Prospects for Nuclear Security Partnership in Southeast Asia

MONTEREY / MOSCOW / VIENNA
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PROSPECTS FOR NUCLEAR SECURITY PARTNERSHIP IN SOUTHEAST ASIA

Prepared by

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PREFACE

The James Martin Center for Nonproliferation Studies (CNS), the Moscow-based Center for Energy and Security Studies (CENESS), and the Vienna Center for Disarmament and Non-Proliferation (VCDNP) are pleased to offer this research report as the result of our joint work on a project funded by the Nuclear Threat Initiative (NTI).

An initial version of this report was created in support of an October 31, 2011 workshop in Vienna, Austria, entitled "Prospects for Nuclear Security Partnership in Southeast Asia." That workshop included experts from Southeast Asia, namely Indonesia, Malaysia, the Philippines, and Vietnam, as well as the United States, Russia, Japan, Australia, the European Union, the International Atomic Energy Agency (IAEA), and the 1540 Committee. The presentations and discussions at that conference contributed significantly to this final report, and comments from participants of that event are cited throughout this text. The conference included sessions reviewing the status of nuclear security in the region, identifying opportunities and recommendations for international cooperation on the issue in Southeast Asia, and discussing appropriate and effective next steps.

Participants to the workshop included:

Sponsoring Organizations

NTI	**CNS/VCDNP**	**CENESS**
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NUCLEAR DEVELOPMENT IN SOUTHEAST ASIA

Many nations in Southeast Asia view their growing energy needs as a looming crisis, one that could potentially be averted by development of civil nuclear programs. Timetables for nuclear development in the region are ambitious, but these ambitions often do not correspond with practical investment plans that are economically viable or logistically feasible. The feasibility and viability of nuclear development in these states is becoming even more complex when nuclear security and nonproliferation concerns are taken into account. While the events in Fukushima have cast a shadow over the pace of this expansion, several countries in Southeast Asia continue to show interest in nuclear power as a means to meet future energy requirements. For this reason, Southeast Asia remains a salient region in any global effort to manage nuclear security risks.

The need to diversify energy sources and reduce dependence on oil and gas imports in part drives Southeast Asian countries' interest in nuclear power. Rapid economic growth in the region, potentially straining electricity supply in states such as Indonesia and Vietnam, contributes to this calculation. Prestige, regional influence, and economic competition further motivate Southeast Asian governments as they watch closely the plans of their regional neighbors. Prior to the Fukushima crisis, a previously tepid public stance toward nuclear energy had showed signs of warming.

From 2006 to 2011, the above factors combined to support the development of ambitious nuclear energy expansion plans by states in the region. In parallel, regional growth in industrial sectors not related to energy but utilizing nuclear technology, such as the production of radioisotopes for medical and agricultural applications, continues. Starting with the historical context, this chapter examines these developments, which are vital to framing any estimate of Southeast Asia's nuclear security needs and challenges.

Historical Context

Steady development of nuclear energy and related technologies has been difficult in Southeast Asia due to a number of innate factors in the region. Southeast Asia is subject to frequent, large-scale natural disasters and emergencies. Plans to build nuclear power plants here have also faced hurdles related to domestic politics, corruption, finances, safety, and public opinion. For these reasons, since 1971 five projects to build research or power reactors in four Southeast Asian countries (Indonesia, Myanmar, the Philippines, and Thailand) were cancelled or indefinitely postponed after reaching various stages of development – *see Table 1 for details.*

Much of the early nuclear development in Southeast Asia stemmed from the U.S.-sponsored Atoms for Peace program and some countries in the region launched initial research reactor projects in the late 1950s and early 1960s. In Thailand, the TRR-1/M1 reactor made by General Atomics became operational in 1962, in the Philippines and Vietnam in 1963, and in Indonesia in 1964. In total, six research reactors are currently operating in the region - in Indonesia, Malaysia, Thailand, and Vietnam; the decommissioning process for the seventh (in the Philippines) began in 2005. Vietnam and Indonesia are considering the possibility of building new research reactors before the end of this decade. In November 2011, the Russian and Vietnamese governments signed an agreement on building a Nuclear Science and Technology Center in Vietnam – *see Table 2 for details.*

In the past, several countries in the region (Indonesia, the Philippines, Thailand, and Vietnam) possessed quantities of HEU used as fuel for research reactors and as targets in the production of isotopes - *see Table 3 for details*. At present, only Vietnam still has HEU in the form of irradiated nuclear fuel (36 percent enriched). This material is scheduled to be removed from the country in late 2013 as part of a Russian Research Reactor Fuel Return (RRRFR) program between Russia, the United States, and the IAEA.

The only nuclear power reactor built to date in Southeast Asia is 100 kilometers west of Manila, the Philippines, at the Bataan Nuclear Power Plant. Construction on Bataan began in 1976 through a partnership between the Philippine government (under Ferdinand Marcos) and U.S.-based Westinghouse. However, the 1979 Three Mile Island accident in the United States and the 1986 Chernobyl disaster in the Soviet Union exacerbated safety concerns surrounding the site, which is located near major earthquake fault lines and close to the Mount Pinatubo volcano. Because of these concerns, and a change in government in Manila, the reactor was never launched, even though construction was more than 90 percent complete by the time work ceased in 1985. More recently, tentative discussions on resurrecting the Bataan reactor were scuttled after the accident at Fukushima.

Ultimately, despite many ambitious timelines for building power reactors, the practical transition from nuclear research to commercial use of nuclear energy in the region has not occurred. However, recent steps have been taken—particularly in Vietnam—to realize this transition within the next 10 to 15 years.

Nuclear Energy Plans in the Region: A Country-by-Country Snapshot

According to the individual national plans made public over the last five years, 16 nuclear energy reactors are planned for construction in Southeast Asia, including four in Indonesia, two in Malaysia, four in Thailand, and six in Vietnam, by 2025 - *see Table 4 for details*. Significantly, most regional authorities have not officially revised the proposed timelines following the events at Fukushima; only Thailand has postponed the launch of the project to build its first nuclear power plant NPP (by three years). However,

judging from the recent informal exchanges with experts and officials in Southeast Asian countries, the existing plans and deadlines are likely to change. Also, judging from previous attempts at launching nuclear power in the region, it is unlikely that more than six reactors will be completed by 2025—most likely four in Vietnam and two in Malaysia. Although Indonesia has arguably the most advanced nuclear infrastructure, Vietnam's nuclear power program is probably the closest to reaching fruition in Southeast Asia. Hanoi appears on track to launch the first NPP in the region shortly after 2020. The Fukushima event, while monitored closely by Vietnam and resulting in official statements emphasizing the importance of safety, is not likely to stall plans.[1] Public opinion in Vietnam is also not as hostile to nuclear energy as in Indonesia and some other countries in the region.

Below is a brief "snapshot" of Southeast Asian states' active nuclear energy development plans. Further details are also presented in *Table 4*.

- **Indonesia's** 2007 Long-Term National Development Plan envisions the construction of four new reactors that would be operational by 2024. The first reactor, scheduled to begin in 2010, is already delayed, and at least a 5-10 year delay in the overall plan appears likely. Negative public opinion—reinforced by the Fukushima event—is a significant factor, reflected in remarks by President Susilo Bambang Yudhoyono questioning the role of nuclear power in Indonesia's future. However, Jakarta has announced no official changes to the development plan and proponents of nuclear energy in Indonesia suggest that newer reactor technology should mitigate the risks of a Fukushima-type incident. Given Indonesia's leadership role in the region, it will be watching developments in Vietnam closely. However, Indonesian authorities are unlikely to make the political decision on building nuclear power plants before the next presidential elections in 2014.

- According to **Vietnam's** National Master Plan for Power Development for the 2011–2020 period with the Vision to 2030, Hanoi will build ten reactors, with the first going on-line by 2020. Two of the reactors will be constructed with Russian assistance, and two with Japanese assistance. The Vietnamese government plans to have a nuclear generation capacity of 6 GW by 2025. While Vietnamese officials have emphasized safety in public statements following the Fukushima crisis, recent announcements confirm continued engagement with Russia and Japan on reactor development.[2] Limitations in infrastructure and human resources, though, will likely affect this plan. Nonetheless, assuming no additional occurrence of Fukushima-type events, Vietnam appears well positioned to

[1] "Foreign Ministry Spokesperson Remarks on the Recent Earthquake and Tsunami in Japan," Ministry of Foreign Affairs of Vietnam, 21 April 2011, http://www.mofa.gov.vn/en/tt_baochi/pbnfn/ns110315154436/view#flSKmso3d3WD.

[2] "Vietnam Wants Highest Safety for Planned Nuclear Power Plant," Vietnamnet, 20 September 2011, http://english.vietnamnet.vn/en/science-technology/13193/vietnam-wants-highest-safety-for-planned-nuclear-power-plant.html; and "Japanese Agreement for Second Vietnam Nuclear Plant," *World Nuclear Association Weekly Digest*, 6 October 2011.

become the first Southeast Asian state to introduce an operational nuclear power plant.

- A final decision on introducing nuclear power in **Malaysia** is pending, although Kuala Lumpur has set up the Nuclear Power Development Steering Committee (JPPKN) and three Working Committees to study the possibility. In June 2009, the Malaysian government issued a formal decision to evaluate nuclear energy as a possible source for electricity from the year 2020. One year later, the Malaysia formally introduced a national nuclear policy. In January 2011, Prime Minister Najib Razak announced the establishment of the Malaysian Nuclear Power Corporation, which will lead the planning process. The final decision on introducing nuclear power was expected to occur in 2013, but this could be delayed, as Malaysian officials have indicated any decision will be dependent upon issuance of a full report on the events at Fukushima by the Malaysian Nuclear Agency.

- **Thailand** had an ambitious plan, as set forth in its Power Development Plan 2010 (2010 - 2030), to construct and bring into operation five NPPs by 2030; the first two NPPs were to be built in 2020 and 2021, the third and fourth NPPs in 2024 and 2025, and the fifth one in 2028. The Thai Nuclear Power Program Development Office (NPPDO), under the Ministry of Energy, did a "self-evaluation" for the IAEA in 2010. Agency experts recommended to Bangkok authorities that Thailand make essential improvements to its nuclear safety and human resources development. In April 2011, as an immediate consequence of the Fukushima crisis, the Thai government decided to delay the start of reactor construction by three years; as a result, the first reactor is unlikely to go on line before 2023.[3] This decision also pushed the construction timeline for the fifth reactor out beyond the current development plan timeframe, so the revised development plan includes only four reactors.

- **The Philippines** is the only country in the region with a nuclear energy reactor, which has been sitting 90 percent finished since 1985. The government decided not to launch the reactor owing to protests against nuclear energy as well as safety concerns. Recent reports from the Philippine government state that this plant is not considered viable and is scheduled for dismantlement. Manila currently has no active plans for nuclear energy development but the Philippine authorities are also not excluding nuclear energy in the future.

- **Singapore** has not committed to nuclear power development, but it continues to keep it as an option, even after the events at Fukushima. In the fall of 2011, Singapore reaffirmed its interest in conducting a pre-feasibility study, with an expectation of concluding the study in 2012. Due to its small land area, it is generally expected that if Singapore were to choose the nuclear power option, the

[3] Meeting Report (27 April 2011), National Energy Policy Committee, http://www.eppo.go.th/nepc/kpc/kpc-136.htm#2 (in Thai.)

city-state would have to partner with one of its neighbors—such as Malaysia or Indonesia.

- **Myanmar** has expressed interest in developing a research nuclear program, but there have never been any official announcements suggesting that the country plans to build nuclear power plants. The issue of nuclear development in Myanmar has garnered significant attention over the last few years, with some concerns that their program could have military implications. In 2010, the Myanmar government announced that it did not plan to further develop research nuclear program due to inadequate resources and concerns about potential misunderstandings about the program's intent.

- **Cambodia** joined the IAEA in 2009 and is currently studying the possibility of nuclear power. However, nuclear energy development is considered a distant, long-term option.

- **Laos** became an IAEA member in September 2011. Laos's interest in peaceful use of nuclear energy and technology has related solely to medicine, agriculture, and environmental protection, not for power generation.

- **Brunei** is not an IAEA member and has no nuclear energy plans at present.

Status of Enrichment and Reprocessing in the Region

At present, countries in the region do not have any enrichment or reprocessing facilities. Vietnam and Indonesia, two of the region's more advanced nuclear technology countries, have indicated their interest in returning irradiated nuclear materials to the country of origin, which means that a nuclear fuel leasing arrangement could be an especially attractive option for Southeast Asian nuclear power plants. The Russian-Vietnamese agreement on the construction of the "Ninh Thuan-1" NPP says that the issue of spent nuclear fuel will be addressed later on, given that there will be no spent nuclear fuel to remove from Vietnam at least until 2025. Currently, national authorities return spent fuel from domestic research reactors to the fuel's country of origin.

The U.S. government and NGOs have raised concerns surrounding alleged nuclear activities in Myanmar. Defectors from Myanmar's army have claimed that a "nuclear battalion" in the country is exploring the development of a uranium enrichment capability for military use.[4] These claims remain the subject of considerable debate, but further illustrate the sensitivity surrounding development of any indigenous enrichment and reprocessing capabilities in the region. The decision of Myanmar's government not to

[4] Robert E. Kelley and Ali Fowle, "Nuclear Related Activities in Burma," Democratic Voice of Burma website (report was prepared for DVB), May 2010, http://www.dvb.no/burmas-nuclear-ambitions/burmas-nuclear-ambitions-nuclear/expert-analysis/9297.

keep uranium (a byproduct of gold ore mining) in the country and to export it to China, and its announced decision in 2010 to halt the development of a nuclear research program suggest that the country's leadership is trying to send a signal that it has no military-related nuclear ambitions.[5]

Overview of Relevant Counter-Proliferation Activities in the Region

Currently, five ASEAN countries have participated in some capacity activities related to the Proliferation Security Initiative (PSI): Brunei, Cambodia, the Philippines, Singapore, and Thailand. Singapore has been the most active in the region and hosted the first PSI exercise in Southeast Asia, called Exercise Deep Sabre, in 2005; a follow-up exercise (Deep Saber II) was hosted by Singapore in 2009.[6] During the East Asia Summit in November 2011, the Thai Prime Minister announced that Thailand would join PSI. However, some Thai officials remain concerned about domestic levels of skills and equipment, lack of sufficient resources, need for clarity concerning compensation for inspected vessels, and delegation of responsibility to law enforcement agencies.[7] During the 66th UNGA meeting, U.S. Secretary of State Hillary Clinton encouraged Vietnam to join PSI and Vietnamese Foreign Minister Pham Binh Minh informed her that Vietnam would consider it.[8]

Although Malaysia was previously skeptical of PSI, its attempts to garner favor with Washington appear to have moderated its views of the Initiative. In 2007, Malaysia observed the exercise Pacific Shield hosted by Japan. During the November 2011 East Asia Summit, President Obama asked Malaysia to consider the PSI participation; Prime Minister Datuk Seri Najib Tun Abdul Razak told his U.S. counterpart that Malaysia was studying PSI.[9]

Indonesia continues to show reservations about PSI, especially concerning sovereignty and the legality of interdiction, dealing with compensation for shipment delay when vessels are inspected, and the potential contradictions with the UN Convention on the Law of the Sea. Indonesia strongly opposed PSI since the Initiative's inception in 2003. Numerous officials, both from the Foreign Ministry and military establishment have

[5] "Press Statement of the Ministry of Foreign Affairs on the Unfounded Allegations against Myanmar regarding the Nuclear Program," Myanmar Ministry of Foreign Affairs, Nay Pyi Taw, 11 June 2010.
[6] "Singapore Hosts Proliferation Security Initiative (PSI) Exercise," Singapore Ministry for Defence website, 27 October 2009, http://www.mindef.gov.sg/imindef/news_and_events/nr/2009/oct/27oct09_nr.html.
[7] "Yingluck backs U.S. initiatives," *The Nation*, 20 November 2011.
[8] "Vietnam, U.S. Discuss Boosting Bilateral Partnership," Vietnam Permanent Mission to the UN, 29 September 2011, http://www.vietnam-un.org/en/news.php?id=155&cid=2.
[9] "Obama Hopes Malaysia Will Play Productive Role Towards World Prosperity," Office of the Prime Minister of Malaysia website, 18 November 2011 http://www.pmo.gov.my/?menu=newslist&news_id=8940&news_cat=13&cl=1&page=1731&sort_year=&sort_month=.

stated clearly that Indonesia will not being joining PSI, despite direct invitations by Washington.[10]

Other Industrial Uses of Nuclear Technology and Radiological Sources

An overall trend of industrialization in the Southeast Asia region is expected to create a greater demand for non-energy-related usage of nuclear technology throughout Southeast Asia, such as the use of radioisotopes in medicine, agriculture, and other industries - *see Table 5 for details*. Indonesia boasts one of the region's most developed and dynamic radioisotope production industries. Indonesian reactors generate several varieties of radioisotopes for medical, industrial, and academic applications. Production capacity has enabled Indonesia to meet domestic demand, and it is now looking to export radiological materials to other states in the region.[11] Vietnam has 220 radiation facilities, including 24 with "Group A" sources,[12] using 4,275 radioactive sources in 63 provinces for healthcare, industrial, education, and other purposes.[13]

A significant expansion of the Southeast Asian radioisotope market was projected in the last decade, but did not materialize due to the world economic crisis in 2008. Despite the current slowdown, the use of radiological sources can be expected to increase as states in the region, such as Vietnam and Indonesia, continue to enjoy economic growth. This represents an added, and likely long-term, dimension to the region's nuclear and radioactive materials security picture.

