markets for the construction of 500 MW heavy water, natural uranium reactors.<sup>24</sup>

**11/4/86**

AEC Chairman Raja Ramanna announces that India has acquired the capability to enrich uranium, and that the Bhabha Atomic Research Centre (BARC) is already enriching uranium on a pilot scale.<sup>25</sup>

**11/27/86\***

The USSR offers to provide India with a 2 billion ruble credit (loan) against its purchase of a nuclear power plant and hydro-electric project. The offer renews discussions of a nuclear power plant purchase from the USSR. The long-term, low interest rate loan would be repayable in rupees.<sup>26</sup>

**1/30/87\***

Indian Prime Minister Rajiv Gandhi's government bypasses India's DAE and appoints an expert committee, led by Scientific Advisor to the Prime Minister M.G.K. Menon, to examine (in the context of expanding Indian power generation) the Soviet offer to supply a nuclear power plant on easy credit terms. The "Menon Committee" concludes that India should not import items that would require it to sign the NPT and that the requisite safeguards should not hinder the country's nuclear power generation program.<sup>27</sup>

**2/87**

Indian Nuclear Power Board Chairman Malur Srinivasan replaces Raja Ramanna as chairman of India's AEC.

Director of BARC P.K. Iyengar, who favors indigenous development of India's nuclear power sector, resigns over the appointment of Srinivasan, who favors foreign imports.<sup>28</sup>

**5/7/87\***

Indian Minister of State for Science and Technology K.R. Narayanan says India has a high opinion of Soviet nuclear technology and that it would carefully consider foreign offers to supply a nuclear power plant with safeguards.<sup>29</sup>

**6/87**

India makes a gesture to accept the Soviet offer if the requirement for safeguards is dropped and a guarantee of an uninterrupted fuel supply is added.<sup>30</sup>

**6/87\***

India is reported to be constructing a gas centrifuge plant near Karnataka.<sup>31</sup>

**7/87**

Officials from the USSR and India hold another round of talks to discuss the purchase of two 440 MW reactors from the USSR. Indian officials want the reactors sold with fuel supplies guaranteed and without comprehensive safeguards, but reports suggest that the USSR is unlikely to accede to such conditions. Financial arrangements include a low interest (2.5 percent) 20-year loan with an initial three-year payment waiver.<sup>32</sup>

**7/16/87\***

Chairman of India's AEC Malur Srinivasan says that foreign reactors will not be imported at the expense of India's traditional nuclear policy of self-reliance, its stance on the NPT, and its determination not to accept full-scope safeguards. Srinivasan justifies the use of foreign reactors by citing India's need for a rapid increase in the country's capacity to generate power.<sup>33</sup>

**8/28/87\***

India's parliament approves a nuclear energy bill that enables the government to designate the NPC or a government-owned company to design, construct, and operate nuclear power plants. According to Minister of State for Science and Technology K.R. Narayanan, such an organization is essential if India is to achieve its objective of generating 10,000 MW of nuclear power by the year 2000.<sup>34</sup>

**9/87\***

The USSR and India are reported to be close to reaching agreement on the export of two 440 MW reactors to

India. Ongoing negotiations include the following: a less than full-scope safeguards agreement covering only the plant and the materials supplied under the agreement; an uninterrupted supply of fuel; the return of irradiated fuel to the USSR for reprocessing and waste disposal; and the design and financing of the plant.<sup>35</sup>

**10/28/87\***

Renewed discussions between India and the USSR result in a Soviet offer to supply a 2 billion ruble credit with the condition that safeguards be worked out with the IAEA.<sup>36</sup>

**11/87**

Soviet Prime Minister Nikolai Ryzhkov proposes selling India a uranium enrichment plant as a means of allaying India's misgivings about the possibility that the USSR would stop promised enriched uranium fuel supplies for the Soviet-supplied reactors.<sup>37</sup>

**2/18/88\***

The 440 MW reactors the USSR is offering India are reportedly modified versions that include containment structures.<sup>38</sup>

