



# India's Nuclear Safety and Security: Policies and Practices

Rajeswari Pillai Rajagopalan

## Summary

*Even though nuclear safety and security have been global concerns since the end of the Cold War, the issue gained prominence only in the wake of the 9/11 terrorist attacks in the United States. Situated in a not-so-benign neighbourhood, India too has remained concerned about nuclear security especially from a terrorist threat perspective, and this predates the post-9/11 global focus. India's atomic energy rules and regulations, as well as the institutional architecture, have been periodically reviewed in line with changing threat perceptions and realities.*

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1. While a great deal of contemporary global focus is rightly on nuclear security, safety and security are two sides of the same coin. Considering the synergies between safety and security practices in the nuclear context, the two should be dealt together as a single basket issue.

## Evolution of India's Atomic Energy Program

2. Beginning in the 1950s, India planned a three-stage civil nuclear program devised by the father of India's atomic program, Dr Homi Bhabha, which continues to drive India's pro-

gram. The key objective of India's civil nuclear program is to contribute to its growing energy requirements by using both uranium and thorium reserves found in southern India.<sup>1</sup> There is a particular focus on the use of thorium because of large domestic reserves, although uranium has been more viable economically as the global uranium prices are far lower.<sup>2</sup>

3. Bhabha devised a program that would gradually erode the salience of the relatively limited uranium holdings. His plan would use "indigenous three-stage nuclear power program based on optimum utilization of the country's nuclear resources of modest uranium and abundant thorium."<sup>3</sup> Simply put, India's approach was (i) to convert India's small reserves of uranium in pressurized heavy water reactors, (ii) to produce plutonium, that (iii) would be converted to U-233 in fast breeder reactors which would finally be combined with thorium in advanced heavy water reactors in the third and final

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<sup>1</sup> For details, see Government of India, Department of Atomic Energy, "Annual Report 2015–2016," <http://dae.nic.in/writereaddata/areport/ar1516.pdf>

<sup>2</sup> Ashley J. Tellis, *Atoms for War? U.S.-Indian Civil Nuclear Cooperation and India's Nuclear Arsenal* (Washington DC: Carnegie Endowment for International Peace, 2006), <http://carnegieendowment.org/files/atomsforwarfinal4.pdf>

<sup>3</sup> Government of India, Department of Atomic Energy, "Cases of Nuclear Exposure," Rajya Sabha Unstarred Question No. 797 to be Answered on 09.02.2017, <http://dae.nic.in/writereaddata/parl/budget2017/rsus797.pdf>

stage.<sup>4</sup> In addition, following the US–India nuclear deal and the waiver from the Nuclear Suppliers Group in 2008, India is also pursuing foreign collaboration as a means to enhance capacity addition at a faster pace. India now imports uranium from Russia, Kazakhstan, France, Canada, and Uzbekistan. It is also pursuing bilateral deals with other countries, including Australia which has the world’s largest uranium reserves.<sup>5</sup>

4. Currently, India is in the process of implementing the second stage involving the construction of commercial fast breeder reactors. The construction of the 500 MWe prototype fast breeder reactor is complete and it is expected to be “fully functional by October 2017.”<sup>6</sup> India plans to construct two additional fast breeder reactors of 600 MWe each at Kalpakkam, Tamil Nadu. The three-stage process is complex and expensive but in the face of international sanctions from the mid-1970s, New Delhi felt it had no choice but to pursue this costly option in order to meet its energy security demands.

5. India’s nuclear program started with a research reactor APSARA in Trombay, developed with assistance from the United Kingdom, which also provided the initial fuel supply. A pool type light water reactor, APSARA went critical in 1956, with a maximum output of one MW thermal (MWt).<sup>7</sup> Subsequently, in 1964, India signed an agreement with the United States to build a uranium-based reactor in Tarapur. The Tarapur Atomic Power Station was India’s first atomic power project.<sup>8</sup> Even

though the United States agreed to supply India enriched uranium for 30 years, this was abruptly ended after India’s 1974 nuclear tests. However, continuing negotiations led France to step in and supply uranium fuel to the Tarapur reactor.