Safety, Fukushima, and the Need to Assess Nuclear Security

A political decision to develop nuclear energy in Southeast Asian countries involves consideration of several critical factors. These include availability of alternative energy sources, adequate safety measures, public acceptance of the use of nuclear technologies, the availability of cadres and expertise, and reliable and sustainable financing of the projects.

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[10] "Indonesia general: Participation in proliferation initiative 'unnecessary'," BBC Monitoring Asia Pacific, 4 July 2006; and "Indonesia rejects U.S. request to join Proliferation Security Initiative," BBC Monitoring International Reports, 18 March 2006.

[11] *Preventing Nuclear Dangers in Southeast Asia and Australasia*, IISS Strategic Dossier (September 2008), p. 68.

[12] Within Vietnam's legal framework regarding the categorization of radioactive sources and corresponding security requirements, Group A signifies the most radioactive sources (or groups of sources). For more details see Vietnam's Ministry of Science and Technology's *Decision on the Issuance of Radioactive Sources Categorization Complying With Security Requirements*, Document No. 17/2007/Q§-BKHCN, 31 August 2007, http://www.varans.vn/vanbanphapluat/QD%20Phan%20nhom%20nguon%20px%20QD17BT07%20tAnh.pdf.

[13] Presentation by Vietnamese delegation at the International Conference on Safety, Security and Safeguards in Nuclear Energy, on 1–2 September 2011, Bangkok, Thailand.

Safety is one of the key criteria for long-term success of nuclear energy development in the region, particularly in light of the area's developing infrastructure and propensity for large-scale natural disasters. Nuclear accidents elsewhere have heavily influenced political opposition to nuclear power in the region, resulting in notable slowdowns in development. As noted previously, the Three Mile Island and Chernobyl incidents both contributed to Manila's abandonment of the Bataan NPP. Likewise, the more recent crisis at Fukushima appears to have affected, or at least slowed, nuclear development plans under consideration in most regional capitals, with the possible exception of Vietnam.

The impact of Fukushima continues to reverberate across Southeast Asia, as the region has itself experienced major earthquakes and tsunamis within the past decade, along with volcanic eruptions, flooding, and other natural disasters. Nonetheless, the plans described in this chapter have not been cancelled, and if Vietnam enjoys success in viable nuclear power generation, the slowdown may prove temporary, as other states may follow Hanoi's lead. Accordingly, with development of nuclear energy and nuclear-related industries likely to continue, understanding the current and future state of nuclear security in the region becomes even more essential. Our next chapter therefore aims to shed light on this picture. Terrorism, maritime piracy, and proliferation-related illicit trafficking networks are challenge, already present in the region that will be considered – keeping in mind that the energy and industrial developments described here add urgency to countering such threats.

TABLE 1. NUCLEAR INFRASTRUCTURE PROJECTS CANCELLED IN SOUTHEAST ASIA, 1971-2011

Country	Project, Location	Details	Reasons to Cancel
Indonesia	**IRT research reactor (1-2MW)** Center for Research of Science and Technology, Serpong	In early 1965, the Soviet Union supplied the equipment under a 1960 intergovernmental cooperation agreement. However, Indonesia never built a facility to house the planned reactor. Components laid unassembled for years until the project was officially abandoned in 1971. The equipment supplied by the Soviet Union was later used during the construction of the TRIGA Mark II research reactor in Yogyakarta; the reactor was designed by General Atomics.	**Political obstacles** As result of 1965 coup in Indonesia, Soviet - Indonesian trade, economic and scientific cooperation, including in the nuclear field, was reduced dramatically as the new government saw communists as political rivals.
	Isotope Production Reactor, RPI-10 (10 MW) Center for Research of Science and Technology, Serpong	The Indonesian industrial company IKPT, with the support of the Indonesian Atomic Energy Authority (BATAN), planned to design and construct a 10 MW Isotope Production Reactor, called RPI-10. The reactor was expected to be built in the BATAN Research Center at Serpong, and commercially operable in 2000. The basic design of the reactor island was completed and detailed designs were underway. The site license was received, but the project was ultimately cancelled.	**Financial problems** Indonesia canceled the project in late 1998 as result of the financial crisis in Asia.
Myanmar	**IRT research reactor (10 MW)**	On May 15, 2007, Russia and Myanmar signed an agreement on the construction of a nuclear research center in central Myanmar, including 10 MW (thermal) pool-type nuclear reactor. There are no indications that construction ever began.	**International reaction, financial problems** On June 11, 2010, Myanmar Foreign Ministry made a statement that nuclear research development plans were suspended due to inadequate resources and the government's concern about misunderstanding it may cause among the international community.
Philippines	**Bataan Nuclear Power Plant (BNPP)**	Construction of the 620 MW PWR BNPP based on Westinghouse technology started in 1976. The nuclear power plant was about 90% ready by 1985, when its	**Safety concerns, public opinion** Domestic authorities suspended

		construction was suspended.	construction due to safety concerns and negative public opinion. Support of the program diminished notably after Ferdinand Marcos fell from power. Among the issues raised was the site's proximity to major earthquake fault lines and the Mount Pinatubo volcano.
Thailand	**10 MW TRIGA Reactor** Ongkharak Nuclear Research Center	In June 1997, the Office of Atomic Energy for Peace (OAEP) awarded a turnkey contract to General Atomics (GA) to design, build and commission the Ongkharak Nuclear Research Center (ONRC) near Bangkok. The ONRC research complex includes 10 MW TRIGA research reactor, an Isotope Production Facility (IPF), and a Centralized Waste Processing and Storage Facility. The basic design of the reactor island and other balance-of-plant systems had been completed and detailed designs were underway. Fuel loading and commissioning was expected around the end of 2002.	**Financial problems** Thai authorities cancelled the project during the Asian financial crisis in the late 1990s. There were discussions at a later stage to revive the project, but that has never materialized.

Sources: H. Hastowo, "RPI-10, the Indonesian 10 MW Isotope Production Reactor, International Group on Research Reactors, No. 9," June 1997, IGORR-News; *Preventing Nuclear Dangers in Southeast Asia and Australasia*, IISS, 2009, p. 62; Dmitry Konukhov and Anton Khlopkov, "Russia, Myanmar And Nuclear Technologies," Nuclear Club journal (in Russian), No. 1, 2011; Carlo A. Arcilla and Alfredo Mahar F. Lagmay, "Mothballed Philippine Nuclear Power Plant – Some Postmortem, Perspectives," *National Institute of Geological Sciences*, University of the Philippines, Quezon City; and Junaid Razvi, "A New Multipurpose 10 MW TRIGA for Thailand," TRTR 1997 Session Proceedings.

TABLE 2. RESEARCH REACTORS IN SOUTHEAST ASIA

Country	Location	Supplier	Type/ Name	Power	First Criticality	Status
Indonesia	Center for Nuclear Techniques Research *Bandung*	General Atomics, USA	TRIGA Mark II, BANDUNG	2000 kW 1000 kW 250 Kw	2000 1971 1964	Temporarily shutdown*
	Center for Accelerator and Material Process Technology *Yogyakarta*	General Atomics, USA	TRIGA Mark II, KARTINI-PTAPB	100 kW	1979	Operational
	Center for Research of Science and Technology *Serpong*	Interatom/ Siemens, Germany	Multipurpose Research Reactor, MTR, GA SIWABESSY MPR	30 MW	1987	Operational
Malaysia	Malaysian Institute for Nuclear Technology *Kuala Lumpur*	General Atomics, USA	TRIGA Mark II, TRIGA PUSPATI (RTP)	1000 kW	1982	Operational**
Philippines	Philippine Nuclear Research Institute *Quezon City*	General Atomics, USA	TRIGA Mark III (before conversion – PRR-1)	3000 kW 1000 kW	1988 1963	Decommissioning since 2005
Thailand	Thailand Institute of Nuclear Energy *Bangkok*	General Atomics, USA	TRIGA Mark III, TRR-1/M1 (before conversion - MTR)	2000 kW 1000 kW	1977 1962	Operational
Vietnam	Institute of Nuclear Research *Dalat*	Atomenergoexport, USSR General Atomics, USA	VVR-M, IVV-9*** (before reconstruction - TRIGA Mark II)	500 kW 250 kW	1983 1963	Operational
	Nuclear Science & Technology Centre, *near Hanoi*	Atomstroyexport, Russian Federation	IRT-10	10 MW	2015-2016 (expected)	Negotiations of contract details

Notes:

* Due to control rod problems, the Bandung reactor was temporary shutdown. According to a BAPETEN official, the reactor will probably be decommissioned, even though its operational license does not expire until 2015. As of December 2011, no final decision regarding the future of the reactor had been made. In order to replace this research reactor, Indonesian authorities could build a new one, possibly at a new site. According to some sources inside Indonesia, the necessary spending for the project has already been approved. The choice of the site for the new reactor will be based on, among other things, the location's proximity to the domestic consumers of isotopes, and to transport facilities available for the exports of short-lived isotopes.

** According to one Malaysian official, Malaysia plans to decommission this reactor and construct a new research reactor in the coming years.

*** The Soviet designed core was integrated into the infrastructure of the U.S.-made TRIGA research reactor. The undismantled components of the former reactor include the reactor aluminum tank, the concrete shielding, the graphite reflector, the beam tubes, and the thermal column; new components include the reactor core, the cooling system, and the reactor control system. For more details see Pham Van Lam and Pham Hoai Phuong, "The Preparation and Progress for the Decommissioning Plan of the Dalat Nuclear Research Reactor," Workshop on the IAEA Review of a Decommissioning Plan under the Research Reactor Decommissioning Demonstration Project (R^2D^2P), Bucharest-Magurele, Romania 4–8 July 2011, p. 3.

Sources: IAEA Research Reactors Database (RRDB); Corazon C. Bernido, "International Research Reactor Decommissioning Project," Excerpts from the Paper presented at the American Nuclear Society Meeting: DD&R 2007, Chattanooga, Tennessee, USA, September 2007; TRIGA Research Reactors, International Installations, General Atomics Electronic Systems website, http://www.ga-esi.com/triga/about/install_inter.pdf; Pham Van Lam and Pham Hoai Phuong, "The Preparation and Progress for the Decommissioning Plan of the Dalat Nuclear Research Reactor,"
Workshop on the IAEA Review of a Decommissioning Plan under the Research Reactor Decommissioning Demonstration Project (R^2D^2P), Bucharest-Magurele, Romania, 4-8 July 2011; C. Tippayakul, and D. Saengchantr, "Fuel management methodology upgrade of Thai Research Reactor (TRR-1/M1) using SRAC computer code," International Conference on Research Reactors: Safe Management and Effective Utilization, 5-9 November 2007, Sydney, Australia; and project researchers interview with Indonesian officials, December 2011.

TABLE 3. HEU IN SOUTHEAST ASIA

Country	Quantity, U-235	Form	Use	Status
Indonesia	Gram quantity	HEU targets, 93% U-235	Between 1996 and 2008, Indonesia produced Mo-99 from HEU fission product mainly for domestic consumption, and for export to Bangladesh and Malaysia.	Since 2008, Indonesian reactors have produced Mo-99 from LEU foil target, as part of the U.S. Reduced Enrichment for Research and Test Reactors Program (RERTR). HEU irradiated targets were repatriated to the United States.
Philippines	3 kg	Nuclear fuel for research reactor, 93% U-235	The U.S. shipped a total of 3,3 kilograms of HEU to the Philippines in 1967. The material was for use as a fuel in the Philippines Research Reactor (PRR-1).	The HEU was returned to the United Sates (SRS, Aiken, SC) in April 1999 as part of Removed U.S. DOE Foreign Research Reactor Spent Nuclear Fuel Acceptance (FRRSNF) Program.
Thailand	5 kg	Nuclear fuel for research reactor, 90% U-235	The U.S. shipped 5,3 kilograms of HEU to Thailand in 1962. The material was for use in the TRR-1/ M1 TRIGA Mark III research reactor.	The HEU was returned to the United States (SRS, Aiken, SC) in April 1999 under FRRSNF program.
Vietnam	N/A	Nuclear fuel for research reactor, Enrichment N/A	The U.S. shipped an unknown quantity of HEU to Vietnam in 1963-1967. The material was for use in the Dalat Nuclear Research Reactor (DNRR).	In April 1975, shortly before the end of U.S. involvement in Vietnam, the fresh and irradiated HEU-nuclear fuel was shipped back to the United States.
	5.3 kg	Nuclear fuel for research reactor, 36% U-235	With Soviet assistance, Vietnam reconstructed the DNRR in the early 1980s. The first criticality of the reconstructed reactor was achieved on 1 November 1983. The core was loaded with VVR-M2 fuel assemblies with 36% enrichment.	4.3 kg of fresh HEU-fuel (about 1,4 kg of U-235) was returned to Russia in September 2007. The reactor was fully converted for LEU use by December 2011. Repatriation of irradiated HEU-fuel is scheduled for late 2013 as part of a joint U.S., Russian and IAEA Program on Russian Research Reactor Fuel Return (RRRFR).

Sources: Budi Briyatmoko, et al, "Indonesia's Current Status For Conversion Of Mo-99 Production To LEU Fission," 29th International Meeting on Reduced Enrichment for Research and Test Reactors (RERTR), 23-27 September 2007, Prague, Czech Republic; J. E. Matos, "Foreign Research Reactor Irradiated Nuclear Fuel Inventories Containing HEU and LEU of United States Origin," Argonne National Laboratory, December 1994; Global Threat Reduction Initiative, "Foreign Research Reactor Spent Nuclear Fuel Shipments" U.S. Department of Energy, update as of December 7, 2004; *Preventing Nuclear Dangers in Southeast Asia and Australasia*. IISS, 2009. p. 151; Luong Ba Vien, "Operation Status of Dalat Nuclear Research Reactor, and Decommissioning Planning," Technical Meeting on the Research Reactor Decommissioning Demonstration Project: Transition Phase, Sydney, Australia, 12–16 November 2007; and project researchers interview with Vietnamese officials, Hanoi, December 2011.

TABLE 4. Southeast Asia Countries Nuclear Plans*

Country	Proposed Power Reactors (based on officially announced plans)	Plan Regulations	Fukushima Impact	Comments
Indonesia	**4 units by 2024 (4,200 MW)** The construction work for the first unit was originally expected to start in 2010, with operations beginning in 2016.	Presidential Decree #5/2006 of National Energy Policy; Act No. 17 of 2007 of Long-Term National Development Plan of Indonesia for 2005 to 2025.	There were no officially announced changes in country plans for nuclear energy development. Officials say that Indonesia's future plants would use technology far more advanced than that of the Fukushima plant built in the 1970s. However, Indonesian President Susilo Bambang Yudhoyono has provided a somewhat pessimistic outlook on nuclear power in Indonesia and public opinion polls show that the Fukushima incident has negatively impacted views on nuclear power in Indonesia.	With site selection not finalized, construction yet to start, a skeptical president, and increasingly negative public attitude towards nuclear power, it is very likely that plan implementation will be delayed at least 5 to 10 years, i.e. no operational nuclear power plants before 2021.
Malaysia	**2 units by 2022 (2,000 MW)** The Malaysian government should make a final decision on developing nuclear energy by 2013. Authorities will base the decision on a review by the Nuclear Power Development Steering Committee (JPPKN) and three Working Committees. If approved, the first unit could be operational in 2021.	Governmental Decision on June 26, 2009 to consider nuclear energy as one of the options for electricity generation post 2020. On July 16, 2010, Government adopted national nuclear policy. National Nuclear Power Infrastructure Plan to be prepared in 2012.	Kuala Lumpur has not officially changed its related policies, although on March 17, 2011 Malaysia's Energy, Green Technology and Water Minister Peter Chin Fah Kui noted that no final decision to introduce nuclear energy will be made by the Government until the Malaysian Nuclear Agency releases its full report on the Fukushima accident.	If Kuala Lumpur chooses to build a power reactor, Malaysia could overtake Indonesia and become the second country in the region after Vietnam to construct a NPP.
Myanmar	**None**	According to a Myanmar Foreign Ministry statement from June 11, 2010, authorities suspended nuclear research development plans due to inadequate resources and concern about possibly misunderstandings in international community.	None apparent.	Myanmar plans to further develop nuclear technologies is unclear. Considering the following factors - a) the decision of national government to export uranium (which is a byproduct of gold ore mining) to China, b) general lack of qualified personnel and expertise, and c) announced in 2010 a decision to halt the development of a nuclear research program - Myanmar possible nuclear power plant operation appears highly unlikely before 2030.