**4/21/88\***

Chairman of India's AEC Malur Srinivasan visits Moscow to continue negotiations over the Soviet supply of a two-unit nuclear power station to India. Following two rounds of negotiations, Soviet officials waive a number of safeguard requirements. Srinivasan expresses optimism over the negotiations.<sup>39</sup>

**4/28/88\***

Secretary of India's AEC K. V. Mahadeva Rao says that the financing terms offered by the Soviet Union are almost irresistible. But India's Atomic Energy Regulatory Board continues to have misgivings about the safety of Soviet reactors.<sup>40</sup>

**7/88\***

Indian Minister for Defence Production Shivraj Patil tells parliament that the government is on the verge of making a decision to purchase two 1,000 MW reactors from the USSR. Soviet General Secretary Gorbachev is expected to sign the agreement with Indian Prime Minister Gandhi during his visit to India in November 1988.<sup>41</sup>

**9/88**

India obtains consent from the IAEA Board of Governors for the application of safeguards pursuant to the

Soviet supply of two 1,000 MW LWRs to India. The supply-related safeguards agreement contains a "no weapons use" stipulation, provisions for the application of safeguards only to the reactors and Soviet-supplied nuclear fuel, and a provision covering the return of spent fuel to the Soviet Union. Outgoing IAEA Board Chairman Reinhard Loosch says that the Indian-Soviet reactor agreement is "superficially unusual" because of a clause providing for safeguards on spent fuel from the reactors to terminate once the fuel reaches the Soviet border.<sup>42</sup>

**10/18/88\***

In anticipation of the signing of the Indian-Soviet LWR deal by Indian Prime Minister Gandhi and Soviet General Secretary Gorbachev in November 1988, the Indian government sanctions advance procurement of key components for the Soviet-supplied nuclear power plant. Chairman of India's AEC Malur Srinivasan says that health and safety aspects of the plant must be examined by experts from India's DAE before approval for a site can be given.<sup>43</sup>

**11/20/88**

In India, Soviet General Secretary Gorbachev and Indian Prime Minister Gandhi sign an agreement that will provide India with a multi-billion dollar credit toward the purchase of two 1,000 MW LWRs from the Soviet Union. The Soviet vendor Atomenergoexport will supply the reactors, which will be constructed on a turnkey basis. A team of Indian experts will be trained in the USSR to operate the Soviet-built nuclear power plant. Under the agreement, the USSR will supply enriched uranium fuel to India for the operational life of the nuclear power plant. Construction will begin in 1992.<sup>44</sup>

**11/26/88**

At a news conference given by Governor of Madras P.C. Alexander and experts from India's DAE, Alexander expresses his concern for the safety of the area surrounding Koodankulam, where the new nuclear power plant will be built.<sup>45</sup>

**12/9/88\***

India announces its decision to return spent fuel from the Soviet-supplied reactors to the USSR for reprocessing and waste disposal for reasons related to safety, fuel storage, and safeguards.<sup>46</sup>

**2/6/89\***

V. Gulko, president of the Soviet nuclear export firm Atomenergoexport, says the Soviet-built 1,000 MW nuclear reactor, the type which will be supplied to India, has safety features that make it one of the most reliable of its kind in the world. The Soviet development of the 1,000 MW nuclear reactor included special emphasis on safety.<sup>47</sup>

**2/16/89**

Finnish contracting firm Imatran Voima Oy (IVO) signs a contract with India to participate in the construction of the two Soviet-supplied 1,000 MW LWRs in Koodankulam. IVO will assist India's NPC in establishing technical specifications for the plant.<sup>48</sup>

**2/29/89\***

At a seminar organized by the Department of Polymer and Environmental Sciences of Madras University, the DAE, and University Students Advisory Bureau, V.S.G. Rao, project director of the Koodankulam Project for India's NPC, says that the quality of life in the surrounding community will not be affected by construction of the new nuclear power plant. Rao says the USSR will use Indian contractors and laborers even though the reactors will be supplied on a turnkey basis.<sup>49</sup>