6. India had also signed an agreement with Canada in 1955 to supply a 40 MW CIRUS research reactor for India’s civil nuclear power plants. Further, in 1963, Canada and India signed an agreement for the construction of a 200 MW commercial nuclear power plant in Rajasthan (RAPS 1), which went operational in 1972. A third agreement was signed in 1966 for the construction of a second nuclear power plant (RAPS 2) although the construction was not completed when Canada cut off all nuclear cooperation with India following India’s 1974 nuclear tests. RAPS 1 and 2 have been under International Atomic Energy Agency (IAEA) safeguards from the time of initial operation and therefore it is unlikely that these have contributed to India’s nuclear weapon program.<sup>9</sup> Subsequently, India developed its own version of CANDU reactors though the cut-off of technology by Canada significantly delayed the Indian nuclear power plant program. As of now, India has 21 operational commercial power reactors, with a further five under construction.<sup>10</sup>

## The Interplay between Civilian and Weapons Programs

7. Indian political leaders and the atomic energy leadership were well aware of the fact that India’s atomic energy program also gave it the capacity for a weapons program. In the aftermath of the 1964 Chinese nuclear test, there was a major domestic debate about India developing its own atomic weapons. The atomic weapons program was pushed in particular by Bhabha, but the political leaders of the 1960s

<sup>4</sup> Tellis, *Atoms for War?*

<sup>5</sup> See Ramesh Thakur, “Australia, India and Global Nuclear Order,” in Mark Beeson and Shahar Hameiri, eds., *Navigating the New International Disorder: Australia in World Affairs 2011–2015* (Melbourne: Oxford University Press, 2016), pp. 208–23.

<sup>6</sup> Government of India, Department of Atomic Energy, “Progress of Prototype Fast Breeder Reactor at Kalpakkam,” Rajya Sabha Unstarred Question No. 798 to be Answered on 09.02.2017, <http://dae.nic.in/writereaddata/parl/budget2017/rsus798.pdf>

<sup>7</sup> Bhabha Atomic Research Centre, “Celebration of Golden Jubilee of APSARA: The Cradle of Nuclear Technology in India,” <http://barc.gov.in/press/2006/05.html>

<sup>8</sup> National Power Corporation of India Limited, “Tarapur Atomic Power Station,” <http://www.npcil.nic.in/main/ProjectOperationDisplay.aspx>

<sup>9</sup> Ronald E Stansfield, “The Impact of the US–India Joint Statement for Canadian and International Nuclear Non-proliferation Effort,” in Wade L Huntley and Karthika Sasikumar, eds, *Nuclear Cooperation with India: New Challenges, New Opportunities* (Vancouver: Simons Centre for Disarmament and Non-proliferation Research, 2006), p. 37.

<sup>10</sup> Nuclear Power Corporation of India, “Plants Under Construction,” <http://www.npcil.nic.in/main/allprojectoperationdisplay.aspx>

were reluctant to pursue a weapons program. Instead they sought nuclear guarantees from both the superpowers – Soviet Union and the United States. India also sought multilateral arms control through an international treaty, hoping that nuclear disarmament would obviate the need for developing its own nuclear weapon program. But the Nuclear Non-proliferation Treaty (NPT) as it developed did not satisfy India's hopes for nuclear disarmament, such that India decided to stay outside the NPT.

8. After the NPT came into force in 1970, India decided to test its weapons capability in 1974 though the specific reasons why India decided to test at that time are somewhat unclear. The Indian test led to massive international pressures and forced India to stop further development of its nuclear weapon program. But India's nuclear tests in 1974 spurred a Pakistani nuclear weapon program that had already been started in 1972. By the late 1970s, the advances in Pakistan's nuclear program began to increase pressure on India to restart its nuclear weapon program. Sometime in the mid-to-late 1980s, as it became clear that Pakistan had come very close to developing its nuclear weapons, India's political leadership ordered the re-start of India's own weapons program.