Country	Proposed Power Reactors (based on officially announced plans)	Plan Regulations	Fukushima Impact	Comments
Philippines	**None** No official plan to construct a new nuclear power plant or to finish Bataan nuclear power plant.	--	Fukushima appears to have sidelined a proposal to activate the shelved Bataan plant due to due to potential problems with meeting up-to-date safety standards.	Due to a set of reasons (no adequate funding and expertise, lack of public support), it is very unlikely that Philippines will have an operational nuclear power plant before 2030.
Singapore	**None** Singapore has not ruled out the option of using nuclear power as part of its energy diversification strategy. No plan to construct a nuclear power plant has been officially approved.	--	It is very unlikely that exotic/not-proven technology, like underground nuclear power plant, will be considered in Singapore after Fukushima, which was the case until recently.	Due to the size of the country (50km x 25km) it is very unlikely that nuclear energy will be introduced in Singapore in the foreseeable future. Singapore could however become part of a nuclear power plant project in neighboring countries (Malaysia, Indonesia) in the future.
Thailand	**4 units by 2030 (4,000 MW)** Construction of the first NPP was expected to start in 2014. First two units could be operational by 2020; next two by 2021.	Thailand's Power Development Plan 2010-2030 approved by Thai Government in 2010.	Thai government decided in April 2011 to delay for 3 years start of NPP plan implementation.	Due to the three year delay, it is unlikely that Thailand will operate a nuclear power plant before 2023. Thailand's implementation of its development plan will likely depend significantly on how its neighbors proceed with introducing nuclear electricity generation.
Vietnam	**6 units by 2025 (6,000 MW)** Vietnam's first two units will be built with the assistance of Russia, followed by two more with Japanese technology. The first unit is to be operational by 2020. 6,000 MW of nuclear electricity generation are expected by 2025; 10,700 MW by 2030.	Prime Minister Decisions on Approval of National Master Plan for Power Development for 2011–2020 period with the Vision to 2030 (Decision No. 1208, dated 21 July 2011), Approval of Direction for NPP Development Plan up to 2030 (Decision No. 906, dated 17 June 2010) and on Approval of Master Plan for Peaceful Utilization of Atomic Energy up to 2020 (Decision No. 957, dated 24 June 2010)	There were no officially announced changes in country plans for nuclear energy development. However, Hanoi introduced more stringent safety requirements to imported reactor technologies and sites for the future NPPS.	Vietnam is becoming the regional leader in the peaceful use of nuclear technology. Most likely it will be the first in Southeast Asia to operate a nuclear power plant shortly after 2020.

* Brunei Darussalam, Cambodia, and Laos have not publicly shown interest in construction of nuclear research or nuclear power reactors in the near future.

Sources: "Press Statement of the Ministry of Foreign Affairs on the Unfounded Allegations against Myanmar regarding the Nuclear Program," Myanmar Ministry of Foreign Affairs, Nay Pyi Taw, 11 June 2010; Goncharuk Artyom, "Outlook for Nuclear Energy in ASEAN Countries," Nuclear Club Journal, No. 2, 2011; Peimani Hooman, "Nuclear Energy in Asia: A Post-Fukushima Perspective," *Journal of Energy Security*, May 2011; Presentation by Vietnamese delegation, International Conference on Safety, Security and Safeguards in Nuclear Energy, 1–2 September 2011, Bangkok, Thailand; S. Biramontri, "Thailand and Nuclear Non-Proliferation," 11th International Export Control Conference, 8–10 June 2010,

Kyiv, Ukraine; Matsuo Yuji, et al, "An Outlook for Introduction of Nuclear Power Generation in Southeast Asian Countries," Institute of Energy Economics Japan (IEEJ), 2008, http://eneken.ieej.or.jp/en/data/pdf/456.pdf; Alwin Chew, "Underground Nuclear Power Plant: What Not?" RSIS Commentaries, 4 March 2009; Le Doan Phac, Vietnam Atomic Energy Agency (VAEA), "Vietnam's Nuclear Power Development Plan Challenges and Preparation Work for the First Nuclear Power Projects," presentation at the INPRO Dialogue Forum on Nuclear Energy Innovations: Common User Considerations for Small and Medium-Sized Nuclear Power Reactors, 10-14 October 2011, Vienna, Austria; and project researchers interview with Vietnamese officials, Hanoi, December 2011.

TABLE 5: USE OF RADIOACTIVE SOURCES FOR NON-ENERGY PRODUCTION PURPOSES IN SOUTHEAST ASIA

Applications	Brunei	Cambodia	Indonesia	Laos	Malaysia	Myanmar	Philippines	Thailand	Singapore	Vietnam
Irradiators	N/A	N/A	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Nuclear medicine	N/A	N/A	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Radiodiagnostic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Radiotherapy (Teletherapy, Brachytherapy, eye applicator)	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cyclotron Facility	N/A	N/A	Yes	N/A	Yes	N/A	Yes	Yes	Yes	Yes
Industrial radiography (NDT)	Yes	Yes	Yes	N/A	Yes	N/A	Yes	Yes	Yes	Yes
Industrial gauges (Well logging/moisture gauges)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Research reactor	No	No	Yes	No	Yes	No	Yes*	Yes	No	Yes
Neutron generator/Isotope production	N/A	N/A	Yes	N/A	Yes	Yes	Yes	Yes	Yes	Yes
Waste storage facility	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

*Philippines has research reactor but not in operation. Slightly irradiated fuel rods remain on the PRR-1 reactor site (as of 2009).
N/A = Information not available.

Sources: "Radioactive Waste Management Profiles No.8," IAEA, 2007, http://www-pub.iaea.org/MTCD/publications/PDF/rwmp-8.pdf; "Country Indicators," World Health Organization, http://www.who.int/; Department of Medical Services, Brunei Ministry of Health website, http://www.moh.gov.bn/medhealthservices/ripas.htm; "HSE Standard: Module 20 Ionising Radiation Safety," Brunei Shell Petroleum Company Sendirian Berhad, https://www.bsp.com.bn/; Presentation by Dr. Chhun Vannak, Deputy Director-General for Inspection, Ministry of Environment of Cambodia at International Conference on Safety, Security, and Safeguards in Nuclear Energy, Bangkok, Thailand, September 1 – 2,2011; As Natio Lasman, Indonesian Nuclear Energy Regulatory Agency, "Trends and Challenges in Nuclear Safety, Security and Safeguards in Indonesia," International Conference on Safety, Security, and Safeguards in Nuclear Energy, Bangkok, Thailand, 1-2 September 2011; Forum for Nuclear Cooperation in Asia, FNCA Consolidated Report on RWM, http://www.fnca.mext.go.jp; IAEA Department of Nuclear Energy, Country Nuclear Power Profiles, http://www-pub.iaea.org/; Presentation by Dr. Sourioudong Sundara, Lao Ministry of Science and Technology, "Trends and Challenges in Nuclear Safety Security Safeguards in Lao PDR," International Conference on Security, Safety and Safeguards in Nuclear Energy, Bangkok, Thailand, 1-2 September 2011; "Nuclear Safety, Security and Safeguards in Myanmar," International Conference, 1-2 September, 2011, Bangkok Thailand; "Tackling Nuke Waste in Singapore's Backyard," 21 April 2011, http://www.eco-business.com/news/tackling-nuke-waste-in-singapore-backyard/.

NUCLEAR SECURITY CHALLENGES IN SOUTHEAST ASIA

Due to the increased flow of nuclear materials and radioactive sources in the region, the development of robust nuclear security capabilities in Southeast Asia is critical. Among the key challenges for nuclear security in the region are the high level of terrorist activity, weak maritime security, insufficient border and export controls, and scarcity of adequately trained and supported human resources.

Terrorism

A number of terrorist groups and networks, such as Jemaah Islamiyah (JI) and Abu Sayyaf, remain active in Southeast Asia and are connected to influential terrorist groups beyond the region. Although these non-state actors have shown little direct interest in nuclear or radiological terrorism, the chance that a terrorist group could try to get access to sensitive materials from nuclear facilities in the region cannot be ignored. In spite of the fact that there are few known incidences of radioactive theft in the region, there is a clear need for strengthened nuclear security as nuclear power development and non-energy application of nuclear technology continues to grow in Southeast Asia. Apart from material protection, regional actors have also given increasing attention to emergency preparedness and response capacity with regard to nuclear and radiological materials, indicating the increased concerns that authorities have about potential malicious use of these materials.

Weak Maritime Security

Maritime security is another major issue in Southeast Asia, given the long coastlines in many states, the persistence of piracy in the Strait of Malacca, and the expansion of terrorist networks in the region, some of whom have significant maritime capabilities and connections.[1] Weak maritime security may ultimately have a negative effect on nuclear security by facilitating the illicit transportation of nuclear and radiological materials. Regional authorities have noted that the issue of maritime security is not only pertinent to international transfer of cargo and materials, but also to domestic transfers. In archipelagic countries made up of countless islands, such as Indonesia, the Philippines, and Malaysia, the control of maritime transfers within national borders is as critical as international transfers.

Insufficient Border and Export Controls

A lack of strong border and export controls makes states in the region prime targets for illicit trafficking networks, with trafficking in arms, drugs, and people a considerable problem in the region. In discussions with regional authorities, clear concerns were raised about countries in the region becoming illicit trafficking hubs and mechanisms meant to avoid this were highlighted as important areas of cooperation for regional actors. A foiled

[1] See for example Catherine Zara Raymond, "Maritime Terrorism in Southeast Asia: A Risk Assessment," *Terrorism and Political Violence*, Spring 2006, pp. 239-257.

2003 attempt to sell a Cs-137 source in Thailand, which smugglers had routed through Laos, illustrates the potential for illegal transfer of nuclear materials in the region and the types of challenges regional authorities face. The AQ Khan network's past activities in the region are well documented; the network had links to or was active in a number of Southeast Asian countries, including Indonesia, Malaysia, and Singapore. The activities of the Khan network, as well as more recent trafficking efforts coordinated from Iran and North Korea, illustrate continued weaknesses in the regional strategic trade control systems.[2] While countries like Malaysia and Singapore have made strides in improving their systems, other regional players have been slow to respond. As nuclear power development continues to grow in the region, so too does the flow of dual-use technologies and the need for controlling their transfer by establishing proper trade control enforcement. States in the region that continue to ignore the need to increase their strategic trade management capacity are likely to be negatively impacted economically as major supplier countries place increasing importance on the issue of trade security.

Although dual-use controls are still weak in the region, nuclear and customs authorities have recognized the need to strengthen detection capacities for nuclear and radiological materials. Most countries in the region with a nuclear energy program or with significant amounts of non-energy related nuclear technology or materials have developed some level of radiological detection capacity at their ports of entry or exit. However, many customs and nuclear authorities feel their capabilities in this area are severely limited due to capital constraints and lack of proper equipment.

Scarcity of Adequately Trained and Supported Human Resources

In addition to the detection of nuclear and radiological materials, investigative and response capabilities (including both traditional law enforcement and technical areas such as forensics) need to be developed in the region, and training of officials on these issues should accompany initiatives aimed at infrastructure development.[3] According to a 2008 report, personnel at Indonesia's National Atomic Energy Agency (BATAN), one of the most developed authorities in the region responsible for peaceful use of nuclear energy, "often take on another job to supplement their salaries."[4] This highlights the problem of the under-resourcing of human capital in the region, and increases exposure to potential risks. During discussions with multiple regional experts, the issue of human capacity and inadequate training was consistently highlighted as a major challenge for nuclear security

[2] See segment regarding AZ Technologies and an illicitly routed shipment to Iran that used Malaysia as a transshipment point in "Made in the USA in Iran," video broadcast 14 February 2010, on "60 Minutes", CBS Network (USA), http://www.cbsnews.com/video/watch/?id=6207595n&tag=related;photovideo. Illicit WMD-related procurement directed from North Korea have involved Malaysia and Myanmar as transit points or destinations. See Lieggi et al, "Taking Control: Stopping North Korean WMD-related Procurement," *Bulletin of the Atomic Scientists,* September/October 2010, pp. 21-34.

[3] "Philippine Statement by Honorable Mario G. Montejo, Secretary of Science and Technology, Republic of the Philippine on the Occasion of the High Level Meeting on Nuclear Safety and Security," issued by the Philippine Mission to the United Nations, 22 September 2011.

[4] *Preventing Nuclear Dangers in Southeast Asia and Australasia,* IISS Strategic Dossier (September 2008).

in the region as well as a potentially important area for cooperation with international partners.[5]

The pervasiveness of corruption in the region could have a negative impact on creating an effective nuclear security framework and culture. Corruption in the region is often linked with inadequate pay for public officials and lack of resources to combat the problem. The issue significantly affects the regulatory agencies that interact with the public; customs agencies are also notoriously open to graft.[6] If anti-corruption efforts currently underway in many countries—including nuclear energy aspirants such as Indonesia—are successful in curbing the practice, it is likely to strengthen nuclear security in the region.

Three Case Studies: Indonesia, Vietnam and Myanmar

To better understand the challenges mentioned above—and progress at the state-level to address them—examination of three states in the region are presented below.

Indonesia

Indonesia has made considerable progress in the area of nuclear safety; both the National Atomic Energy Agency (BATAN) and the Nuclear Energy Regulatory Agency (BAPETEN) have worked closely with the IAEA on issues related to nuclear safety and safeguards. Until recently, Indonesian authorities have given much less attention to the issue of nuclear security, although some work in this area has started and is expected to expand.

Since 2007, Indonesia has been upgrading its regulatory framework, developing new rules and regulations on the safety and security of radioactive sources, physical protection, and emergency preparedness and response.[7] Indonesia is also involved in the Nuclear Security Summit process and is acting as chair for the working group looking at model legislation. However, little interagency cooperation appears to have occurred with regard to the summit, and Indonesia's nuclear authorities have not been regularly included in the discussions. This highlights the overarching issue of lack of coordination between the technical and policy-making agencies in Indonesia, an issue seen by nuclear authorities as an ongoing challenge in the domestic system.[8]

Institutional Framework

[5] Discussions and presentations from the International Workshop on Prospects for Nuclear Security Partnership in Southeast Asia, Vienna, Austria, 31 October 2011.
[6] Jon S. T. Quah, "Curbing Asian Corruption: An Impossible Dream?," *Current History,* April 2006, http://iis-db.stanford.edu/pubs/21128/Corruption_article_in_CH.pdf.
[7] Presentation by BATAN official, "Practices on Physical Protection and International Cooperation: Indonesia's Plans and Challenges," at International workshop on Prospects for Nuclear Security Partnership in Southeast Asia, Vienna, Austria, 31 October 2011
[8] Project researchers interview with Indonesian officials, February 2011.

A small cadre of officials from the BATAN and BAPETEN are beginning to pay increasing attention to nuclear security, largely due to concerns about terrorism and trafficking. Currently, Indonesia has an interagency group working on nuclear security issues, which includes BAPETEN, BATAN, and the Indonesian State Intelligence Agency (Badan Intelijen Negara, or BIN). This group creates the Design Basis Threat (DBT) that is then localized for each nuclear site.[9] According to an official from BATAN, the DBT is an essential part of the nuclear security evaluation process; concerns about the "insider" threat are very prominent in these assessments. The DBTs, which consider intelligence data related to terrorist and non-state actor activities, among other data points, are reviewed every two years.

Despite the interest placed on the issue by BATAN and BAPETEN, lack of sufficient resources and attention from policy-making organs, including the Foreign Ministry, hamper efforts to improve Indonesia's nuclear security infrastructure. These policy-making agencies remain skeptical of the need for major changes in the areas of nuclear security and related- UNSCR 1540 implementation, and see these issues as having a lower priority relative to other domestic and international security concerns.[10]

Both BAPETEN and BATAN are undertaking efforts to develop a nuclear security capacity and culture within the nuclear sector; activities include regular security drills at nuclear facilities, particularly research reactor sites. The scenarios used in these drills include cases of sabotage from insiders and are usually based on the most recent threat assessments. BAPETEN also holds special training programs on physical protection for its inspectors as well as programs for the staff at nuclear facilities.[11] Guards at the main BATAN facility have conducted annual joint counter-terrorism training with police and military response forces. Further, Nuclear authorities have recently upgraded security procedures based on the IAEA's International Physical Protection Advisory Service (IPPAS) review of Indonesia's facilities.

In the last few years, Indonesia's production of radioisotopes has increased and has become an area of export growth, with licensing of these exports controlled by BAPETEN. The latter is also responsible for assuring the security of radioactive sources and physical protection, and it regulates the industries working with these materials. A 2001 mission from IPPAS praised Jakarta's efforts to bring the nuclear industry in Indonesia into line with internationally recommended physical protection practices.[12] Indonesia's current regulatory framework includes rules based on international standards such as the IAEA's Code of Conduct on the Safety and Security of Radioactive Sources (and supplementary Guidance on the Import and Export of Radioactive Sources) and the Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/Rev.4

[9] Project researcher's interview with Indonesian officials, February 2011, and presentation by BATAN official, 31 October 2011. For more general information on Design Basis Threats see http://www-ns.iaea.org/security/dbt.asp?s=4.
[10] Project researcher's interview with Indonesian officials, February 2011.
[11] Project researcher's interview with BAPETEN official, Jakarta, February 2011.
[12] M. Ridwan, "Physical Protection of Significant Radioactive Sources: An Indonesian Perspective," Proceedings of an International Conference on Security of Radioactive Sources, Vienna, March 2003.

(corrected)).[13] However, concerns have been raised about the potential customers for Indonesia's radioisotopes, which appear to include countries without solid domestic regulatory capacity, including Myanmar.