**10/12/89\***

The signing of a contract for the USSR to construct two 1,000 MW LWRs for India at Koodankulam is delayed over questions of financing and for other reasons. Although the two parties signed an intergovernmental agreement (November 20, 1988) for the preparation of a project report (i.e., a detailed design study), a contract for preparation of the report must still be signed. Chairman of India's AEC Malur Srinivasan said that the signing of the contract for turnkey execution of the project would come only after the design study is completed.<sup>50</sup>

**10/14/89**

An Indian-Soviet working group of the Koodankulam project advances completion of the two 1,000 MW Soviet-built reactors by one year. The new schedule envisages completion of the first station by 1998, and the second by 1999. The working group decides that all equipment and subsystems for both reactors will originate from the USSR.<sup>51</sup>

**Early 11/89**

Representatives from India and the USSR meet to discuss financing terms for the Koodankulam project. Con-

struction of the first unit is expected to begin in 1990.<sup>52</sup>

**12/89\***

In response to pressure from anti-nuclear demonstrators, the Indian government agrees to set up a panel of scientists and ecologists to evaluate environmental and social aspects of the Koodankulam nuclear power plant project.<sup>53</sup>

**2/1/90**

Director of BARC P.K. Iyengar replaces Malur Srinivasan as chairman of India's AEC. Unlike Srinivasan, who pushed for importation of foreign technology, Iyengar favors indigenous development of nuclear technology.<sup>54</sup>

**3/90\***

Indian-Soviet negotiations on the details of the Koodankulam project continue. The issues in question include work schedules, training of Indian operators, and storage of spent fuel.<sup>55</sup>

**6/90\***

Disagreement over the price of the 1,000 MW reactors the USSR will supply to India slows negotiations.<sup>56</sup>

**9/4/90**

Chairman of India's AEC P.K. Iyengar says that most of the land acquisition for the two Soviet-supplied 1,000 MW reactors has been completed in Koodankulam. Completion of the project report (see October 1989) is anticipated for October 1990.<sup>57</sup>

**11/8/90\***

As part of ongoing negotiations, Iyengar says that the USSR has agreed to reduce installation costs of the two VVER-1,000 nuclear reactors.<sup>58</sup>

**4/4/91\***

Iyengar says that India and the USSR have agreed on "specifications, some details of the schedule, and on the maximum cost" of the two 1,000 MW reactors. Construction is expected to begin in 1992.<sup>59</sup>

**9/91**

Iyengar says that a final agreement on design and financing of the Soviet-supplied reactors has not been reached, even though an initial agreement covering installation was signed in November 1988. Iyengar says that the reactors will contain a Western-style control system, and that India has budgeted \$250 million for Western "equipment and expertise." Most electrical systems and software will be developed in India.<sup>60</sup>

**1/92\***

“Preliminary work” on the proposed Soviet-supplied nuclear power plant comes to a halt because of political instability in the former Soviet Union and Indian environmental concerns.<sup>61</sup>

**1/23/92\***

India has reportedly given up hope of receiving aid from Russia. Instead, it now plans to build two indigenously designed nuclear reactors.<sup>62</sup>

**3/92**

Russian President Boris Yeltsin signs a decree requiring foreign acceptance of full-scope safeguards as a condition for nuclear material and equipment sales.<sup>63</sup>

**4/3/92**

Russia signs the NSG “Guidelines for Transfers of Nuclear-Related Dual-Use Equipment, Material and Related Technology” and the “List of Nuclear-Related Dual-Use Equipment and Materials and Related Technology.”<sup>64</sup>

**4/23/92\***

Chairman of India’s AEC P.K. Iyengar reports that Russia may not allow the shipment of a VVER-type nuclear power plant to India without payment in U.S. dollars.<sup>65</sup>

**10/92**

Iyengar says that the deal between India and the former Soviet Union to build two VVER-1,000 reactors has completely collapsed because the Russian Federation does not have sufficient capital for the project. However, the deal has not been formally cancelled. Iyengar laments that one of the main attractions of the deal was its deferred payment schedule. The Indian government simultaneously signals its intent to “transfer nuclear plant construction to the private sector.”<sup>66</sup>

**1/93**

Russia and India sign a “Treaty of Friendship and Cooperation.” Under Article IV, the two parties agree that the process of nuclear and conventional disarmament, including the reduction and ultimate elimination of weapons of mass destruction, should be accelerated.<sup>67</sup>