9. By the late 1980s, both India and Pakistan had a rudimentary nuclear weapon capability. In the aftermath of the Cold War, the indefinite extension of the NPT in 1995 and the adoption of the Comprehensive Test Ban Treaty (CTBT) in 1996 put pressure on Indian leaders to make a decision one way or the other, to either become a full-fledged nuclear weapon state or risk losing its nuclear weapon capability.<sup>11</sup> In 1998, in response to these pressures, India conducted a series of nuclear tests and declared itself to be a nuclear weapon possessing state. India's nuclear weapon program has progressed at a slow but steady pace since then and currently India has more than one hundred warheads based on dozens of short and long range ballistic missiles and bomber aircraft.

India is now deploying the third, sea-based leg of its triad with a nuclear-powered ballistic missile submarine. India's missiles still do not have sufficient range to cover all of China and so India can be expected to continue developing further long range missiles in the coming years.

## Nuclear Safety and Public Opinion

10. Nuclear safety issues have had some resonance in the public debate, especially in areas where nuclear power plants are located and also where there have been concerns of nuclear and radiological leaks. Even though there have been some protests in various parts of the country, these have not been particularly effective and there is no large scale public opposition to nuclear power, unlike the case in the United States, parts of Europe, or Japan in the post-Fukushima period. Given India's significant lack of energy resources and large shortages of power production, there is a strong consensus that India needs to expand its energy production and that atomic energy has to be part of that energy mix. Most major political parties, with the possible partial exception of the communist parties, strongly support India's atomic energy program and this is unlikely to change in the near future.

11. India has instituted legal and institutional frameworks to govern both nuclear safety and security. Key institutions include the Atomic Energy Commission (AEC), the Department of Atomic Energy (DAE), Atomic Energy Regulatory Board (AERB), Nuclear Controls and Planning Wing, and Bhabha Atomic Research Centre (BARC) among others. While the AERB is primarily responsible for regulating the civilian nuclear sector, the DAE and BARC also contribute on matters related to India's strategic nuclear programs.

## India's Nuclear Legal Architecture

12. India has established a legal architecture to govern nuclear safety and security, most of which came out in the 1960s and 1970s. These have since then undergone several amendments keeping abreast with the changes in the threat perceptions and technological advancements. Five key principles drive India's ap-

<sup>11</sup> See Ramesh Thakur, "The Nuclear Option in India's Security Policy," *Asia Pacific Review* 5:1 (Spring/Summer 1998), pp. 39–60.

proach to nuclear safety and security: governance; nuclear security practice and culture; institutions; technology; and international cooperation. These have been outlined in a brochure on nuclear security released by the Ministry of External Affairs in 2014.<sup>12</sup> While there is no one best method to assess the effectiveness of safety and security measures, these principles have proven to be fairly credible in assessing the state of the play of both safety and security of India's nuclear facilities, materials, and infrastructure.

13. The key overarching legislation that drives the safety and security of India's nuclear and radiological materials and facilities is the Indian Atomic Energy Act of 1962.<sup>13</sup> This Act is the legal basis for the development, control, and use of nuclear energy in India. It also empowers the central government to establish rules and regulations as well as release notifications to implement the provisions of the Act.

14. There are a number of additional laws that deal with environmental issues among others, which remain critical for determining the location and operation of atomic power plants. These include: the Environment (Protection) Act, 1986, the Atomic Energy (Factories) Rules, 1996 and the Electricity Act 2003. The DAE also formulated the Guidelines for Nuclear Transfers (Exports) in 2006.

15. There are also a few other laws introduced under the Atomic Energy Act. Three of these are especially important.

16. The Atomic Energy (Radiation Protection) Rules 1971 (revised in 2004) sanction activities for nuclear fuel cycle facilities and radiation use in industry, medicine, and research.<sup>14</sup> The Rules, especially since the 2004 revision, are comprehensive, in the sense that they clearly sets out roles and responsibilities of different parties including the employers, radi-

ological safety officers and others while dealing with protection against radiation. These rules also spell out the powers of the AERB in the following ways: detailing requirements regarding safety, health surveillance of workers, radiation surveillance, and records to be maintained; issuing directives; inspections; and enforcement actions.<sup>15</sup>