Indonesian industry's high volume production of radiological materials raises questions regarding the security of radioisotopes and the possibility that non-state actors could use such materials in the construction of a radiological dispersal device (RDD). Indonesia has had an unfortunate history of violent terrorist attacks and the existence of known terrorist networks in the region increased concerns about these or other groups gaining access to sensitive materials through Indonesia's radiological industry.[14]

1540 Reporting

Indonesia submitted its reports to the UNSCR 1540 Committee in 2004 and 2005. In these reports, Jakarta did not request assistance for 1540 implementation and in other fora has appeared skeptical about the need for extensive trade controls.[15] Indonesian officials have generally argued that the country does not produce sensitive dual-use materials items and thus it would be detrimental to Jakarta's trading position for Indonesia to establish strict controls on exports.[16]

While it is true that Indonesia's current production of sensitive dual-use materials is limited, this is likely to change as the country's industrial base expands. Some officials within Jakarta's policy-making structure recognize that securing sensitive trade is important for overall trade facilitation.[17] These officials tend to come from agencies such as the Ministry of Trade or the nuclear agencies BATAN and BAPETEN. However, there is still consistent resistance from the Foreign Ministry, based to some extent on a historical distrust of nonproliferation-related supplier regimes and on disapproval at the way in which the 1540 mandate came about.

Export and Border Controls

Indonesia faces several major challenges in detecting intentional and inadvertent unauthorized movement of nuclear and other radioactive materials. Indonesia is an archipelago consisting of over ten thousand islands; as such, the country consists of an extremely abundant number of ports, which makes the prevention of illegal movement of

[13] As noted within a presentation obtained from BAPETEN officials, relevant domestic regulations include: *GR No. 33/2007 on the Safety of Ionizing Radiation and Security of Radioactive Sources*, which regulates general requirements on the security of radioactive sources, including obligations in regard with import and export of radioactive sources; *CR No. 07/2007 on the Security of Radioactive Sources*, which "regulates detailed requirements on the security of radioactive sources, including categorization of radioactive sources"; and *CR No. 01/2009 on the Physical Protection of Nuclear Material and Nuclear Facilities.*

[14] "Indonesia," *Nuclear Strategic Concern*, http://www.sipri.org/; and *Preventing Nuclear Dangers in Southeast Asia and Australasia*, IISS Strategic Dossier (September 2008).

[15] Project researchers interview with Indonesian officials, February and June 2011.

[16] Project researchers interview with Indonesian Foreign Ministry officials, February and June 2011.

[17] Project researchers interview with officials from the Indonesian Ministry of Trade and BATAN, February 2011.

radioactive material, both in regards to both domestic and international trade, extremely difficult.

The legal structure that regulates Indonesia's external trade is a patchwork of rules, most unrelated to concerns about WMD proliferation. Indonesian officials noted in a presentation to the International Export Control Conference in 2008 that Jakarta was considering the creation of a comprehensive law on export controls. This move would likely be assisted by export/import reporting requirements set forth in Indonesia's Additional Protocol. However, recent discussions with Indonesian officials indicated that no progress has been made on a comprehensive law.

Indonesia has porous, difficult to control borders and inadequate port management capabilities. Customs officials are also not well equipped to control cross border trade, especially with regard to exports. Corruption also remains an issue in Indonesian ports of entry and exit.[18] Industry outreach is also significantly impeded by the lack of interagency coordination and, in some cases, tension between agencies. The agencies dealing with strategic trade control issues appear to be waiting for the Ministry of Trade to assume more responsibility before pushing forward with internal activities. The Ministry of Trade has played the role of export licensing authority for materials such as explosives and other controlled materials, but no regulations currently exist to allow for the establishment of an effective licensing system for sensitive dual-use materials.

According to Indonesian Customs, controlling the export of sensitive materials is not a priority for their agency.[19] The export licenses that Customs look at deal mainly with issues outside the realm of WMD proliferation, such as wildlife, and items related to narcotics and explosives. Indonesia's customs agency recently created a customs targeting systems largely based on the U.S. national targeting system. A major difference between the U.S. and Indonesian system is that the latter system looks solely at incoming materials—dual-use exports are not tracked by the system.

Although trade controls are not widely represented in the Indonesian legal system, Jakarta has legislation that criminalizes the use of WMD. In particular, Indonesia's Anti-Terrorism Law (No. 15/2003) prohibits the use of WMD-related materials for the purpose of terrorism. Other anti-terrorism activities in Indonesia have contributed positively to Jakarta's ability to secure trade and sensitive materials. For instance, as part of its aim to secure trade through the Secure Trade in the APEC Region (STAR) initiative, Indonesia has implemented a number of efforts aimed at managing sensitive trade, including the

[18] "Realigning bonded zones," *Jakarta Post*, 24 January 2012, http://www.thejakartapost.com/news/2012/01/09/realigning-bonded-zones.html. As noted by the editors of the *Jakarta Post*, Indonesian Customs is considered by the domestic audience to be "one of the most corrupt public institutions." See also "KPK's Shock Therapy At The Port Awaited: Tariff Games Become Increasingly Crazed," *Suara Pembaruan* via Indonesia Infrastructure Initiative website, http://www.indii.co.id/news_daily_detail.php?id=1836; and "Investors urge KPK to quash bribery at Batam port," *Jakarta Post*, 23 June 2009, http://www.thejakartapost.com/news/2009/06/23/investors-urge-kpk-quash-bribery-batam-port.html.

[19] Project researcher's interview with Indonesian Customs officials, Jakarta, February 2011.

creation of a Border Control Management system.[20] Indonesia has also been implementing the World Customs Organizations (WCO) SAFE Framework and Customs has had some related training on dual-use issues.

Currently only the ports of Tanjung Priok (Jakarta), Tanjung Perak (East Java), Batam Port (Riau Islands) and Belawan (North Sumatra) have radiation portal monitors. However, in connection to the 2012 Nuclear Security Summit, Indonesia's leadership announced that more ports will see this equipment installed in the near future.[21]

Human Resources

A number of recent studies have pointed out that an ageing, underfunded pool of experts in the nuclear sector is a serious concern– both for safety and security reasons. Nuclear authorities appear to recognize this problem, as well as the need for increased training directly related to nuclear security. Indonesia's nuclear authorities have created a training scheme that singles out key positions within the relevant facilities and structures instruction based on the needs of the position. For instance, according to the scheme, reactor operators, heads of laboratories, and top security professionals would receive intensive training on physical protection and security management. Other personnel, including technical personnel and facility guards would receive basic training on these issues, while facility managers and support staff would receive training aimed at raising awareness to these issues related to nuclear security.[22]

Vietnam

Hanoi has expressed interest in cultivating a robust nuclear security capacity and culture, reflecting Vietnam's support for responsible nuclear energy development. Discussions with Vietnamese officials from agencies relevant to nuclear security indicated that the country's efforts in these areas are indeed serious and that officials are giving it a fair degree of prioritization. Vietnam participated actively in the 2010 Nuclear Security Summit in Washington, DC. At the summit, the delegation from Hanoi pledged to convert its Dalat Nuclear Research Reactor from HEU to LEU. Vietnam recently join the Russia-U.S.-led Global Initiative to Combat Nuclear Terrorism. Vietnam has also expressed some interest in participating in the PSI or similar activities, and has observed some PSI exercises.

At the 2012 Nuclear Security Summit, South Korean and Vietnam announced a pilot project supported by the IAEA, which would established a real-time tracking system for

[20] See also Indonesia's "APEC Counter-Terrorism Action Plan," on the APEC website at http://www.apec.org/Groups/SOM-Steering-Committee-on-Economic-and-Technical-Cooperation/Task-Groups/~/link.aspx?_id=6B7B2BAA018C48A98F733314CF7CA193&_z=z.
[21] Bagus BT Saragih, "Govt expands nuclear monitoring at major ports," *Jakarta Post*, April 3, 2012. http://www.thejakartapost.com/news/2012/04/03/govt-expands-nuclear-monitoring-major-ports.html
[22] Presentation by BATAN official, "Practices on Physical Protection and International Cooperation: Indonesia's Plans and Challenges," at International Workshop on Prospects for Nuclear Security Partnership in Southeast Asia, Vienna, Austria, 31 October 2011.

radiological materials in Vietnam. The project would use a GPS-based system developed by the Korean Institute for Nuclear Security (KINS).[23] The aim of the pilot project is to improve the ability of states to ensure the physical protection and transport security of radioactive materials.

Institutional Framework

The legal infrastructure for Vietnam's nuclear power program includes:

- the National Master Plan for Power Development for 2011–2020 with the Vision to 2030 (approved by the Prime Minister on 21 July 2011);
- the Direction for NPP Development Plan up to 2030 (approved by the Prime Minister on 17 June 2010);
- the Master Plan for Peaceful Utilization of Atomic Energy up to 2020 (approved by the Prime Minister on 24 June 2010); and
- the 2009 Atomic Energy Law.

Vietnam also has a number of laws regulating radioactive sources and related safety issues.[24] Those familiar with Vietnam's legal system have noted that Hanoi still needs to harmonize Vietnam's international commitments fully with its domestic laws. The Vietnamese government must still promulgate "sub-laws" to support implementation of the Atomic Energy Law; these "sub-laws" are needed to explain how to implement the law in the context of Vietnam's legal and governing system.

Hanoi continues to need technical assistance in building its legal framework.[25] In the fall of 2011, the Vietnamese Ministry of Science and Technology approved a new circular governing the choice of NPP sites. The regulations were developed in cooperation with Russian, Japanese, and IAEA specialists, and took Vietnam Agency for Radiation and Nuclear Safety (VARANS) two years to complete.[26] Dozens of other pieces of nuclear regulation will have to be produced in a relatively short timeframe. The issue has

[23] See "ROK, Vietnam and the IAEA to Pilot Radioactive Source Tracking System," Press Release, 2012 Nuclear Security Summit website, 27 March 2012, http://www.thenuclearsecuritysummit.org/eng_media/press/press_view.jsp?oCmd=6&b_code=1&f_gubun=0&idx=294&rnum=11. KINS's RadLot system deploys specialized tracking devices radiological sources that provide both GPS-based location information as well as beacon emission capabilities to facilitate recovery. Korea Institute of Nuclear Safety, "Deployment of the Advance of Regulatory System: RadLot (Radiation Source Location Tracking System," http://www.kins.re.kr/english/deploy/dep_rsts.asp, accessed 21 July 2011; and Seong Ho, "National Regulatory Bodies and International Networks: Lessons Learned in Korea," 12th International Congress of the International Radiation Protection Association, Buenos Aires, 19-24 October 2008, available at http://www.irpa12.org.ar/special_sessions.php.

[24] See "Legal Documents," on the VARANS website at http://www.varans.vn/Default.asp?actType=1&menuup=105000&TypeGrp=1&menuid=105110&menulink=100000&menupage=.

[25] Discussions and presentations from the International Workshop on Prospects for Nuclear Security Partnership in Southeast Asia, Vienna, Austria, 31 October 2011

[26] Project researcher's interview with VARANS officials in Hanoi, December 2011.

highlighted the shortage of experienced specialists the Vietnamese nuclear regulator is facing.[27]

VARANS—previously the Vietnam Radiation Protection and Nuclear Safety Authority (VRPA)—has authority over much of the operational aspects of nuclear security. It reports to the Ministry of Science and Technology (MOST). Due to this structure, VARANS is not a truly independent regulatory body.[28] VARANS recognizes the need to consider a different framework for regulating nuclear development in Vietnam and officials from the agency say that various options are being studied as part of the work on the new nuclear energy law, which could replace the existing one in 2013. However, officials are concerned that restructuring could mean a loss of political influence, especially since the current VARANS director also holds the influential office of deputy science and technology minister.[29]

Relevant to its security-related efforts, VARANS has established a Technical Support Center for Radiation Protection and Emergency Response. When discussing the center, VARANS officials highlighted that the institution received over US$1 million in government funding, of which a certain portion was allocated to measures designed to counter illicit trafficking.[30]

The Vietnam Atomic Energy Commission (VAEC), also under direction of MOST, assists VARANS on performing technical radiation protection services such as calibration. More generally, VAEC's activities relate mainly to the research and development side of Vietnam's nuclear energy development, whereas VARANS has more of a regulatory responsibility.

Reflecting the steady advancement of Vietnam's nuclear energy development, VARANS has expanded its staff from 8 in 2005 to 45 in 2006 and to more than 90 in 2011 (comprised of 11 PhDs, 13 MSc's, and 66 engineers). VARANS continues to recruit scientists and technical specialists.[31] However, senior officials with VARANS express concern about the limited availability of personnel with multiple years of technical experience. Most of VARANS's staff members have only recently graduated from engineering/technical programs, and specialists with in-depth experience are scarce. The average VARANS staff member is less than 30 years old[32]. Competition from the private sector in recruiting skilled personnel is compounding this problem. Of more systemic concern, as voiced by one VARANS official, is the limited number of professors at Vietnam's technical universities with expertise in nuclear engineering; and most have not had any recent experience at nuclear facilities.

[27] Project researcher's interview with VARANS officials in Hanoi, December 2011.
[28] Project researcher's interviews in Hanoi, March 2011.
[29] Project researcher's interview with VARANS officials in Hanoi, December 2011.
[30] Project researcher's interview with VARANS officials in Hanoi, March 2011
[31] Project researcher's interview with VARANS officials in Hanoi, March 2011.
[32] Project researcher's interview with VARANS officials in Hanoi, December 2011.

In the near–term, Vietnamese authorities are expected to emphasize attention on rapidly training large numbers of specialists abroad, especially in Russia and Japan, the two countries set to supply reactor technology to Vietnam. Later, Vietnam will develop training programs domestically, based, among other things, on IAEA standards and recommendations. It will be important to train an indigenous cadre of instructors, equip the laboratories and develop the technological base for domestic nuclear training programs.[33]

An additional complication for the Vietnamese specialists training program is that the country has decided to diversify its reactor technology imports. VARANS will have to assign 30 specialists to oversee the operation of one nuclear energy reactor; 40 specialists will be required for two reactors of the same type. But if the two reactors are different designs, i.e. one Russian and one Japanese, some 60 specialists will be needed. The same principle applies to developing nuclear regulation.[34]

1540 Reporting

Vietnam has been diligent in submitting reports to the UNSCR1540 Committee, with National Implementation Reports sent in 2004, 2005 and 2008. The reports document what was an active period in the country's legal and regulatory framework development. In drafting the reports, Vietnamese authorities took care to update progress on ongoing measures. For example, while the 2004 report asserted that Vietnam "established a relatively adequate legal framework," the 2006 report observed that: "the related laws, regulations and measures … are resulting in positive outcomes and effects."[35]

Illustrating its interest in improving its 1540 implementation, Hanoi's 2005 report noted that Vietnam's General Department of Customs (GDC) required assistance with acquiring advanced equipment, such as cameras and detectors "to strengthen activities of controlling and overseeing goods; and special training for detecting, identifying and controlling weapons of mass destruction." Three years later, in the 2008 report, this request evolved into a list of five areas in which Vietnam's GDC sought assistance:

> "(i) A database system to keep track of those who exchange and sell weapons, and of terrorists; establish an up-to-date information technology system within and outside the Customs sector for compliance management, risk management and exchange of electronic data, so as to control most effectively the transport of WMD;
> (ii) Information on nonproliferation and terrorism prevention in general, and on transborder smuggling and transport of banned goods, and state crimes in particular;

[33] Project researcher's interview with VARANS officials in Hanoi, December 2011.
[34] Project researcher's interview with VARANS officials in Hanoi, December 2011.
[35] Annex to the note verbale dated 26 October 2004 from the Permanent Mission of Vietnam to the United Nations addressed to the Chairman of the Committee, Vietnam's first country report on the implementation of Security Council resolution 1540 (2004), S/AC.44/2004/(02)/39.

(iii) Opportunities to participate in conferences, exchange experience between Viet Nam Customs and Customs of other countries, and international organizations in the non-proliferation field;
(iv) Means to strengthen goods control and monitoring (such as video cameras, X-ray machines ...);
(v) Training in skills to detect, identify and control WMD and their related materials."[36]

In more recent discussions, GDC officials noted that some assistance had been received from the U.S. Department of Energy (DOE); however, Vietnam still required much of the requested equipment.[37]

Vietnam's 2005 and 2008 reports also expressed interest in receiving financial support for the translation of some of their key legal documents into English (in particular, the country's 2005 Law on Environmental Protection.) Another noteworthy element of Vietnam's 1540 reporting is the considerable emphasis in the 2004 report on measures to curb illicit transshipment of sensitive goods. For example, the report stated that the GDC will: "[d]evelop and maintain effective and suitable supervision measures…to discover, intercept and prevent the illegal transshipment of smuggled and forbidden goods, ammunition, explosive material and other toxic substances." While this emphasis becomes more muted in the 2005 and 2008 reports, Vietnam officials across multiple agencies express concern about the country being used by traffickers for the illicit transshipment of WMD-related dual-use goods or other controlled items.[38]

Export and Border Controls

Vietnam's export control system is improving, but questions remain over the degree to which Vietnamese authorities are successfully implementing and enforcing the domestic regulatory framework. From 2005 to 2008, the Vietnamese government issued decrees containing clear controls on certain exports. Notable among these are Decree No. 59/2006/ND-CP, covering select categories of commodities for export, and Decree No. 100/2005/NC-CP, which fully developed export controls specific to Vietnam's obligations under the Chemical Weapons Convention. Most significant for nuclear security is Vietnam's 2008 Atomic Energy Law, which contains provisions controlling the import and export of nuclear and radiological material.