**Late 1993**

Russian President Yeltsin visits India to discuss the possibility of reviving the original Indian-Soviet agreement to construct a nuclear power plant at Koodankulam.<sup>68</sup>

**3/29/94**

Managing Director of India’s NPC S.K. Chatterjee says that India is again considering the plan to construct a nuclear power plant consisting of two Russian-supplied 1,000 MW units at Koodankulam.<sup>69</sup>

**6/94**

A “final” round of discussions between Indian and Russian representatives is scheduled to consider the possibility of Russian-supplied reactors for Koodankulam.<sup>70</sup>

**Late 1994**

Russian Prime Minister Viktor Chernomyrdin signs a government-to-government economic cooperation agreement during a visit to India.<sup>71</sup>

**1/95**

A *Rossiiskaya gazeta* article quotes Russian Minister of Atomic Energy Viktor Mikhailov as saying that the Indian-Russian reactor deal is worth \$2.6 billion, 15 percent of which will be paid in hard currency and the remainder in four-percent-per-year credits. Mikhailov says the deal is the largest contract signed by Minatom in 1994. Construction of the nuclear power station is expected to take eight years, beginning in 1995. About 1,000 Russian nuclear experts will work on the project. Russia is expected to begin shipping equipment to India in 1996.<sup>72</sup>

**1/12/95\***

Members of the NSG ask the Russian government to clarify unconfirmed reports that Russian Minister of Atomic Energy Viktor Mikhailov signed a contract with India in late 1994 to build two 1,000 MW reactors at Koodankulam. An unofficial report from Moscow said that the deal is valued at nearly \$2 billion, about \$1.7 billion of which will be provided in the form of countertrade. A Russian government official says that the Ministry of Foreign Affairs confirmed the reactor deal, and that it would take place only “on the basis that India comply with full-scope safeguards.”<sup>73</sup>

**2/22/95**

Minatom announces that a detailed contract for the supply of an additional reactor to India will be signed in the near future. Minatom says that NSG concerns about India not being a party to the NPT are baseless because the reactor’s design will not allow the “industrial production of [weapons-grade] plutonium.”<sup>74</sup>

**8/4/95**

Following a meeting with his Indian counterpart, Pranab Mukherjee, Russian Foreign Minister Andrei Kozyrev says that “our cooperation is based on our own regulation and our own laws, and we take into account the interests of the nonproliferation of nuclear weapons and weapons of mass destruction.”<sup>75</sup>

**9/95**

A group of Russian officials visits India to consider re-viving the project to construct two Soviet 1,000 MW reactors at Koodankulam. Existing proposals suggest that Russia will equip the plants with essential components, and India will undertake construction, perhaps providing instrumentation as well.<sup>76</sup>

**10/95**

A Russian delegation visits India and signs a Memorandum of Understanding with India’s NPC concerning Russian-supplied nuclear reactors.<sup>77</sup>

**12/95**

Russian government officials say that until India provides guarantees that it has sufficient funding to complete the nuclear power plant at Koodankulam and receives approval for changes to the sales agreement, Russia will not continue with the project. Although Managing Director of India’s NPC Y.S.R. Prasad says that the final agreement will involve Russia’s provision of a long-term loan, Russia refuses to accept India’s proposed interest rate and partial countertrade proposal. According to Russian officials, India no longer wants a turnkey operation, as was originally agreed. Instead, India wishes to obtain pressurized water reactor technology that would allow it to build its own plant “like China.”<sup>78</sup>

**4/23/96\***

Under pressure from the U.S. administration, Russia reportedly intends to renegotiate the terms of the November 1988 Indian-Soviet agreement. The new terms could include the shipment of all “fissile material produced from the nuclear power reactors” to Russia.<sup>79</sup>

**6/24/96\***

Russian First Deputy Minister of Atomic Energy Lev Ryabev says that Russia will not link Indian-Russian nuclear cooperation with India’s position on the Comprehensive Test Ban Treaty.<sup>80</sup>