17. The Atomic Energy (Working of the Mines, Minerals and Handling of Prescribed Substances) Rules 1984 are meant to regulate activities related to mining, processing, and/ or handling of prescribed substances.<sup>16</sup>

18. The Atomic Energy (Safe Disposal of Radioactive Wastes) Rules 1987 establish the parameters for the decommissioning and disposal of radioactive wastes and make the AERB the responsible authority to ensure that the licensees comply with the rules on the safe disposal of radioactive wastes.<sup>17</sup>

19. Like most countries, India's nuclear regulations were quite haphazard, split between various parts of the Indian legal structure. However, after the passage of UN Security Council Resolution 1540 (S/RES/1540, 28 April 2004), India has consolidated its rules under the Weapons of Mass Destruction (WMD) and their Delivery Systems (Prohibition of Unlawful Activities) Act in June 2005.<sup>18</sup> Also, even as India remains outside some of the export control regimes, New Delhi, in its own interest, has adhered to the guidelines issued by these regimes, including the Nuclear Suppliers Group.

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<sup>15</sup> Department of Atomic Energy, Public Accounts Committee, Ninetieth Report, "Activities of the Atomic Energy Regulatory Board," submitted to the Lok Sabha on 9 December 2013, [http://164.100.47.134/lssccommittee/Public%20Accounts/15\\_Public\\_Accounts\\_90.pdf](http://164.100.47.134/lssccommittee/Public%20Accounts/15_Public_Accounts_90.pdf)

<sup>16</sup> For details on India's legislative framework, see SA Bhardwaj, DAE - Homi Bhabha Chair, "Nuclear Energy and Indian Society: Public Engagement, Risk Assessment and Legal Frameworks," speech at the Third Nuclear Law Association (NLA) Meet, 1 March 2014, <http://www.nlain.org/blog/inaugurallecturesabhardwajdaehomibhabhachairretiredirectortechncpil>

<sup>17</sup> Based on interviews with senior AERB officials, Mumbai, 19 February 2014.

<sup>18</sup> The text is available at [http://www.mea.gov.in/Uploads/PublicationDocs/148\\_The-Weapons-Mass-destruction-And-Delivery-Systems-Act-2005.pdf](http://www.mea.gov.in/Uploads/PublicationDocs/148_The-Weapons-Mass-destruction-And-Delivery-Systems-Act-2005.pdf)

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<sup>12</sup> Government of India, "Nuclear Security in India" (New Delhi: Ministry of External Affairs, March 2014), <http://www.mea.gov.in/Images/pdf/Brochure.pdf>

<sup>13</sup> Its predecessor was the Atomic Energy Act, 1948, which was replaced by the 1962 Act.

<sup>14</sup> Government of India, Department of Atomic Energy, "Atomic Energy (Radiation Protection) Rules, 2004," <http://dae.nic.in/writereaddata/RPR2004.pdf>

20. Furthermore, attention has been paid to nuclear safety and security culture and practices within the domestic nuclear arena by aligning with international standards, while being somewhat sensitive to India's own social and cultural contexts. This comes from the recognition that one may possess the best technologies and legal regimes, but it is the individual who matters when it comes to compliance and adherence. Therefore, imparting a safety and security culture across the board within the nuclear establishment is more significant. As the former US Department of Energy official, Eugene Habiger, said, "good security is 20 per cent equipment and 80 per cent people."<sup>19</sup>

21. India thus defines nuclear security culture as: "Every person, from a custodian to a technician to a scientist to a guard in the protective force, needs to believe in and support the nuclear security program for it to succeed. This is nuclear security culture."<sup>20</sup> This has further translated into additional measures to strengthen nuclear safety and security measures.

22. Mention must be made of also the Nuclear Controls and Planning Wing established within the DAE in 2013. This Wing is an important institutional initiative meant to "assist in the implementation of India's commitments related to nuclear safeguards, export controls and nuclear safety and security."<sup>21</sup>

### Nuclear Regulatory Framework

23. The Radiological Safety Division of the AERB is responsible for ensuring compliance with the 2004 Radiation Protection Rules and the 1987 Atomic Energy (Safe Disposal of Radioactive Wastes) Rules. The AERB, as the regulatory authority, has done a reasonably good job of ensuring compliance with and adherence to the rules and regulations pertaining to nuclear safety and security, but there have been perceptions of it not being a truly independent agency to carry out its functions.