Despite this increase of regulatory activity, Hanoi's system has not yet adopted the control lists of the multilateral export control regime, including the Nuclear Suppliers Group (NSG). While historical concerns regarding the fairness of such regimes are present within Vietnam's political culture, this deficiency appears also driven by

[36] Annex to the note verbale dated 7 March 2008 from the Permanent Mission of Vietnam to the United Nations addressed to the Chairman of the Committee Socialist Republic of Vietnam, Additional information to Vietnam's country reports on the implementation of resolution 1540 (2004) of the United Nations Security Council, S/AC.44/2007/12.
[37] Project researcher's interview with General Department of Customs officials in Hanoi, March 2011.
[38] Project researcher's interview with Vietnamese government officials, March 2011.

confusion surrounding the concept of "dual-use" – a key element of all the major nonproliferation export control regimes. Vietnamese officials across multiple agencies involved with export control expressed concern that understanding of this concept remains poor at the operational level of key implementing authorities.[39]

Vietnam does not have an overarching strategic trade control law, and discussions with Ministry of Industry and Trade's Department of Import and Export Management indicated that introduction of such legislation is not likely in the near-term.[40] As a partial consequence of this, the nonproliferation-related export control innovations designed to counter illicit trafficking networks, including catch-all, transshipment and brokering controls, have not been adopted fully within Vietnam's legal and regulatory framework.

Implementation of strategic trade controls is scattered across multiple agencies such as VARANS (export licensing authority for nuclear and radiological materials, plus related equipment); Vinachemia (export licensing authority for chemicals subject to Vietnam's CWC obligations) and MOIT (export licensing authority for "prohibited items", which include fairly broad categories such as munitions and antiquities). This has the advantage of drawing from the technical expertise associated with such agencies, but may also create gaps in export controls that could be exploited by enterprising traffickers. The GDC must authenticate the export licenses issued by all these authorities. Although the total number of these licenses is minimal—only 25 were issued in the year of 2010 by Vinachemia and none were issued by VARANS—one export control practitioner based in Vietnam expressed doubt over whether GDC possesses the technical capability to critically evaluate such licenses.[41]

Enforcement of export controls is recognized as an ongoing challenge by Vietnamese government officials from various agencies (notably MOIT, GDC, VARANS, and Vinachemia), as well as NGO observers. Vietnamese officials link this to the broader issue of industry awareness and self-regulation. Indeed, the key implementing agencies responsible for export controls highlight industry awareness as a priority area for improvement.

The GDC is responsible for the management and enforcement of border controls designed to prohibit illicit imports and exports. Many of the more visible enforcement successes involve illicit trade in narcotics and light arms – posters depicting seizures of illegal drugs are prominently featured in the GDC's headquarters building in Hanoi. However, while reluctant to single out a particular resolution, GDC officials confirmed that UN Security Council resolutions related to Iran and North Korea are being implemented at border control stations throughout Vietnam in the form of restricted entities lists and updated risk assessment guidelines.

GDC officials also expressed a keen interest in improving their capability to detect radiological materials. This interest informed Vietnam's 2005 and 2008 1540 Committee

[39] Project researcher's interview with Vietnamese government officials, March 2011.
[40] Project researcher's interview with officials of the Ministry of Industry and Trade in Hanoi, March 2011.
[41] Project researcher's interview in Hanoi, March 2011.

reports, and has contributed to the GDC's active engagement with U.S. DOE training programs and initiatives. Relevant training includes Commodity Identification Training (CIT) and participation in the U.S. Megaports Initiative, with GDC officials speaking favorably of both programs. However, GDC officials also indicated that, in their opinion, the risk assessment techniques now employed in Vietnam—and use of related equipment, where available—are now quite mature. Accordingly, officials see receipt of additional equipment and hardware as the current priority.[42] In 2011, as part of an IAEA pilot project, the installation of the Russian-made Yantar automated radiation detection systems began at the passenger terminal of the Hanoi airport in Vietnam.

Myanmar

The case of Myanmar, in many respects, is the most controversial of those presented here. As evidenced by its efforts in the prior decade to commission from Russia the construction of a research reactor, Myanmar has expressed interest in developing a research nuclear program. However, allegations—based primarily on reports from defectors on purchases of dual-use equipment linked to the DPRK—have surrounded Myanmar's actual intentions, and whether they might be military in nature.[43] At the same time, experts have questioned the veracity of these allegations, and whether Myanmar would have the technical capability to embark on such a program.[44]

Institutional Framework

Based on available information, Myanmar appears to have at most a rudimentary and limited structure to provide nuclear security. Myanmar currently has no national nuclear authority, and its ability to control the access and transfer of sensitive materials is heavily lacking.

1540 Reporting

Myanmar's country report to the UNSCR 1540 Committee, submitted in 2005, stated clearly that Myanmar would not acquire nuclear weapons or other weapons of mass destruction. The report also points to various areas of regional cooperation with regard to secure trade as indicating Myanmar's effort to control the use of its territory for the

[42] Project researcher's interview with General Department of Customs officials in Hanoi, March 2011
[43] Desmond Ball and Phil Thornton, "Burma's Nuclear Secrets," *Sydney Morning Herald*, 1 August 2009; and Robert E. Kelley and Ali Fowle, "Nuclear Related Activities in Burma," Democratic Voice of Burma website (report was prepared for DVB), May 2010, http://www.dvb.no/burmas-nuclear-ambitions/burmas-nuclear-ambitions-nuclear/expert-analysis/9297.
[44] Robert Kelley, Andrea Scheel Stricker and Paul Brannan, *Exploring Claims about Secret Nuclear Sites in Myanmar,* January 28, 2010; and Catherine Boye, Melissa Hanham, and Robert Shaw, "North Korea and Myanmar: A match for nuclear proliferation?" *Bulletin of the Atomic Scientists*, 27 September 2010, http://www.thebulletin.org/web-edition/features/north-korea-and-myanmar-match-nuclear-proliferation.

transiting of sensitive dual-use materials.[45] Myanmar notably did not request assistance for improving its 1540 implementation.

Export and Border Controls

Myanmar lacks any significant legislative or enforcement measures in the biological, chemical or nuclear area. While all companies that engage in import/export activities, depending on the origin/destination of the shipment, must apply for a license from either the Directorate of Trade (DOT) or the Department of Border Trade (DOBT), within the Ministry of Commerce (MOC), these domestic agencies do not have any procedures for controls of sensitive dual-use materials. Myanmar has few export controls in the formal sense, beyond a series of antiquated laws against trafficking in arms, ammunition, and explosives that were largely issued between 1878 and 1951.[46]

The Atomic Energy Act provides that an individual receive "prior permission" to export "nuclear material, radioactive material or irradiation apparatus."[47] A 2002 money laundering law also prohibits financial transactions related to "illegal trafficking in arms, ammunition and explosives."[48]

The Myanmar Customs Administration, which is under the Ministry of Finance and Revenue, inspects a portion of the cross-border trade using basic risk management techniques. Customs is not, however, computerized. "Our major constraints in implementing computerized risk management," according to the Assistant Director of the Customs Administration, "are limited financial resources, lack of technical know-how and expertise, insufficient information and communication infrastructure."[49] Presentations by Myanmar officials showing customs officers at work show offices with no computers or digital devices. During a 2010 workshop in Hanoi on UNSCR 1540 implementation in the region, Myanmar representatives acknowledged challenges related to a lack of resources and appropriate equipment. Myanmar would require a major assistance effort in order to close the gaps in almost every aspect of 1540 implementation.

[45] "Note verbale dated 6 April 2005 from the Permanent Mission of Myanmar to the United Nations addressed to the Chairman of the Committee," S/AC.44/2004/(02)/113, 7 April 2005, available via the 1540 Committee website, http://www.un.org/sc/1540/nationalreports.shtml.

[46] "National Mechanisms to Monitor Exports, Re-Exports, Transit and Transshipments" Presentation for Workshop on the Implementation of UNSC Resolution 1540,on behalf of the Union of Myanmar by U Moe Kyaw Aung, Ministry of Foreign Affairs (Myanmar), September 28-October 1, 2010, Hanoi, Vietnam; "Matrix [for Union of Myanmar] as approved by the 1540 Committee on 24 November, 2010," website for the 1540 Committee, http://www.un.org/sc/1540/approvedmatrices.shtml

[47] Chapter IX (Prior Permission), paragraph 21, The State Peace and Development Council [of the Union of Myanmar], The Atomic Energy Law, The State Peace and Development Council Law No. 8/98, The 14th Waxing [Day] of Nayon 1360 M.E. (8 June 1998).

[48] Chapter III (Money Laundering Offences), The Union of Myanmar, State Peace and Development Council, The Control of Money Laundering Law, The State Peace and Development Council Law No. 6/2002, The 7th Waxing Day of Nayon 1364 M.E (17th June 2002).

[49] Win Thant, "Implementation of Customs Risk management System In Myanmar," Workshop on the Implementation of UNSCR 1540, 15 January 2011

Myanmar has established eight Border Liaison Offices (BLO) in cooperation with Cambodia, China, Laos, Thailand, and Vietnam. The BLO's mandate is to strengthen border control in the fight against the illicit trafficking of all kinds. However, so far, primary foci have been drugs and related precursors and human trafficking, rather than illicit WMD-related trade.[50]

A number of studies have examined the problem of "missing imports" – discrepancies between reported exports and reported imports that indicate smuggling. One study of Myanmar, using this method, found that the volume of imports, as declared by Myanmar authorities, was only about two-thirds of the volume of exports declared by the country's trading partners. This would suggest that up to one-third of all imports to Myanmar, by value, are unrecorded.[51] The discrepancies would seem to suggest a substantial informal flow of goods, especially across Myanmar's land borders. In this context, there is also an opinion, based on recent enforcement cases in Japan, that North Korean procurement networks might be utilizing Myanmar territory as a transshipment point to circumvent nonproliferation sanctions imposed by UN Security Council Resolutions 1718 and 1874.[52]

However, more recently, officials who attended a UNSCR 1540 implementation workshop in Hanoi, Vietnam in 2010 described Myanmar's participation within the event as positive and supportive.[53] As further indication of expanded engagement with regional institutions, Myanmar is scheduled to assume the chairmanship of ASEAN in 2014.[54]

Potential for Shared Approach

While the domestic nuclear security frameworks of the individual states in Southeast Asia will have to be molded to fit each state's needs, identifying areas of convergence and shared challenges is important. Issues such as terrorism, securing trade, and human resource deficiencies cut across Southeast Asia. Based on the three case studies covered here and interviews in the Southeast Asia region, the following challenges have been identified as particularly salient for improving nuclear security in Southeast Asia:

Indonesia

[50] UNODC Regional Centre for East Asia and the Pacific, "Border Liaison Offices in Southeast Asia 1999 – 2009," http://www.unodc.org/documents/eastasiaandpacific//2010/07/blo-cambodia/Border_Book_final_6mar09.pdf.
[51] Koji Kubo and Nu Nu Lwin, "Smuggling and Import Duties in Myanmar," IDE Discussion Paper No. 258 (October 2010).
[52] Catherine Boye, Melissa Hanham, and Robert Shaw, "North Korea and Myanmar: A match for nuclear proliferation?" *Bulletin of the Atomic Scientists*, 27 September 2010, http://www.thebulletin.org/web-edition/features/north-korea-and-myanmar-match-nuclear-proliferation.
[53] Project researcher's interview with a member of a governmental delegation that participated in the 1540 Implementation Workshop in Hanoi, Vietnam (September 28-October 1, 2010).
[54] "Winds of Change or Just a Smokescreen?" *Bangkok Post*, 2 October 2011, http://www.bangkokpost.com/news/local/259250/winds-of-change-or-just-a-smokescreen.

- **Insufficient Resources for Improving Capacity and Security Culture**

Description of Challenge: Nuclear security is a growing area of interest for Indonesian nuclear experts, but efforts to improve in this field have been hampered by a lack of financial resources and political will. Policy-making organs, including the Foreign Ministry, continue to see the issue as a lower priority.

- **Strengthening Human Resources in the Nuclear Sector**

Description of Challenge: A number of recent studies have pointed out that an ageing, underfunded pool of experts in the nuclear sector is a serious concern– both for safety and security reasons. These issues appear to be recognized by nuclear authorities although it is unclear if efforts to improve the situation are properly funded. Indonesian nuclear authorities view international cooperation in the area of improved human resources as essential, particularly noting the need for collaboration on issues related to physical protection.

- **Absence of Interagency Coordination**

Description of Challenge: Lack of interagency coordination is an overarching problem for strengthening the nuclear security capacity and culture in Indonesia. BATAN and BAPETEN have worked well together in the area of nuclear safety, indicating that these two key agencies have a strong potential to also work well together in the area of nuclear security. However, in areas where foreign policy comes into play, the Foreign Ministry takes the lead role. As mentioned above, Indonesia's Foreign Ministry is playing an active role in the Nuclear Security Summit process; however, nuclear authorities have until recently not been included in the discussions related to the summit. Officials at BATAN and BAPETEN have noted that policy-making agencies, particularly the Foreign Ministry which interacts the most with the relevant international actors, are not reaching out to the technical agencies. DBT assessments in Indonesia could act as a model for wider interagency coordination. In the DBT, the nuclear authorities work with the law enforcement and intelligence communities to create assessments; tapping knowledge from other agencies—including the Foreign Ministry—could be an effective method for avoiding the tendency for stove-piping in the Indonesian system.

- **Radioisotope Exports to States without Appropriate Regulations or Controls**

Description of Challenge: Indonesia's export of radioisotopes is increasing, which is likely to place pressure on nuclear and customs authorities to maintain sufficient trade controls on these materials. The potential customers for Indonesian radioisotope exports include countries who do not have well-

established controls for domestic materials. This raises concerns that these materials could ultimately be diverted for nefarious end-uses.

Vietnam

- **Insufficient Level of Sustained Training of Personnel**

Description of Challenge: Key Vietnam agencies have been receiving training in nuclear-security and related areas, with the IAEA, Rosatom, U.S. DOE, EXBS, and JAEA all contributing resources to training. The problem is that most of the training is short-term, typically consisting of a short visit by experts lasting only a few days. Tacit "on-the-job" training in actual settings is also needed. Vietnamese experts have highlighted the need for further international partnership in this area.

- **Lack of Equipment for Border Control and other Nuclear Security Activities**

Description of Challenge: Both the GDC and VARANS have received some equipment via international assistance, notably from U.S. EXBS and the IAEA. However, officials from GDC and VARANS emphasized that more equipment is needed, especially related to radiation scanning and infrastructure. The request seems genuinely driven by concerns about keeping up with Vietnam's international trade growth and nuclear energy expansion plans.

- **Risk of Vietnam Being Used As a Transshipment Hub by Illicit WMD-related Trafficking Networks**

Description of Challenge: Vietnam's economy and international trade volume continues to expand year-on-year. As a result, port facilities in both northern and southern areas of the country are preparing to expand capacity, and higher cargo throughout is expected. Given this expanding volume of trade, officials from multiple agencies in Vietnam all expressed concerns about the potential for illicit traders to use Vietnam as a transshipment hub to route illicit WMD-related shipments.

- **Poor Understanding of the Concept of "Dual-Use" Goods**

Description of Challenge: Interviews with officials in Vietnam confirmed that the concept of "dual-use goods" remains difficult to grasp for Vietnamese authorities and industry, especially at operational levels. Accordingly, development of adequate export controls over dual-use goods is impacted. This also increases risks associated with illicit trafficking listed above. One Vietnamese official noted that public outreach—via media and other sources—could help with widening the understanding of these and other nuclear security related issues.

- **Absence of a Truly Independent Nuclear Regulatory Authority**

Description of Challenge: As part of MOST, VARANS is not a truly independent regulatory authority. Observers familiar with VARANS have been impressed with the agency's progress, but also agreed that establishment of a truly independent regulatory authority in Vietnam will be a challenge given the existing political/institutional structure and culture. VARANS recognizes the need to consider other options for how it is positioned in the government machinery. Its representatives have noted that various options are being studied as part of the work on the new nuclear energy law which could replace the existing one in 2013.

Myanmar

- **Lack of Legislative and Enforcement Measures in the Nuclear Area**

Description of Challenge: Myanmar has few export controls, beyond a series of antiquated laws against trafficking in arms, ammunition, and explosives. Lack of comprehensive and adequate laws on export controls is related to the fact that the country remains in early stages of nuclear research and uranium industry development; however creation of these controls should be adjusted in accordance with domestic plans in these areas.

- **Absence of National Nuclear and Regulatory Authorities**

Description of Challenge: Based on available information, Myanmar appears to have only a rudimentary and limited structure able to provide nuclear security. It has no national nuclear and regulatory authorities and its ability to control the access and transfer of sensitive materials is lacking. This raises concerns about how efficient controls over use, export, and possible import of nuclear materials in Myanmar are.

- **Lack of Resources and Equipment for Border Control, including Insufficient Computerization of Customs Service**

Description of Challenge: During a 1540 workshop in Hanoi, Myanmar Customs Administration officials acknowledged challenges related to a lack of resources, communication infrastructure, and appropriate equipment. These areas should be among the priorities for international assistance to Myanmar for improving its 1540 implementation.