**10/28/96**

During a visit by Russian Minister of Foreign Economic

Relations Oleg Davydov and other Russian officials to India to discuss the 1,000 MW reactor deal with Indian officials, Davydov announces at a press conference that the two sides are close to signing an agreement.<sup>81</sup>

**2/11/97\***

During talks with Indian Minister of Foreign Affairs Inder Kumar Gujral, Russian First Deputy Prime Minister Viktor Ilyushin says Russia plans to go ahead with its sale of two 1,000 MW LWRs to India. Russia has offered a \$2.6 billion credit for the purchase of the reactors.<sup>82</sup>

**2/15/97\***

Russian Deputy Foreign Minister Grigoriy Karasin affirms Moscow’s intention to build two 1,000 MW LWRs in India. Karasin says that construction is a “bilateral issue” and that Russia’s participation in the project “does not contradict Russian law, nor does it conflict with Russia’s international obligations.”<sup>83</sup>

**3/25/97**

During talks with Indian Prime Minister H.D. Deve Gowda in Moscow, Russian President Yeltsin agrees “in principle” to the sale of two LWRs to India. Moscow and New Delhi have been unable to agree on how India will repay a low interest loan of \$2.6 billion at four percent over a 12-year period. Moscow and New Delhi have also been at odds over where nuclear waste produced by the reactors will be stored.<sup>84</sup>

**6/23/97\***

According to Russian Minister of Atomic Energy Viktor Mikhailov, disagreement between Russia and India over financing will be resolved “within a month.”<sup>85</sup>

**7/3/97\***

In an effort to attract private investment, the Indian government decides to open nuclear power generation to the private sector. Persistent funding shortfalls are cited as the cause. India is reportedly “extremely uncertain” as to whether the Indian-Russian deal to construct LWRs at Koodankulam will come to fruition.<sup>86</sup>

**8/8/97**

Apparently referring to the United States, newly-appointed Indian Prime Minister Inder Kumar Gujral says: “Some countries are not positive towards India getting nuclear power technology (from Russia) and are coming in our way.” Gujral says India will not be “deterred in following [its] nuclear policy whether there is pressure direct or indirect, from any quarter.”<sup>87</sup>

9/8/97

During a "working visit" to New Delhi, Russian Minister of Atomic Energy Viktor Mikhailov says technical parameters for the Koodankulam project have been "fully agreed upon." Negotiations related to the conditions of repayment of the low-interest loan Moscow has offered New Delhi are "being tackled" and should be resolved within six to eight weeks, making it possible to begin construction of the nuclear power plant this year. Mikhailov says: "The implementation of this project is putting cooperation between [Russia and India] into a qualitatively new orbit."<sup>88</sup>

<sup>1</sup> "Minatom Will Increase Its Exports to 3.5 Billion by 2000," *Segodnya*, January 21, 1997 (<http://www.eastview.com/segodnia>).

<sup>2</sup> For an insightful look at some of the challenges Minatom poses to the international nuclear nonproliferation regime and how these challenges might be addressed, see John C. Baker, *Non-Proliferation Incentives for Russia and Ukraine*, Adelphi Paper 309 (London: Oxford University Press for International Institute for Strategic Studies, 1997), pp. 55-78.

<sup>3</sup> "Communication of 29 April 1996 Received from the Permanent Mission of the Russian Federation to the International Atomic Energy Agency Regarding Guidelines for the Export of Nuclear Material, Equipment and Technology," INFCIRC/254/Rev. 2/ Part 1/Add. 1, June 7, 1996 (emphasis added).

<sup>4</sup> "Principles and Objectives for Nuclear Non-Proliferation and Disarmament," NPT/CONF. 95/32/DEC. 2, May 11, 1995 (emphasis added).

<sup>5</sup> Although the deal was never formally cancelled, India acted as if it had been. By mid-1992, India was already considering plans to construct either a series of 220 MW PHWRs, similar to those in operation in India at the time, or a 500 MW PHWR, a newer design whose principal advocate was the Indian Atomic Energy Commission. See "Confusion at Koodankulam," *Nuclear Engineering International* (August 1992), p. 7.