24. By way of addressing this issue as well as to further enhance domestic regulation, the Government of India introduced the Nuclear Safety Regulatory Authority Bill in September 2011. The bill intends to replace the AERB with a new authority entitled The National Safety Regulatory Authority. The bill entails the establishment of a Council of Nuclear Safety under the leadership of the prime minister.<sup>22</sup> The Bill, when reintroduced in parliament and approved, will provide India with a legally independent nuclear regulator.

25. The Nuclear Safety Regulatory Authority is a big step for India, moving away from the existing set up, but it still draws flak for not being progressive enough. There are many who argue that the independence and autonomy of the proposed Authority is not clear in the bill in its current form.<sup>23</sup> There have also been questions on the independence of some members of the National Safety Regulatory Authority.<sup>24</sup>

26. This illustrates the larger problem that exists in India in this area: shortage of qualified people in the nuclear sector who are not asso-

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<sup>19</sup> Matthew Bunn and A Wier, *Securing the Bomb: An Agenda for Action* (Cambridge, MA: Harvard University, 2004), cited in Edward George Bitzer III and Andrew Hoffman, "Psychology in the Study of Physical Security," *Journal of Physical Security* 2:1 (2007), [http://jps.anl.gov/vol.2/4-Psychology\\_and\\_Security.pdf](http://jps.anl.gov/vol.2/4-Psychology_and_Security.pdf)

<sup>20</sup> Rita Guenther, Micah Lowenthal, Rajaram Nagappa, and Nabeel Mancheri, "India-United States Cooperation on Global Security: Summary of a Workshop on Technical Aspects of Civilian Nuclear Security," *National Academy of Sciences*, 2013, [http://www.nap.edu/catalog.php?record\\_id=18412&utm\\_expId=4418042-5.krRTDpXJQISoXLpdo-1Ynw.0&utm\\_referrer=http%3A%2F%2Fissp.in%2Ffindia-united-states-cooperation-on-global-security%2F](http://www.nap.edu/catalog.php?record_id=18412&utm_expId=4418042-5.krRTDpXJQISoXLpdo-1Ynw.0&utm_referrer=http%3A%2F%2Fissp.in%2Ffindia-united-states-cooperation-on-global-security%2F)

<sup>21</sup> "National Progress Report – India," Nuclear Security Summit 2014, <https://www.nss2014.com/sites/default/files/documents/india.pdf>

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<sup>22</sup> "Note for the Cabinet: The Nuclear Safety Regulatory Authority Bill, 2011," Department of Atomic Energy, August 19, 2011, [http://dae.nic.in/writereaddata/er190712\\_Sig.pdf](http://dae.nic.in/writereaddata/er190712_Sig.pdf)

<sup>23</sup> "The Nuclear Safety Regulatory Authority Bill 2011," PRS Legislative Service, [www.prsindia.org/billtrack/the-nuclear-safety-regulatory-authority-bill-2011-1980/](http://www.prsindia.org/billtrack/the-nuclear-safety-regulatory-authority-bill-2011-1980/)

<sup>24</sup> "The Nuclear Safety Regulatory Authority Bill 2011," PRS Legislative Service, <http://www.prsindia.org/billtrack/the-nuclear-safety-regulatory-authority-bill-2011-1980/>. See also Kundan Pandey, "New Bill, old problems," *Down To Earth*, 15 January 2015, <http://www.downtoearth.org.in/coverage/new-bill-old-problems-48038>



ciated with the atomic energy agencies of the country. Because there is no private sector participation in the nuclear arena, those that pursue nuclear engineering and science have to be necessarily affiliated to either DAE or the AERB. However, there is a rule that ensures that once officials move from the DAE to the regulatory agency, AERB, they cannot come back to the parent department, DAE.<sup>25</sup> This will ensure certain amount of distancing between the promoter and the regulator, but India has to put in greater efforts to improve even the perception of having an independent regulator.