- **Insufficient Level of Personnel Training in the Field of Nuclear Security**

Description of Challenge: More than 350 Myanmar specialists were trained in the field of physics and safety of nuclear reactors in Russia and other countries over the last 10 years. However, based on publicly available information it could be concluded that training did not include any special courses focused on nuclear security. A need for customs officials training was emphasized by a Myanmar

Customs Administration representative during the above-mentioned workshop in Hanoi.

To address all challenges listed above, the sharing of information and experiences, as well as the establishment of relevant models for states to follow, will assist countries in the region with plans for building civilian nuclear infrastructure and to more efficiently and effectively create a nuclear security capacity and culture. Existing mechanisms—regional, bilateral, and multilateral—can offer pragmatic means to achieve demonstrated, near-term progress. Accordingly, framed by these challenges, our next chapter will survey some existing and proposed mechanisms for advancing nuclear security in Southeast Asia.

INDENTIFYING MECHANISMS AND APPROACHES TO ADDRESS NUCLEAR SECURITY IN SOUTHEAST ASIA

Against the previously described backdrop of challenges, this chapter will explore a range of existing mechanisms – projects, instruments, action plans – that could be used to advance nuclear security in Southeast Asia. These include mechanisms at the regional, bilateral and multilateral levels, coordinated by institutions, governments, and international organizations active in the region. Additionally, new mechanism and methods identified through the development of this report are noted.

Regional Cooperation

Although individual states and relevant actors have a number of challenges unique to their domestic situations, it is notable that many issues can be viewed as shared problems, and potentially approached with shared solutions. Regional cooperation is important to helping address nuclear security and safety issues, considering the transnational nature of the problem. In this context, regional institutions and regimes can play an essential role, and Southeast Asia has an established framework for cooperation through ASEAN and its subsidiary bodies. These bodies include regional mechanisms for the sharing of information and best practices, harmonization of laws and regulations across institutional boundaries and training of relevant personnel. However, despite promising regional channels for cooperation, significant hurdles remain.

ASEAN

The Association for Southeast Asian Nations (ASEAN) was established in 1967 under the Bangkok Declaration, which called on states in the region to join together "to strengthen further the existing bonds of solidarity and cooperation."[1] According to this founding document, the purpose of ASEAN is to accelerate economic growth and promote regional peace and stability. The "ASEAN way", which is the principle guiding the organization's activities, is centered on non-intervention and consensus-based decision making. This principle can prove to be a barrier for implementing pro-active initiatives that affect domestic legislation of member states. It has, however, built confidence and solidarity among Southeast Asian nations and helped to forge a community mindset.

[1] "The Bangkok Declaration, Bangkok, 8 August 1967," ASEAN website, http://www.aseansec.org/1212.htm.

Despite the limitations evident within ASEAN's mandate and *modus operandi*, the organization's cooperative framework could provide a basis for facilitating nuclear security cooperation. The 2008 ASEAN Charter and the Roadmap for an ASEAN Community 2009-2015 (which includes "Blueprints" for its three communities – political-security, economic, and socio-cultural) provide a comprehensive framework for regional cooperation, supported by the ASEAN Secretariat and external dialogue partners.[2] The Secretariat's Political Security Directorate handles issues related to nonproliferation. However, nuclear security has so far not been on the agenda of those working on nonproliferation issues in ASEAN; instead priority has been given to other issues—particularly the ratification of the protocols for the Southeast Asian Nuclear Weapons Free Zone (SEANWFZ).

The Bangkok Treaty, which established the SEANWFZ, entered into force in 1997. Under the treaty, ASEAN states are obliged to refrain from developing or acquiring nuclear weapons. Additionally, states agree to abstain from assisting others in the acquisition of nuclear weapons or undertaking sensitive nuclear trade with other countries unless under IAEA safeguards. In 2007, ASEAN member states concluded an action plan on the SEANWFZ that spelled out crucial objectives to be met by 2012. The plan reiterated states' commitment to accede to the IAEA's nuclear safety instruments and the Convention on Early Notification of a Nuclear Accident, the Comprehensive Test Ban Treaty (CTBT), and the IAEA Additional Protocol.[3] In addition, the plan encouraged the development of cooperative mechanisms and networks for capacity building on nuclear safety and emergency preparedness, among other goals. ASEAN foreign ministers reiterated this plan of action in July 2010.[4] *Detailed information on International Treaty & Regime Memberships in Southeast Asia can be found in Table 6.*

The plan of action also sought "close consultation" with the five NPT nuclear weapon states (NWS). The protocols to the Bangkok Treaty are open to signature by the NWS and, if ratified, would restrain these states from threatening to use nuclear weapons within the SEANWFZ or against any State Party to the treaty. None of the NWS have yet signed the protocols largely because, unlike other NWFZs, the Bangkok Treaty extends the zone to include continental shelves and exclusive economic zones (EEZ) and restricts the passage of nuclear powered ships through the zone. In November 2011, ASEAN announced that negotiations had been concluded between the regional organization and the five NWS that would help pave the way for NWS signature of the protocols. According to regional officials familiar with the negotiations, ASEAN and NWS negotiators came to agreement on a number of definitional issues. While this appears to be a major move that would strengthen the SEANWFZ, it remains unclear if the NWS

[2] ASEAN's dialogue partners are currently Australia, Canada, China, the EU, India, Japan, New Zealand, Russia, South Korea, and the U.S..

[3] Graham Gerard Ong-Webb, "ASEAN Must Keep Nuclear Cloud At Bay," *Bangkok Post*, 27 December 2007.

[4] "ASEAN Vows to Promote Implementation of SEANWFZ Treaty," Xinhua, 19 July 2010, http://news.xinhuanet.com/english2010/world/2010-07/19/c_13405097.htm.

will ratify and fully implement the protocols in the near future due to domestic impediments.

Along with actions taken under the SEANWFZ, the ASEAN Charter, which entered into force in 2008, called for the establishment of a zone free of weapons of mass destruction in the region.[5] Additionally, as part of the "Blueprint" for an ASEAN Political-Security Community, which should "bring ASEAN's political and security cooperation to a higher plane,"[6] member states should comply with the Bangkok Treaty and accede to IAEA safeguards agreements. Given these agreements and statements, ASEAN has played a role in strengthening regional nonproliferation and nuclear security awareness in the region. However, these efforts remain largely indirect, particularly on issues that require changes in domestic legislation or the development of new legislation.

One notable initiative that might prove beneficial to nuclear security in the region is the ASEAN Single Window (ASW), part of the "Blueprint" for ASEAN's Economic Community.[7] The ASW is a trade facilitation mechanism that is part of the organization's wider move toward regional economic integration. It is intended to create a regional portal where National Single Windows (NSWs) of ASEAN member states can operate in order to help streamline ASEAN trading ties and minimize the cost (financial and otherwise) of doing business in the region.[8] The ASW, once functional, will be an environment in which the ten NSWs can operate and integrate to streamline, standardize, and expedite trade and customs activities. The ASW could also serve as a future indicator of relevant capacity in the area of trade management, including for radioactive materials and dual-use commodities related to nuclear development. As a number of regional officials have noted, there is currently no effective method for sharing information between regional partners on trafficking of nuclear and radiological-related material. The ASW would greatly enhance this capacity. Additionally, the process of creating a national portal to participate in the ASW requires ASEAN states to strengthen domestic expertise and legislation in trade and customs management. This same expertise could assist these countries in creating risk management systems focused on nuclear and radiological materials.

ASEAN has also developed useful mechanisms for cooperation on counter-terrorism and transnational crime that could serve as a model for cooperation on nuclear security. In 2001, ASEAN heads of state released the Declaration on Joint Action to Counter Terrorism.[9] In this declaration, finalized during the Seventh ASEAN Summit, member states committed to combat terrorism at a regional level including "joint practical

[5] "The ASEAN Charter," ASEAN website, http://www.aseansec.org/publications/ASEAN-Charter.pdf.
[6] "ASEAN Political-Security Community Plan of Action," ASEAN website, http://www.aseansec.org/16826.htm.
[7] "ASEAN Economic Community Blueprint," ASEAN website, http://www.asean.org/21083.pdf.
[8] "Agreement to Establish and Implement the ASEAN Single Window," December 2005, http://www.asean.org/18005.htm. A "Nation Single Window" is defined as a government's trade portal which allows for a single submission of data, synchronized data processing, and a single point for decision-making for customs release and clearance.
[9] "Joint Communique of the Special ASEAN Ministerial Meeting on Terrorism, Kuala Lumpur, 20-21 May 2002." ASEAN website, http://www.aseansec.org/5618.htm.

counter-terrorism measures." This declaration clearly linked ASEAN's existing work on transnational crime with activities related to counter-terrorism. In a follow-on to the 2001 declaration, the ASEAN Ministerial Meeting on Transnational Crime (AMMTC) held a special session in April 2002 to discuss regional counter-terrorism efforts.[10] This special session promoted a program of work, which included proposals on information sharing and training of counter-terrorism personnel. Although these early efforts did not refer specifically to concerns about nuclear-related trafficking and security, the counter-terrorism and transnational crime activities included concrete actions towards strengthening customs and border controls.

These efforts are strongly supported by ASEAN's dialogue partners, many of who have joint declarations with ASEAN to combat terrorism and transnational crime. Significant capacity building activities have been supported under these frameworks, including the establishment of three regional counter-terrorism centers: the Jakarta Center for Law Enforcement Cooperation (JCLEC) in Indonesia; the South East Asia Regional Center for Counter-Terrorism (SEARCCT) in Malaysia; and the International Law Enforcement Academy (ILEA) in Thailand. These centers are used for capacity building on combating terrorism and transnational crime, including border security, trafficking, and the threat or use of chemical, biological, radiological or nuclear weapons.

During the 2007 ASEAN summit, leaders finalized the ASEAN Convention on Counterterrorism (ACCT).[11] The ACCT aims to strengthen preparedness for dealing with chemical, biological, radiological and/or nuclear terrorism, as well as other types of terrorism. ASEAN secretariat officials point to this convention as one direct effort related to UNSCR 1540 implementation, although the resolution is not mentioned within the ACCT. ASEAN Secretary General, Dr. Surin Pitsuwan, noted that the ACCT serves as the cornerstone for enhancing the region's capacity to confront terrorism and deepen counter-terrorism cooperation. ASEAN officials have described the ACCT as an important tool for the regional body's security efforts. As part of ACCT obligations, ASEAN states must take measures to strengthen export controls and prevent proliferation, financing and shipments, in addition to securing sensitive materials that could be used for weapons of mass destruction and their means of delivery.

In recent years, there have been growing discussions at ASEAN among senior government figures from member states on developing civilian nuclear power, which also included an agreement in 2007 to form an ASEAN Nuclear Energy Safety Sub-Sector Network (NES-SSN). In November the same year, ASEAN heads of government resolved to cooperate towards a nuclear safety regime in the region. Although there have been a few meetings of NES-SSN since 2007, there has not been any indication of meaningful progress towards a firm institutional arrangement.[12] In general, while several high-profile meetings have taken place under ASEAN auspices, they have generally not

[10] "Joint Communique of the Special ASEAN Ministerial Meeting on Terrorism, Kuala Lumpur, 20-21 May 2002." ASEAN website, http://www.aseansec.org/5618.htm.
[11] "ASEAN Convention on Counter Terrorism," ASEAN website, http://www.asean.org/19250.htm.
[12] *Preventing Nuclear Dangers in Southeast Asia and Australasia,* IISS Strategic Dossier (September 2008), p. 14.

been followed up with concrete measures to implement resolutions and agreements emerging from such gatherings.[13]

ASEAN Regional Forum

A prominent mechanism for discussion of security matters in Southeast Asia is the ASEAN Regional Forum (ARF), which was established in 1994 and consists of all ASEAN states as well as several states from neighboring regions.[14] The objectives of ARF are "to foster constructive dialogue and consultation on security issues of common interest and concern, and to make significant contributions to efforts towards confidence building and preventive diplomacy in the Asia-Pacific region."[15] The Forum includes countries and groupings—namely the United States, Japan, Australia, and the EU—who have been financial supporters of nuclear security-related initiatives in the region; for this reason many experts, including officials within the ASEAN secretariat, point to ARF as the most appropriate vehicle for regional initiatives related to nuclear security.

In 2004, ARF made its first statement on nonproliferation, noting that "ARF participants will closely collaborate with each other and duly cooperate with the Committee of the Security Council established under Resolution 1540." In this statement, the group encouraged its participants: to improve domestic control of WMD-related materials, particularly noting the importance of export controls and the secure management of radioactive sources; to cooperate on the prevention of illicit trafficking of WMD-related materials; and to provide technical assistance when possible towards these ends. [16]

In addition to annual Ministerial-level ARF meetings, the Forum hosts 'intersessional' meetings on issues of importance to the region. The most recent addition to this group of thematic meetings is the Intersessional Meeting on Nonproliferation and Disarmament (ISM-NPD), which held its first meeting in July 2009. At this meeting, delegations discussed challenges to domestic 1540 implementation, particularly capacity limitations and the need for greater assistance to many ARF participants. Options put forward as to how ARF could assist in promoting UNSCR 1540 activities included identifying an ARF liaison on 1540 matters and promoting ARF dialogue with the IAEA and the 1540 Committee.

At the July 2010 ARF meeting in Vietnam, Ministers adopted the Hanoi Plan of Action (PoA) to implement the ARF Vision Statement. This PoA is policy guidance and is expected to help cooperation process to be more action-oriented. In the PoA, six areas of

[13] Tanya Ogilvie-White, "Preventing Nuclear and Radiological Terrorism: Nuclear Security in Southeast Asia," Centre for Peace and Conflict Studies Occasional Paper, pp. 29-30.
[14] ARF includes the 10 ASEAN members plus Australia, Bangladesh, Canada, China, the European Union, India, Japan, North Korea, South Korea, Mongolia, New Zealand, Pakistan, Papua New Guinea, Russia, East Timor, and the United States.
[15] 'The ASEAN Regional Forum," ARF website, http://www.aseanregionalforum.org/AboutUs/tabid/57/Default.aspx.
[16] "Chairman's Statement at the 11th Meeting of ARF," 2 July 2004, http://www.aseanregionalforum.org/PublicLibrary/ARFChairmansStatementsandReports/ChairmansStatementofthe11thMeetingoftheAS/tabid/67/Default.aspx.

cooperation are identified as the basis for ARF's future work, including: counter terrorism-transnational crime; maritime security; and nonproliferation and disarmament. According to the plan of action, by 2020 ARF should have in place a network of law enforcement and military agencies for capacity-building and information sharing to respond timely to terrorist threats.

Regional experts agreed in discussions in October 2011 that many challenges related to nuclear security could be assisted by increased cooperation within the existing regional organizations. Given the transnational nature of challenges such as nuclear security threats, terrorism, and piracy, the ARF is potentially a crucial body for discussions on coordinated policies on nuclear security matters. ASEAN's efforts with regard to increasing acceptance of the Additional Protocol in the region may also have a positive impact on strengthening nuclear security. Cooperation on nuclear security and secure trade issues could fit within the current ARF PoA; however, it remains unclear if member states see ASEAN or ARF as having a role in coordination on nuclear security matters.[17]

ASEAN +3 / East Asia Summit

ASEAN forms the nucleus of two other regional groupings, the ASEAN +3, which links ASEAN with China, Japan, and South Korea, and the East Asia Summit (EAS), which adds the U.S., Russia, India, Australia, and New Zealand to the 13 ASEAN +3 members. The ASEAN +3 decided in 2007 to establish the ASEAN +3 Forum on Nuclear Energy Safety "to enhance synergy on the peaceful uses of nuclear energy in the region, particularly in terms of technology transfer and capacity-building", although it is unclear how active this forum has been since 2009.[18] The East Asia Summit is a newer forum that is gaining traction in the region. While nuclear nonproliferation is not one of the five priority areas for the EAS, it received attention at the most recent Summit in Bali in November 2011, with participants encouraging regional compliance with UN nonproliferation commitments and welcoming the conclusion of negotiations on the SEANWFZ Protocol.[19] ASEAN +3 and East Asia Summit Energy Ministers also meet annually, with nuclear energy on the agenda for both groupings.

Other Regional Security Initiatives

There are several other initiatives relevant to nuclear security matters in the region. Below are a few examples to illustrate the pattern of increased cooperation in the region.

[17] Michael S. Malley, "Bypassing Regionalism? Domestic Politics and Nuclear Energy Security," in Donald K. Emmerson (ed), *Hard Choices: Security, Democracy, and Regionalism in Southeast Asia* (Stanford, CA: Shorenstein Asia-Pacific Research Center, 2008).
[18] *Preventing Nuclear Dangers in Southeast Asia and Australasia,* IISS Strategic Dossier (September 2008), p. 16.
[19] "Chairman's Statement at the 6th East Asia Summit," 23 November 2011, http://www.aseansummit.org/news272-chairman's-statement-of-the-6th-east-asia-summit--bali,-indonesia,-19-november-2011.html.

However, little has yet been done to coordinate activities of these groups and it is unclear how broad of a reach they have as yet on the issues related to nuclear security.