<sup>6</sup> The countries were Australia (1977), Canada (1976), Czechoslovakia (1978), Germany (1990), Japan (1989), Poland (1978), Sweden (1977), and the United States (1978). See Tadeusz Strulak, "The Nuclear Suppliers Group," *The Nonproliferation Review* 1 (Fall 1993), pp. 2-10.

<sup>7</sup> Harald Muller and Lewis A. Dunn, "Nuclear Export Controls and Supply Side Restraints," Programme for Promoting Nuclear Non-Proliferation (PPNN) Study Four, October 1993, p. 7.

<sup>8</sup> Michael R. Gordon, "Russia Selling Atomic Plants to India; U.S. Protests Deal," *The New York Times*, February 6, 1997, p. A3. On the Russian legislation, see Elina Kirichenko and William C. Potter, "Nuclear Export Controls in Russia: The Players and the Process," in Gary K. Bertsch and William C. Potter, eds., *The Development of Nonproliferation Export Controls in the Former Soviet Union* (forthcoming, 1998).

<sup>9</sup> Dharendra Sharma, *India's Nuclear Estate* (New Delhi: Lancers Publishers, 1983), pp. 19-22.

<sup>10</sup> "Datafile: India," *Nuclear Engineering International* (February 1995), p. 21.

<sup>11</sup> "1996 Performance Records Set around the World," *Nuclear News* (March 1997), pp. 37-53.

<sup>12</sup> Following the November 1988 signing of the Indian-Soviet intergovernmental agreement to construct LWRs at Koodankulam, India announced that it would return spent fuel to Russia. However, by early 1997, reports coming out of India were conflicting, some saying that

the spent fuel would be stored on-site, and others saying that it would be returned to Russia. See *Patriot*, December 9, 1988, p. 5; in JPRS-TND-89-004 (28 February 1989), pp. 10, 11; K.K. Katyal, "PM's Russian Tour to Boost Ties," *The Hindu*, March 20, 1997, p. 12 (<http://www.webpage.com/hindu/today>); and R. Parthasarathy, "Koodankulam: Experts Express Concern," *The Hindu*, April 7, 1997, p. 4 (<http://www.webpage.com/hindu/today>).

<sup>13</sup> G.K. Reddy, "AEC Chairman, Gandhi Discuss Soviet N-Plant Offer," *The Hindu*, December 24, 1983, p. 1; in *Worldwide Report*, February 28, 1984, p. 25.

<sup>14</sup> "Technical Aspects Involved in a Soviet Offer to India . . .," *Nucleonics Week*, December 16, 1982, p. 5.

<sup>15</sup> "N-Power Expert Committee Reports, Recommends," p. 7; "Soviet Team to Discuss Nuclear Power Plant Offer," *Patriot*, January 13, 1984, p. 5; in *Worldwide Report*, March 15, 1984, p. 34; Vinod Taksal, "India, Soviet Union to Cooperate in Nuclear Energy," *Patriot*, October 14, 1984, p. 1; in *Worldwide Report*, December 4, 1984, p. 30; "An Indian Delegation Has Been in Moscow Discussing Technical Details . . .," *Nucleonics Week*, March 3, 1983, p. 8.

<sup>16</sup> "Sethna Visits Moscow for Talks," *Nuclear Engineering International* (February 1983), p. 12.

<sup>17</sup> Brahma Chellaney, "Writer Argues Against Import of Nuclear Technology," *The Statesman*, 7/6/87, pp. 1, 9; in *Worldwide Report*, August 18, 1987, pp. 73, 74.

<sup>18</sup> "AEC Chairman Studies Soviet Nuclear Power Offer," *Patriot*, December 19, 1983, p. 3; in *Worldwide Report*, January 9, 1984, p. 61; Reddy, "AEC Chairman, Gandhi Discuss Soviet N-Plant Offer," p. 1; "India Ponders on Soviet PWRs," *Nuclear Engineering International* (March 1984), p. 14.

<sup>19</sup> S. Kuma, "Indo-Soviet Talks on Nuclear Cooperation Examined," *The Times of India*, July 15, 1987, p. 15; in *Worldwide Report*, September 16, 1987, pp. 32, 33.