27. Despite the perception issues, India is serious about nuclear safety and security issues and has thus taken several steps that will strengthen the practices, especially on the regulatory side. In a first of its kind, the Modi government invited a team from the IAEA to undertake an Integrated Regulatory Review Service mission on the AERB from 16–27 March 2015.<sup>26</sup> The mission's report stated that the AERB functions independently, without any interference from other nuclear entities of the country.<sup>27</sup> Nevertheless, the report recommended that the "de facto" independence of the regulator be made "de jure" by being formalized in a law.<sup>28</sup>

## India and International Regimes

28. In the last few years India has taken these issues fairly seriously for a number of reasons, including the Fukushima accident in 2011 and also the fact that India is making all efforts to integrate with the global non-proliferation architecture, including the export control regimes. Therefore, India has taken steps to further enhance its own security practices but also to push the global agenda and keep up the

momentum created by the Nuclear Security Summit (NSS) process. The Modi government has been proactive in this regard, especially at the last NSS in Washington in 2016, displaying a certain degree of openness and confidence within the nuclear security realm.

29. India has also joined the initiative on strengthening nuclear security implementation – broadly the joint statement of the co-chairs of the previous three summits, which have been formalized by the IAEA in INFCIRC/869. Signed by 38 states in October 2014, INFCIRC/869 is seen as one of the most important measures for an effective and sustainable global nuclear security regime. This document gains significance since it is based on national commitments and action plans to effectively safeguard nuclear security issues.

30. In addition, India joined the "gift baskets" process with undertakings related to countering nuclear smuggling, sharing know-how and best practices through centres of excellence, such as India's Global Centre for Nuclear Energy Partnership. It agreed further to take forward the summit process through an informal contact group in Vienna. The Global Centre for Nuclear Energy Partnership has been a major initiative and India has partnered with several like-minded countries, such as the United States and France, in strengthening international cooperation across a number of areas, including training in the area of nuclear safety and security.

31. In the absence of a regular nuclear security summit process, India can take the leadership and utilize the Global Centre for Nuclear Energy Partnership route to convene and coordinate global nuclear safety and security policies and practices. India also joined international efforts under INTERPOL to counter nuclear smuggling. In February 2017, India hosted a meeting of the Global Initiative to Combat Nuclear Terrorism, a demonstration of its intent with regard to the issue involved but also the global governance role that India can play in this regard.

32. In addition, India is a party to the Convention on the Physical Protection of Nuclear Material (CPPNM), which was drawn up in 1979.

<sup>25</sup> Based on interactions with DAE officials, Mumbai, August 2016.

<sup>26</sup> MP Ram Mohan and Els Reynaers Kini, "India's nuclear regulators have been audited," *The Hindu Business Line*, 3 January 2016,

<http://www.thehindubusinessline.com/opinion/indias-nuclear-regulators-have-been-audited/article8061473.ece>

<sup>27</sup> Atomic Energy Regulatory Board, "Integrated Regulatory Review Service (IRRS) Mission to India,"

<http://www.aerb.gov.in/AERBPortal/pages/English/t/documents/irrs.pdf>

<sup>28</sup> Mohan and Kini, "India's nuclear regulators have been audited."

India has also ratified the 2005 Amendment which sought to plug some of the loopholes in the original convention. The Amendment came into force in 2016 after it was ratified by two-thirds of the States Parties. India also “support(s) the fifth revision of the recommendations contained in INFCIRC/225.”<sup>29</sup> In addition, India is a signatory to the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT), which seeks to facilitate cooperation among member states to combat nuclear terrorism.

33. India will also host a WMD Terrorism Summit in 2018, highlighting India's perception of its threats and challenges but also strengthening the global agenda in this regard. India also supports the Code of Conduct on the Safety and Security of Radioactive Sources. India is also part of the IAEA's Illicit Trafficking Database established in 1995.