Asia-Pacific Safeguards Network

Six Southeast Asian nations are a part of the Asia-Pacific Safeguards Network (APSN). APSN is an informal network of domestic authorities responsible for implementing safeguards in the region. Its objective is to promote safeguards best practices "through enhanced cooperation in areas such as training, professional development and sharing of experiences."[20] According to an Australian expert, the APSN has considerable promise as a regional instrument, especially since the network's research and training activities are expected to expand in the coming years.[21]

Forum for Nuclear Cooperation in Asia

The Japanese Atomic Energy Commission-supported Forum for Nuclear Cooperation in Asia (FNCA) was established as a framework for peaceful use of nuclear technology in Asia. FNCA includes five ASEAN states and many of the forum's activities have focused on radiation safety and waste management in Southeast Asia. The Forum also has a project dealing with nuclear security and safeguards. The goal of this project is to increase awareness of the "importance of nuclear security as well as nuclear safeguards, and to support human resource and infrastructure development through information exchange and discussion on approaches by FNCA countries."[22]

Regional Radiological Security Partnership

The security of radiological sources has been an issue that most countries in the region have already taken action on. For example, all members of ASEAN, with the exception of Myanmar, participate in the Regional Radiological Security Partnership (RRSP). This partnership, which is sponsored by Australian Nuclear Science and Technology Organization (ANSTO), along with the U.S. Department of Energy and the IAEA, aims to improve the physical protection and security management of high risk radioactive sources and lessen the risk of unauthorized and harmful use of radioactive materials. Additionally, RRSP participants have undertaken training on emergency preparedness to increase the capacity of regional actors to respond to scenarios involving the malicious use of radioactive sources.

Asian Nuclear Safety Network

The Asian Nuclear Safety Network (ANSN) was established in 2002 to facilitate regional cooperation and improve safety in the region's developing nuclear programs. The major objective of ANSN "is to provide an instrument for establishing sustainable and

[20] Presentation by ANSTO representative at International Workshop on Prospects for Nuclear Security Partnership in Southeast Asia, Vienna, Austria, 31 October 2011.

[21] Workshop on "Important Considerations for Introducing Nuclear Power in ASEAN: Can Regional Cooperation be Attractive for Nuclear Energy Development?" University of Tokyo and Universiti Kebangsaan Malaysia (UKM), Putrajaya, Malayasia, May/June 2010, http://www.n.t.u-tokyo.ac.jp/gcoe/jpn/research/nonproliferation/docs/Summary_Todai-UKM_workshop_31May-1June2010.pdf.

[22] "Nuclear Security and Safeguards Project," FNCA website, http://www.fnca.mext.go.jp/english/nss/e_introduction.html.

autonomous national and regional nuclear safety activities through the best use of the shared information and discussions in the cyber communities provided by the network."[23] Goals also include capacity building with regards to emergency preparedness and response for nuclear or radiological emergencies.

Prospects for Regional Cooperation on Nuclear Security

While the establishment of a nuclear security infrastructure will be unique to each state's domestic needs, Southeast Asian countries do share a number of common traits—including a lack of comprehensive nuclear security arrangements. Countries in the region remain deficient in areas of strategic trade management, equipping the borders to prevent illicit trafficking of nuclear and radioactive materials, training specialists, and ensuring adequate and sustainable financing of related activity.

With these many overlapping needs, it would be an efficient use of limited resources to cooperate regionally on some issues related to building effective nuclear security frameworks. For instance, given that each Southeast Asian country will need a relatively small number of nuclear specialists, it would make sense for states to pool their efforts and financial resources in setting up joint regional training centers. Training centers could be set up in the region specializing in three distinct subjects: border control, security of nuclear materials and facilities, and nuclear safety. These centers could make use of the existing infrastructure. For example, taking into account the Indonesian leadership in the area of nuclear safety, a regional nuclear safety center could be set up at one of the existing nuclear research institutes in Indonesia. Activities within this center might include development of emergency response capabilities, dealing with management of radiation release and related issues in the event of nuclear incidents or accidents. Vietnam's Dalat Nuclear Research Center could host a regional nuclear security center, while a regional border protection center could be set up in Singapore, which has a large concentration of border checkpoints (at seaport, airport, and land border.)[24]

Another idea would be the development of an ASEAN Nuclear Energy Authority or Southeast Asian Nuclear Energy Authority, focusing on nuclear safety and security matters, among other things. This organization could also coordinate work of all three proposed regional centers and could operate similarly to EURATOM.[25] While at the

[23] From the ANSN website, http://www.ansn.org/default.aspx.
[24] Singapore has the strongest strategic trade management system in the region. It is also part of the U.S. DOE Megaports Initiative and has already taken steps toward a regional leadership role through its hosting and co-sponsorship of the 12th International Export Controls Conference in May 2011. See "Joint Statement: Singapore Affirms Commitment to Counter Proliferation of Weapons of Mass Destruction (WMD)," Ministry of Foreign Affairs, Singapore, 24 May 2011, http://app.mfa.gov.sg/2006/press/view_press_print.asp?post_id=7001.
[25] Andrew Symon, "Southeast Asia's Nuclear Power Thrust: Putting ASEAN's Effectiveness to the Test?" *Contemporary Southeast Asia*, Vol. 30, No. 1, 2008, see pp 130-133.

moment it is not very likely that countries in the region would be able to agree on establishing such a coordinating instrument, the current efforts to forge closer ASEAN Economic and Political-Security communities could bring the issue of nuclear energy development, and with it nuclear security, more under the purview of ASEAN. If established, such a regional mechanism could also coordinate training programs for experts from Southeast Asia at the centers of excellence being set up in East Asia (South Korea and Japan). According to a number of relevant experts, training specialists for Southeast Asia will be one of the key priorities for these centers.[26]

Hurdles on the Way to Adequate Regional Cooperation

Regional institutions and regimes can play a crucial role in developing nuclear security frameworks. This would include facilitation of regional mechanisms for sharing information and best practices, harmonizing laws and regulations across institutional boundaries, and training relevant personnel. However, significant hurdles need to be overcome if this cooperation is to be realized, and some areas may not be suitable for region-wide cooperation because of the large variations of capacity between states in particular areas.[27]

Closer cooperation on security matters in ASEAN has been somewhat hampered by continued territorial disputes among various member states. Most recently, Thai and Cambodian forces clashed on their shared border in February 2011. However, the regional response to the border clash does suggest the possibility of wider coordination of security-related efforts, with ASEAN and Indonesia working behind the scenes to support discussion and help enforce a ceasefire; this demonstrated the potential for a prominent and institutionalized role for ASEAN in dealing with security issues.[28]

Issues related to maritime security further demonstrate continuing hurdles in enhancing security cooperation in Southeast Asia. The three littoral states in the Strait of Malacca—Singapore, Malaysia, and Indonesia— are well aware of the threats to maritime security in the region, but they have different priorities and, consequently, different sets of policies and levels of investment in these security matters.[29] ASEAN member states have also had their own internal security preoccupations, for example the terrorist threat in Indonesia, and the insurgencies in Southern Thailand and the Southern Philippines.

[26] Project researcher's interview with a representative of Australian Department of Foreign Affairs and Trade, October 2011.
[27] Discussions and presentations from the International Workshop on Prospects for Nuclear Security Partnership in Southeast Asia, Vienna, Austria, 31 October 2011
[28] "ASEAN Mediates in Cambodia, Thailand Conflict," Voice of America, February 22, 2011, http://www.voanews.com/khmer-english/news/ASEAN-Mediates-in-Cambodia-Thailand-Conflict-116675409.html.
[29] Sheldon W. Simon, "Safety and Security in the Malacca Straits: The Limits of Collaboration," *Asian Security*, Vol. 7, No. 1, 2011, pp. 27-43.

Regional authorities have also noted that the IAEA and other international entities are often not inclined to take a regional approach.[30] Most states pursuing nuclear energy in Southeast Asia deal directly with the IAEA or out-of-region major powers on nuclear security and safety matters, rather than undertaking inter-ASEAN nuclear security cooperation.[31] Related to this, ASEAN's focus has not yet turned to issues of nuclear security, with member states focusing more on expanding their individual civilian nuclear energy programs. With an ambitious six-year Roadmap to achieve an ASEAN Community by 2015, there is little room for new areas of focus, particularly when nuclear energy in the region is still considered to be some way off.

Compounding this, ASEAN's secretariat is significantly understaffed and nuclear security is not a priority for officials working on wider security issues. As with any international organization, ASEAN's agenda is set by its member states and the secretariat cannot work on issues that are not put forth or prioritized by the members. The Secretariat's role is restricted to administrative support, and while members often task the staff to carry initiatives forward, the Secretariat's mandate limits it to essentially supporting activities and tracking progress. It is also important to note that activities by ASEAN (and by extension the ARF, APT, and EAS) can be heavily influenced by the country holding the ASEAN chair. The chair has significant sway in setting the organization's agenda and creating a level of momentum for any given issue.[32]

Finally, while ASEAN has negotiated and adopted significant security cooperation agreements for the region, it struggles to realize their full, meaningful implementation. For example, the ACCT was signed in 2007 but only came into force in May 2011 after the ratification of 6 member states. Four member states are yet to complete the domestic processes necessary for ratification and have not shown an urgency to do so. This includes Indonesia, with arguably the largest terrorism challenges to tackle.

Relevant International Cooperative Programs

Several initiatives sponsored by major powers, such as Australia, the EU, Japan, Russia, and the United States, along with the IAEA, have aimed to assist regional states with nuclear security development. While most activities remain bilateral and not regional in focus, some efforts have been taken to frame the issue on a regional basis.

United States

[30] Discussions and presentations from the International Workshop on Prospects for Nuclear Security Partnership in Southeast Asia, Vienna, Austria, 31 October 2011

[31] Michael S. Malley, "Bypassing Regionalism? Domestic Politics and Nuclear Energy Security," in Donald K. Emmerson (ed), *Hard Choices: Security, Democracy, and Regionalism in Southeast Asia* (Stanford, CA: Shorenstein Asia-Pacific Research Center, 2008).

[32] "Winds of Change or Just a Smokescreen?" *Bangkok Post*, October 2, 2011, http://www.bangkokpost.com/news/local/259250/winds-of-change-or-just-a-smokescreen.

The United States government has been active in sponsorship of nuclear security activities in the region and Washington's assistance has helped capacity building efforts in Southeast Asia. In the case of Indonesia, BAPETEN and the U.S. Department of Energy's (DOE) National Nuclear Security Administration (NNSA) signed a bilateral agreement on nuclear safeguards and security in 2004. The NNSA has also worked with other regional nuclear authorities to upgrade physical security at nuclear facilities and to address spent fuel disposal issues. The U.S. DOE's Global Threat Reduction Initiative (GTRI) has worked with regional governments to implement physical protection upgrades at facilities in the region and to conduct security-related training and workshops. The DOE NNSA has also focused many activities related to "human-based detection," particularly in the case of sensitive dual-use items. NNSA programs have focused on countering the challenge of illicit trafficking and support for implementation of the Additional Protocol in the region.

Washington has also pushed for cooperative mechanisms to secure trade and improve detection capacities at the region's major ports. The U.S. Container Security Initiative (CSI) and Megaports Initiatives work with host government counterparts to enable the proper screening of U.S.-bound containers. Currently these programs include Southeast Asian ports, namely in Singapore, Malaysia (Klang and Tanjung Pelepas), and Thailand (Laem Chabang). CSI is based on three core pillars: use of automated targeting algorithms and intelligence to assist in the identification of container shipments that pose substantial risk; evaluation of containers of concern prior to loading the shipment; and utilization of technology, such as non-intrusive inspection (NII) technology, to allow for the screening of cargo without hindering the movement of trade. CSI ports generally have an official from the U.S. Customs and Border Protection (CBP) stationed in the port, working cooperatively with host countries officials on identifying and screening questionable U.S.-bound cargo.

The Megaports Initiative works in unison with CSI, providing radiation detection equipment. The mission of the Initiative in Southeast Asia is to provide equipment, training, and technical support to countries in the region in order to enhance their ability to detect, interdict, and deter illicit trafficking of nuclear and other radioactive materials. As an illustration of the scale of assistance, the U.S. DOE has invested over US$20 million into the Laem Chabang Megaports Initiative in equipment, staffing, and training, and US$26 million into setting up the facility in the Philippines.[33] In July 2005, an agreement was signed to equip Manila Port (Philippines) while similar agreements were made with Vietnam in 2010.[34] The Manila Megaports operation was turned over to Philippines control in September 2011, and Philippine and U.S. officials expect to expand

[33] The Laem Chabang Megaports Initiative," U.S. Embassy in Bangkok, 20 September 2010, http://bangkok.usembassy.gov/embassy-activities/2010/sep/03.html; and "Philippines and U.S. Commission Megaports System to Increase Security at the Port of Manila", U.S. Embassy in the Philippines, 13 September 2011, http://manila.usembassy.gov/megaports.html.

[34] "Agreement Aimed at Preventing Nuclear Smuggling," U.S. DOE/NNSA website, 27 February 2008, http://www.nnsa.energy.gov/mediaroom/pressreleases/02.27.08; "NNSA and the Vietnamese Ministry of Finance Agreement," U.S. Department of State, 2 July 2010, http://fpc.state.gov/143928.htm.

to the Port of Cebu in 2012.[35] In addition to the Megaports Initiative, the DOE has also agreed to provide radiation detection equipment to other important regional ports.

Russia

Russia is the leader in terms of training nuclear energy specialists for Southeast Asian countries. Between 300 to 350 specialists from Myanmar undertook a master's program at the National Nuclear Research University (MEPhI) over the last decade. At present, about 100 specialists from Vietnam are studying nuclear energy application in MEPhI, with the costs fully paid by the Russian government. However, it is unclear how much these programs deal with nuclear security issues.

Other programs in Russia are actively involved in training foreign nuclear security specialists, including many from Southeast Asia. The bulk of this training is done at MEPhI and its regional branches, as well as the Central Institute for Continuing Education and Training (TsIPK) in Obninsk. In October 2012 the Russian Customs Academy in Vladivostok will offer training for ASEAN customs and law-enforcement specialists focusing on the prevention of smuggling of nuclear and radioactive materials.

A welcomed development over the past year is the conclusion of an agreement on Russia's voluntary contribution to the IAEA's extra-budgetary Nuclear Security Fund. The Agreement was signed by the Agency and the Russian Foreign Ministry on 2 December 2010, and provides for the allocation of US$6.5 million in 2011-2015 for improving nuclear security measures in IAEA member states, including measures to prevent nuclear terrorism or any other forms of unauthorized access to nuclear materials and facilities.

Australia

Australian support for Southeast Asian countries through the Australian Nuclear Science and Technology Organization (ANSTO) covers a wide range of issues, including nuclear safety, security, research, environment, health, industry, agriculture, and education. ANSTO's recent engagement with ASEAN countries takes place at three levels: regional (especially the RSRS project, described below), bilateral (mainly focused on Indonesia), and through the IAEA's Nuclear Security Fund.

The Regional Security of Radioactive Sources (RSRS) project addresses the physical protection and security management of high-risk radioactive sources used within the countries of Southeast Asia and the Pacific. The RSRS project is undertaken in cooperation with related programs of the IAEA and the U.S. DOE, and includes the Regional Radiological Security Partnership (RRSP) mentioned above. As of now, the

[35] Discussions and presentations from the International Workshop on Prospects for Nuclear Security Partnership in Southeast Asia, Vienna, Austria, 31 October 2011; and "Highlights of Achievements and Commitments by Participating States as stated in National Progress Reports and National Statements," from the 2012 Nuclear Security Summit, April 2012, http://www.thenuclearsecuritysummit.org/eng_media/speeches/speeches_list.jsp.

project achievements have upgraded the security at 63 facilities of Category 1 sources in the region and organized a series of security awareness seminars and training courses for senior decision-makers, regulators, and operators from the region. Total funding for the RSRS project since July 2004 has been (USD) $6.5 million.[36]

Australia has also contributed €250,000 (A$450,000) to IAEA´s Nuclear Security Fund to strengthen nuclear security in Southeast Asia. The activities funded include a regional course on security of nuclear reactors, the 2010 RRSP review meeting on radioactive source security, and radiation monitoring and detection in Indonesia. Australia has also supported International Physical Protection Advisory Service (IPPAS) missions in the region.

Canberra also cooperates with the countries of the region through the Regional Cooperative Agreement (RCA), an IAEA-supported intergovernmental arrangement promoting research, development, and training related to nuclear science and technology in the Asia Pacific region. ANSTO has had periodic requests from the countries of the region for scientific and technical cooperation and assistance. For example, ANSTO has provided advice, consultation, and training of BATAN staff, financed under the IAEA's Technical Cooperation Program and its Extra-budgetary Program on the Safety of Nuclear Installations in Southeast Asia, Pacific, and Far East Countries. One of the areas of particular focus has been the inspection of BATAN's research reactors.[37]

Japan

Japan's involvement with ASEAN, starting in 1973, has primarily focused on trade, investment, and development.[38] Later, in 2004, Japan became party to the Treaty of Amity and Cooperation in Southeast Asia and was the first dialogue partner to establish a Counter-Terrorism Dialogue with ASEAN. In 2008, ASEAN+3 convened a Forum on Nuclear Energy Safety originating from concern for long-term energy security. This forum serves as a platform for government officials and scholars to exchange views and expertise on how to enhance regional cooperation on nuclear safety issues.[39]

Japan also has been contributing to international and regional arrangements seen as beneficial to Southeast Asian countries. Japan has been working actively in cooperation with the IAEA, for example, in implementing programs with a view to strengthen nuclear security. In recent years, Japan has focused efforts on Asian countries including Vietnam and Thailand. Japan has been co-hosting a number of workshops and seminars with

[36] Eulinia Valdezco and Dang Thanh Luong, "South East Asia Regional Radiological Security Partnership: Overview of 2008 and 2010 Review Meetings," Technical Meeting of Technical and Legal Experts for Sharing of Information as to States Implementation of the Code of Conduct on the Safety and Security of Radioactive Sources and its Supplementary Guidance, Vienna, 17-21 May 2010.
[37] Inquiry into Australia's Relationship with ASEAN, Joint Standing Committee on Foreign Affairs, Defence and Trade, http://www.aph.gov.au/house/committee/jfadt/asean1/hearings.htm.
[38] "ASEAN-Japan Relations," Ministry of Foreign Affairs of Thailand, http://www.mfa.go.th/internet/document/3783.pdf.
[39] "ASEAN+3 nuclear safety forum kicks off in Bangkok," Xinhua News Agency, 16 June 2008, http://news.xinhuanet.com/english/2008-06/16/content_8379882.htm.