<sup>20</sup> "India; Power Plants Offer Under Discussion," *Nucleonics Week*, November 27, 1986, p. 13.

<sup>21</sup> "Whatever the Nature of Franco-Indian Nuclear Relations," *Nucleonics Week*, July 4, 1985, p. 14E.

<sup>22</sup> "DAE Clarification," *Patriot*, August 23, 1996, p. 3; in *Worldwide Report*, October 26, 1986, p. 28.

<sup>23</sup> G.K. Reddy, "Moscow Presses India to Accept Nuclear Power Plant," *The Hindu*, October 26, 1986, p. 1; in *Worldwide Report*, January 2, 1987, p. 45.

<sup>24</sup> "Financing Body Planned for 500 MWe Units," *Nuclear News* (January 1987), pp. 67, 68.

<sup>25</sup> "Papers Report Nuclear Scientists' Press Conference," *The Telegraph*, November 5, 1986, p. 1; in *Worldwide Report*, January 2, 1987, p. 53.

<sup>26</sup> "India; Power Plants Offer Under Discussion," p. 13; Chellaney, "Writer Argues Against Import of Nuclear Technology," pp. 1, 9.

<sup>27</sup> Chellaney, "Writer Argues Against Import of Nuclear Technology," pp. 1, 9; "India May Buy Soviet N-Plants," *The Times of India*, January 30, 1987, p. 1; "India: Gandhi Said Considering Soviet Reactor Offer," *Nucleonics Week*, January 29, 1987, p. 13.

<sup>28</sup> "New AEC Head Could Change Direction of Indian Nuclear Program," *Nucleonics Week*, February 12, 1987, pp. 1, 2.

<sup>29</sup> AFP, May 7, 1987; in *Worldwide Report*, June 2, 1987, p. 32.

<sup>30</sup> John Hallam, "India's Rebel Nuclear Industry," *Tribune*, October 28, 1987, p. 10; in JPRS-TND-88-002 (24 February 1988), pp. 24, 25.

<sup>31</sup> "India: Undecided on Imports," *Nuclear Engineering International* (June 1987), p. 31.

<sup>32</sup> Kuma, "Indo-Soviet Talks on Nuclear Cooperation Examined," p. 15; "India: Talks with Moscow on Power Plant to Continue," *Nucleonics Week*, July 30, 1987, p. 15.

<sup>33</sup> V.S. Manium, "Paper Interviews Atomic Energy Commission Head," *The Statesman*, July 16, 1987, p. 4; in *Worldwide Report*, September 16, 1987, pp. 38, 39.

<sup>34</sup> "Parliament Approves Bill on Nuclear Power Agency," *Patriot*, August 28, 1987, p. 5; in *Worldwide Report*, November 4, 1987, p. 32.

<sup>35</sup> "Agreement Near on Soviet Export to India," *Nuclear Engineering*

*International* (September 1988), p. 3.

<sup>36</sup> Hallam, "India's Rebel Nuclear Industry," p. 10.

<sup>37</sup> Sheila Tefft, "Srinivasan Sees Progress in Talks on Soviet Reactors for India," *Nucleonics Week*, April 21, 1988, p. 10.

<sup>38</sup> Karoly Ravasz, "Paks Performs Above Plans, Makes 37% of Hungary's 1987 Electricity," *Nucleonics Week*, February 18, 1988, pp. 4, 5.

<sup>39</sup> Tefft, "Srinivasan Sees Progress in Talks on Soviet Reactors for India," p. 10.

<sup>40</sup> Ann MacLachlan, "Financing Said Soviet Ace in Hole in Selling India a Nuclear Plant," *Nucleonics Week*, April 28, 1988, pp. 4, 5.

<sup>41</sup> "Gorbachev Visit to Mark Reactor Deal," *Nuclear Engineering International* (July 1988), p. 6; S. Kumar and Darryl D'Monte, "Tarapur to Have 2 New N-Plants," *The Times of India*, October 18, 1988, pp. 1, 3; in JPRS-TND-88-021 (23 December 1988), pp. 16, 17; "Gorbachev Visit Includes Credit Pact for Reactors," *Nuclear News* (January 1989), p. 105.