### Nuclear Liability Framework

34. Liability issues with regard to nuclear accidents also became part of a major domestic political debate as a consequence of the US-India nuclear deal. The deal required India to pass liability laws but a significant section of India's elite, who were opposed to the US-India nuclear deal originally, saw in the nuclear liability debate a way of curtailing the US-India nuclear deal. Under pressure from such opinions, the Government of India passed an extremely strict liability bill (The Civil Liability for Nuclear Damage Act) in 2010. The Union Carbide chemical accident in Bhopal that killed 10,000 people in 1984 as well as the Fukushima accident in Japan influenced the liability debate.

35. The conditions of the nuclear liability law required liabilities to be placed on the suppliers of power plant equipment, something opposed both by Indian as well as foreign suppliers of power plants and components. India's nuclear liability bill has effectively managed to scuttle operationalization of aspects of the US-

India nuclear deal including India's purchase of nuclear power plants from the United States and France. The nuclear liability bill also created difficulties in expanding the agreement with Russia to build more power plants in Kudankulam. India managed to overcome Russian concerns with sovereign guarantees.

36. The Government of India has attempted various solutions to the problem created by its liability law. Most recently, this has included an insurance pool that will provide some measure of protection to the suppliers, but suppliers still remain reluctant to enter the Indian market due to concerns around liability issues and this remains a serious obstacle to the expansion of India's nuclear power sector. Nevertheless, the Government of India, even after a change in the administration in 2014, has remained unwilling to change the original liability legislation.

### Bilateral and Regional Cooperation

37. Nuclear safety and security cooperation at the regional level has been negligible. The only other major nuclear power in the neighbourhood is Pakistan and given the state of bilateral relations, there has been no regional cooperation. Bangladesh and Sri Lanka have very rudimentary nuclear programs. Moreover, regional cooperation in general has been slow to develop in South Asia and the regional organization, the South Asian Association for Regional Cooperation (SAARC) remains weak.

### Conclusions

38. India was concerned about nuclear safety and security long before it became a global focus. India's neighbourhood being what it is, New Delhi does not have the luxury of ignoring some of the threats in the form of cross-border terrorism, as well as other domestic internal security challenges in the form of secessionist insurgencies and left-wing extremism. These threat perceptions have thus conditioned India's approach to nuclear safety and security for a couple of decades and India has utilized a mix of legal measures, governance, and technology to mitigate any risk that may exist in

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<sup>29</sup> Nuclear Security Summit Seoul 26-27 March 2012, “National Progress Report India,” [http://nuclearsecuritymatters.belfercenter.org/files/nuclearmatters/files/india-national\\_report.pdf](http://nuclearsecuritymatters.belfercenter.org/files/nuclearmatters/files/india-national_report.pdf)

this realm.<sup>30</sup> Even as nuclear terrorism is assessed a distant possibility, the high impact nature of the threat has remained a constant concern for India and therefore nuclear security and safety have a high priority in India.

39. Even as this is the case, India has done a poor job of publicizing its policies and practices. The Indian restraint in this regard is rather shocking because it has a strong case to make. India's lack of transparency is construed as absence of a policy framework or poor standards, which is far from the case. India's adherence to and implementation of the IAEA guidelines such as the Design Basis Threat, Personnel Reliability Program, and safety and security culture are noteworthy.

40. As in other countries, the threats and challenges are ever changing and there is scope for improvement. Some of the areas to which India needs to accord priority include its level of preparedness in case of a major accident. Periodic multi-agency simulation exercises and scenario planning are necessary to strengthen the coordination between the different security and atomic energy agencies involved. While each of the agencies involved conducts a fair number of such exercises, large-scale exercises involving all the agencies have been somewhat lacking.

41. In addition, India must consider establishing an independent police force for the security of its nuclear facilities. While the Central Industrial Security Force has done a good job so far, it has a broad mandate and is responsible for a number of different functions including airport security and general industrial security. Given that the Indian atomic energy sector is likely to grow, the need for a separate police force cannot be emphasized strongly enough.

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<sup>30</sup> For a more detailed analysis of India's nuclear security, see Rajeswari Pillai Rajagopalan, Rahul Krishna, Kritika Singh and Arka Biswas, *Nuclear Security in India* 2<sup>nd</sup> Ed. (New Delhi: Observer Research Foundation, 2016).

42. India should also do more to rectify even the perceptions of not having an independent nuclear regulator. India should not wait for a major calamity such as Fukushima to occur to realize the requirements in this regard. India can also do more in terms of accounting for nuclear materials and tightening of the licensing process. The Mayapuri radiological incident of 2010<sup>31</sup> revealed certain deficiencies – the atomic energy agencies have since then tightened the measures, but even so India must remain vigilant to potential dangers in this regard. Moreover, given that insider threats are becoming a more significant issue in recent times, graded access and need-to-know basis information sharing practices must be instituted.

43. Lastly, while India has instituted a fairly robust mechanism around nuclear safety and security, it must acknowledge that no one has the perfect solution to all problems and therefore it should study the best practices from other major nuclear powers regarding nuclear safety and security.

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<sup>31</sup> On 26 February 2010, a University of Delhi gamma research irradiator was sold at auction to a scrap metal dealer in Mayapuri, a heavily populated suburb in western Delhi. Dismantled by workers unaware of the hazardous nature of the item and dispersed across several locations, the cobalt-60 fragments caused eight people to be hospitalized. All the radioactive material was claimed to have been recovered by mid-April and remains in DAE custody. However, five years after the incident many Mayapuri residents and businesses were still apprehensive about further incidents owing to lax regulatory practices and inadequate emergency response preparedness. See Durgesh Nandan Jha, "Mayapuri still exposed to radiation," *Times of India*, 28 March 2011, <http://timesofindia.indiatimes.com/city/delhi/Mayapuri-still-exposed-to-radiation/articleshow/7802257.cms>; and Mohit Sharma, "Mayapuri haunted by radiation fears of 2010," *Hindustan Times* (Delhi), 21 July 2015, <http://www.hindustantimes.com/delhi/mayapuri-haunted-by-radiation-fears-of-2010/story-eSJG24Ly9MHYyoAeligF60.html>



### The Author

**RAJESWARI PILLAI RAJAGOPALAN** is Senior Fellow and Head of the Nuclear and Space Policy Initiative at the Observer Research Foundation (ORF), New Delhi. Dr Rajagopalan joined ORF after a five-year assignment at the National Security Council Secretariat (2003–07), where she was an Assistant Director. She is the author of four books: *Nuclear Security in India* (2015), *Clashing Titans: Military Strategy and Insecurity Among Asian Great Powers* (2012), *The Dragon's Fire: Chinese Military Strategy and Its Implications for Asia* (2009), and *Uncertain Eagle: US Military Strategy in Asia* (2009). She has also co-authored and edited six other books, including *Nuclear Security in India*, 2<sup>nd</sup> Ed. (2016).

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The **Centre for Nuclear Non-Proliferation and Disarmament (CNND)** contributes to worldwide efforts to minimize the risk of nuclear-weapons use, stop their spread and ultimately achieve their complete elimination. The director of the Centre is Professor Ramesh Thakur. See further <http://cnnd.anu.edu.au>.

The **Asia Pacific Leadership Network (APLN)** comprises over eighty former senior political, diplomatic, military and other opinion leaders from fifteen countries around the region, including nuclear-weapons possessing states China, India and Pakistan. The objective of the group, founded by former Australian Foreign Minister and President Emeritus of the International Crisis Group Gareth Evans, is to inform and energize public opinion, and especially high level policy-makers, to take seriously the very real threats posed by nuclear weapons, and do everything possible to achieve a world in which they are contained, diminished and ultimately eliminated. The co-Convenors are Professors Chung-in Moon and Ramesh Thakur. The Secretariat is located at the East Asia Foundation in Seoul, Republic of Korea. See further [www.a-pln.org](http://www.a-pln.org).

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### Contact Us

APLN, East Asia Foundation  
4F, 116 Pirundae-ro  
Jongno-gu, Seoul 03535  
Republic of Korea  
Email: [apl@keaf.org](mailto:apl@keaf.org)  
Tel: +82 2 325 2604-6