<sup>42</sup> Gamini Seneviratne and Ann MacLachlan, "China, IAEA Sign Safeguards Pact and Safeguards Okayed for India," *Nucleonics Week*, September 22, 1988, pp. 2, 3; *The Hindu*, October 19, 1988, p. 1; in JPRS-TND-89-001 (13 January 89), pp. 8, 9.

<sup>43</sup> Kumar and D'Monte, "Tarapur to Have 2 New N-Plants," pp. 1, 3.

<sup>44</sup> "Gorbachev Visit Includes Credit Pact for Reactors," p. 105; "Indo-Soviet Agreement Signed," *Nuclear Engineering International* (January 1989), p. 2; *The Hindu*, November 27, 1988; in JPRS-TND-89-002 (25 January 1989), pp. 5, 6; O. Kitsenko, "Developing the Nuclear Power Industry," *Pravda*, August 14, 1989, p. 5; in JPRS-TND-89-017 (29 August 1989), p. 14; "Off Again, On Again at Koodankulam," *Nuclear Engineering International* (May 1994), pp. 8, 9.

<sup>45</sup> *The Hindu*, November 27, 1988; in JPRS-TND-89-002 (25 January 1989), pp. 5, 6.

<sup>46</sup> *Patriot*, December 9, 1988, p. 5; in JPRS-TND-89-004 (28 February 1989), pp. 10, 11.

<sup>47</sup> *The Hindu*, February 6, 1989, p. 4; in JPRS-TND-89-007 (10 April 1989), pp. 21, 22.

<sup>48</sup> "IVO Joins Indian VVER Project," *Nuclear Engineering International* (April 1989), p. 6; "India: Soviet Reactor Deal Signed," *Nuclear Engineering International* (June 1989), p. 25.

<sup>49</sup> *The Hindu*, February 29, 1989, p. 3; in JPRS-TND-89-007 (10 April 1989), pp. 23, 24.

<sup>50</sup> Neel Patri and Ann MacLachlan, "Soviet VVER-1000 Sale to India Said Delayed by Money terms," *Nucleonics Week*, October 12, 1989, pp. 1, 13.

<sup>51</sup> *The Hindustan Times*, October 14, 1989, p. 1; in JPRS-TND-89-022 (29 November 1989), pp. 26, 27; Neel Patri, "Meeting Works Out details of Soviet VVER-1000 Sale to India," *Nucleonics Week*, November 9, 1989, p. 13; "Indo-Soviet Working Group Meets," *Nuclear Engineering International* (December 1989), p. 6.

<sup>52</sup> "Koodankulam Details Discussed," *Nuclear Engineering International* (November 1989), p. 7.

<sup>53</sup> "Indo-Soviet Working Group Meets," p. 6.

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<sup>55</sup> "Indo-Soviet Deal Not Final," *Nuclear Engineering International* (March 1990), p. 7.

<sup>56</sup> "India," *Nuclear Engineering International* (June 1990), p. 24.

<sup>57</sup> "AEC Chief Iyengar on Setting Up of Soviet Reactors," *The Hindu*, September 5, 1990, p. 4; in JPRS-TND-90-019 (25 October 1990), pp. 35, 36.

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<sup>65</sup> "India May Not Get Russian N-Reactors," *The Times of India*, April 23, 1992.

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<sup>70</sup> *Ibid.*

<sup>71</sup> "Russian Reactor Project Revived with MOU Signing," p. 30.

<sup>72</sup> "Agreement on AES Construction," *Rossiiskaya gazeta*, January 6, 1995, p. 10; in FBIS-SOV-95-005 (6 January 1995); "Russia and India Have Signed an Agreement to Construct a Nuclear Power Station in Southern India," *Uranium Institute News Briefing*, January 6, 1995–January 11, 1995, p. 2.

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<sup>74</sup> Hibbs, "Reported VVER-1000 Sale to India Raises NSG Concern on Safeguards," pp. 1, 13.

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