Southeast Asian countries, mostly in collaboration with the IAEA. Japan also participates in the IAEA-sponsored RCA.[40]

Many of Japan's efforts are aimed spreading its domestic expertise and contributing to the establishment of a network of nuclear security-related personnel in Asia. As noted above, the Asian Nuclear Safety Network (ANSN) is a Japan-sponsored mechanism operated by the Japan Nuclear Energy Safety Organization (JNES). Japan has also established the Integrated Support Center for Nuclear Non-Proliferation and Nuclear Security. Its main goals involve capacity building, infrastructure, and technological development. The Center's recent activities have included training for Asian officials in the areas of physical protection, nuclear security, and the Additional Protocol. It is a part of Japan's commitment to strengthen nuclear security as announced at the 2010 Nuclear Security Summit. The center is expected to serve as a regional hub for supporting nuclear security (although it is unclear how, or if, it will coordinate with a similar center proposed by South Korea).[41]

The Japanese government established the FNCA in 1990 to promote cooperation in the field of nuclear energy with neighboring Asian countries. FNCA's activities including training and transferring technology, conducting projects on research reactor utilization development, and nuclear safety and nuclear infrastructure. FNCA also engages in bilateral cooperation on nuclear energy with Vietnam and Indonesia. Currently there are 12 participating countries including Indonesia, Malaysia, Philippines, Thailand, and Vietnam.[42]

European Union

The EU has been an active provider of assistance in Southeast Asia, particularly in the areas of export control assistance, border control activities, and the provision of radiation monitors.[43] Related to export control assistance specifically, the implementation authority for EU outreach projects since 2006 has been Germany's Federal Office of Economics and Export Control – also known as BAFA.[44] These export control outreach projects are implemented in accordance with the EU Long-Term Program, and the BAFA website identifies Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam as partner countries in Southeast Asia.[45] The European Commission has shown interest in

[40] Regional Co-operative Agreement website, http://www.rcaro.org/.
[41] "Japan, South Korea share nuclear expertise with ASEAN," *Mainichi Daily News*, September 2011. http://www.eco-business.com/news/japan-south-korea-share-nuclear-expertise-with-asean.
[42] Forum for Nuclear Cooperation in Asia website, http://www.fnca.mext.go.jp/english/index.html.
[43] Project researcher's interview with European Commission official, October 2011.
[44] "Cooperation in Export Control of Dual-Use Goods: General Project Information," Federal Office of Economics and Export Control (BAFA) website, http://www.eu-outreach.info/eu_outreach/general_project_information/index.html
[45] "Cooperation in Export Control of Dual-Use Goods: General Project Information," Federal Office of Economics and Export Control (BAFA) website, http://www.eu-outreach.info/eu_outreach/general_project_information/index.html; and "Partner Countries: South East Asia," Federal Office of Economics and Export Control (BAFA) website, http://www.eu-outreach.info/eu_outreach/partner_countries/south_east_asia/index.html

having regional workshops on detection of illicit trafficking and wider border capacity issues.

IAEA

The IAEA is active in Southeast Asia, as Vietnam, Indonesia, Malaysia, and other regional states are cooperating with—and seeking guidance from—the agency.[46] This is most recently evidenced by the IAEA's recent review mission in Malaysia to examine radiation safety related to rare earth materials processing activity in the country, and the IAEA Director General Yukiya Amano's visit to Vietnam, Thailand, and Indonesia in October 2011.[47]

The IAEA has a number of guidance documents that have helped states in the region develop legal infrastructure; these include: the Handbook on Nuclear Law–Implementing legislation; International Law Series No. 2 (done with the UN Office on Drugs and Crime); the IAEA Nuclear Security Plan 2010-2013 (GOV/2009/54-GC(53)/18); and the IAEA Nuclear Security Series. Other activities that regional states have benefited from have included assessment services like IPPAS and INSServ missions. The IAEA also actively engages with member states in the region on human resource development, legislation assistance, upgrading of technical capabilities related to protection, detection and response, and information exchange.

Training for regional states has included courses on transport of radioactive materials, legal frameworks for nuclear security, creation of nuclear security culture, and material accounting. The IAEA has to some extent helped to coordinate overall cooperation between assisting states and other international organizations. Equipment donated by the IAEA (with funding provided by the EU) to the three most advanced nuclear programs in the region—Indonesia, Malaysia, and Vietnam—include radiation portal monitors, integrated security networks, and hand-held detection equipment. Also under this funding, the IAEA has provided assistance in developing an Alarm Response System.

Conclusion

This chapter has surveyed regional and international cooperation, with a focus on initiatives, fora and instruments that, together, offer potential mechanisms for advancing nuclear security in Southeast Asia. Among the existing mechanisms described in this chapter, ASEAN, the ASEAN Regional Forum (ARF), the ASEAN Convention on Counterterrorism (ACCT), the Asia-Pacific Safeguards Network (APSN), Australia's Regional Security of Radioactive Sources (RSRS), Japan's Integrated Support Center for

[46] "IAEA Concludes a Review Mission in Malaysia," International Atomic Energy Agency website, 3 June 2011, http://www.iaea.org/newscenter/news/2011/malaysiamission.html; and "IAEA Chief Visits Asian Nations," International Atomic Energy Agency website, 10 October 2011, http://www.iaea.org/newscenter/news/2011/visitasia.html.
[47] "IAEA Chief Visits Asian Nations," International Atomic Energy Agency website, 10 October 2011, http://www.iaea.org/newscenter/news/2011/visitasia.html.

Nuclear Nonproliferation as well as Russian and U.S. initiatives specific to training and capacity-building in the region appear especially promising for achieving pragmatic near-term results. They may also create opportunities for further cooperation on nuclear security–the subject of our next chapter.

TABLE 6. INTERNATIONAL TREATY & REGIME MEMBERSHIPS IN SOUTHEAST ASIA

	Additional Protocol	Physical Prot. of Nuclear Material (CPPNM)	2005 CPPNM Amendment	Global Init. to Combat Nuc. Terrorism	Proliferation Sec. Initiative	Suppress. Acts of Nuclear Terrorism	Nuclear-Weapon-Free-Zone	ASEAN Conv. on Counter-terrorism	Safety of Spent Fuel Management & Rad. Waste	Convention on Nuclear Safety	2012 Nuclear Security Summit	Code on Safety & Security of Radioactive Sources	Imp & Exp of Rad. Sources (Will/ Self-Assess)	Assist. in Case of Nuclear Accident & Rad. Emerg.
Brunei Darussalam	No	No	No	No	Yes	No	11.1996 (R)	Yes	No	No	No	No	No/No	No
Cambodia	No	08.2006 (A); 09.2006 (EIF)	No	Yes	Yes	Yes	03.1997 (R)	Yes	No	4.5.2012 (A) 7.4.2012 (EIF)	No	No	No/No	No
Laos	No	09.2010 (A); 10.2010 (EIF)	No	No	No	No	06.1996 (R)	No	No	No	No	No	No/No *Contact Point Designated*	No
Myanmar	No	No	No	No	No	No	07.1996 (R)	Yes	No	No	No	No	No/No	No
Malaysia	11.2005 (S); not EIF	3.2012 (R)	3.2012 (R)	Yes	No	Yes	10.1996 (R)	No	No	No	Yes	Support	Yes/Yes	09.1987 (S); 10.1987 (EIF)
Indonesia	09.1999 (S; EIF)	7.3.1986 (A) 11.5.1986 (R) 02.8.1987 (EIF)	5.2010 (R)	No	No	No	04.1997 (R)	Yes	10.1997 (S); 06.2011 (EIF)	04.2002 (R)	Yes	Support	No/No *Contact Point Designated*	09.1986 (S); 12.1993 (R)
Philippines	09.1997 (S); 02.2010 (EIF)	02.1987 (EIF); 05.1980 (S)	3.2012 (S)	Yes	Yes	Yes	06.2001 (R)	Yes	03.1998 (S)	10.1994 (S)	Yes	Support	Yes/No *Contact Point Designated*	06.1997 (A; EIF)
Singapore	09.2005 (S); 03.2008 (EIF)	3.2012 (R)	3.2012 (R)	Yes	Yes	Yes	03.1997 (R)	Yes	No	12.1997 (A); 03.1998 (EIF)	Yes	No	No/No	01.1998 (A; EIF)
Thailand	09.2005 (S); not EIF	3.2012 (A)	No	Yes	No	Yes	03.1997 (R)	Yes	No	No	Yes	Support	Yes/Yes	09.1987 (S); 04.1989 (EIF)
Vietnam	08.2007 (S); not EIF	3.2012 (A)	No	Yes	No	No	11.1996 (R)	Yes	No	07.2010 (EIF)	Yes	Support	Yes/No *Contact Point Designated*	09.1987 (A)

Notation: (A) Acceded; (EIF) Entry into Force; No Affiliation; (R) Ratified (S) Signed.

Sources/Notes: See the Model Additional Protocol to safeguards agreements grants the IAEA complementary verification authority, http://www.iaea.org/OurWork/SV/Safeguards/protocol.html; *The Convention on the Physical Protection of Nuclear Material*, 3 March 1980, establishes measures related to the prevention, detection and punishment of offenses relating to nuclear material. See http://www.iaea.org/Publications/Documents/Conventions/cppnm_status.pdf; Created jointly by the United States and Russia on July 15, 2006 in St. Petersburg, Russia, the *Global Initiative to Combat Nuclear Terrorism (GICNT)* is an international partnership of 82 nations and four official observers who are committed to working individually and collectively to implement a set of shared nuclear security principles. See GICNT partner nations list, http://www.state.gov/t/isn/c37083.htm; Launched on May 31, 2003, the Proliferation Security Initiative (PSI) is a global effort that aims to stop trafficking of weapons of mass destruction (WMD), their delivery systems, and related materials to and from states and non-state actors of proliferation concern. See list of PSI participants, http://www.state.gov/t/isn/c27732.htm; *The International Convention for the Suppression of Acts of Nuclear Terrorism* entered into force on 7 July 2007. See status list, http://untreaty.un.org/cod/avl/ha/icsant/icsant.html; See additional information on the Central Asia Nuclear-Weapon-Free-Zone and the Southeast Asian Nuclear-Weapon-Free-Zone (SEANWFZ) at http://www.nti.org/e_research/official_docs/inventory/index.html; *The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* entered into force on 18 June 2001. The Joint Convention applies to spent fuel and radioactive waste resulting from civilian nuclear reactors and applications and to spent fuel and radioactive waste from military or defense programs if and when such materials are transferred permanently to and managed within exclusively civilian programs, or when declared as spent fuel or radioactive waste for the purpose of the Convention by the Contracting Party. The Convention also applies to planned and controlled releases into the environment of liquid or gaseous radioactive materials from regulated nuclear facilities. See status list, http://www.iaea.org/Publications/Documents/Conventions/jointconv_status.pdf; *The Convention on Nuclear Safety* was adopted in Vienna on 17 June 1994. Its aim is to legally commit participating States operating land-based nuclear power plants to maintain a high level of safety by setting international benchmarks to which States would subscribe. See status list, http://www-ns.iaea.org/conventions/nuclear-safety.asp; The Nuclear Security Summit took place on 12-13 April 2010 in Washington, DC. See additional information, http://www.state.gov/nuclearsummit/; *The Code of Conduct on the Safety and Security of Radioactive Sources* is a central piece of the greater radiological security framework and outlines the IAEA guidelines to promote the safety and security of radioactive sources. It is a voluntary measure and is not legally binding. Since it was first endorsed in 2003, the Code of Conduct has achieved extensive political support. More than ninety states endorse the resolution which is a non-binding agreement. However, not all of the states who expressed support for the Code, such as Indonesia, have implemented further measures spelled out in the subsequent *Guidance on the Import and Export of Radioactive Sources*. See additional information, http://www-ns.iaea.org/tech-areas/radiation-safety/code-of-conduct.asp; The Supplementary Guidance on the Import and Export of Radioactive Sources seeks to establish an effective import and export control over nuclear and radioactive materials. Like the Code of Conduct, the Guidance is not a legally binding agreement. The guidelines establish the accepted transfer protocol for radioactive sources to ensure that practices are consistent with the exchange provisions provided in the Code of Conduct. States endorsing the Supplementary Guidance Code should act in accordance with the policies on the import and export of radioactive sources, maintain relevant points of contact, and complete a self-assessment questionnaire on the implementation of the code and guidance. See additional information, http://www-ns.iaea.org/tech-areas/radiation-safety/code-of-conduct.asp; *The Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency* establishes an international framework for facilitating cooperation among member states in the event of a nuclear accident or radiological emergency. Entered into force 26 February 1987, the Convention provides the materials, personnel, and technical assistance to members following an emergency request. All coordinating and assistance bodies are directed through the appropriate IAEA bodies that provide the emergency support equipment, information, and additional services. See additional information, http://www.iaea.org/Publications/Documents/Conventions/cacnare.html.

OPPORTUNITIES FOR RUSSIAN-U.S. AND MULTINATIONAL COOPERATION ON NUCLEAR SECURITY IN SOUTHEAST ASIA

Need for Cooperation As Seen from the Region – Overview of Discussions at Project Workshop

In discussions with numerous regional players at the October 2011 workshop on the issue of nuclear security in Southeast Asia, potential areas of collaboration were highlighted aimed at strengthening nuclear security in Southeast Asia. In these discussions, varying opinions were voiced about how collaboration should be carried out and who would be the most effective partners. For some issues, like legislative assistance and building of physical capacity, purely bilateral cooperation was seen to be most effective. In other cases, such as increasing information sharing and building networks of nuclear expertise, taking a regional approach for cooperation appeared more efficient. In these discussions, there was a general view that Russian-U.S. experiences, accentuated by that of other international partners, could be a useful tool in the region. Information sharing, particularly in areas related to halting illicit trafficking, was identified as an important area for collaboration; international partners, including the IAEA and the EU, might be particularly helpful in assisting regional actors in this area.

Participants thought that Russian-U.S. cooperation was particularly useful in strengthening border control and detection capabilities, as well as creating a cadre of nuclear experts in the region. One participant also noted that Russian-U.S. cooperation would work well if focused on scientific cooperation, and that they could leverage their scientific expertise in support of nuclear security. Focusing on "science" can also help with political challenges given that the emphasis is placed on identifying the specialists that are best at a particular technical area. As one official noted, Russian-U.S. cooperation would help with defining outcomes and showing the variation of approaches that could successfully be used to meet these outcomes. A number of other participants noted, however, that for political and practical considerations, the most likely place for there to be Russian-U.S. collaboration was in Vietnam, due to both countries' interest in cooperating with Hanoi in the area of nuclear power, but exact format of cooperation that would meet all sides' interests needs to be developed.

Northeast Asia was also seen as a useful source of support for strengthening nuclear security in the region. Similar to Japan's Integrated Support Center, South Korea plans to

launch a training center in 2013. It is unclear, however, if these centers will act in coordination or if Seoul and Tokyo will ultimately be competitors for attention from states in search training. Southeast Asia is a key area of interest for both Japan and South Korea, and countries in the region have been highly receptive to bilateral and multilateral training efforts from both countries.

The Seoul Nuclear Security Summit was highlighted on a few occasions during the workshop as a vehicle for moving the region forward on a positive track. Outside partners could cooperate with regional players in meeting goals set forth at the 2010 meeting in Washington and the 2012 meeting in Seoul.

One issue that was highlighted a number of times was the need for coordination of programs by all actors in the region. Concerns were raised about "outreach fatigue" and the importance of avoiding overwhelming local domestic systems through overlapping programs and inefficient use of resources. This is also a common complaint from dialogue partners implementing various capacity building programs with ASEAN, and one that ASEAN itself is conscious of. The importance of avoiding duplication was highlighted by many participants and one expert noted that entities like the Global Partnership could be useful for this; another pointed to the Border Monitoring Working Group, supported by the U.S. DOE, the EU's Joint Research Center and the IAEA, as another good example of how to coordinate cooperation and assistance.

Potential Russian-U.S. Cooperation in Southeast Asia

The United States and Russia have extensive experience cooperating on nuclear security, spanning almost 20 years. Most activities were in reaction to the break-up of the Soviet Union, and related to the need to implement nuclear arms reduction treaties and introduce measures to secure nuclear materials and facilities despite the deep economic crisis affecting those countries. Cooperation programs (some of which are still under way) covered a broad range of issues, including export controls, physical protection, and accounting of nuclear materials. While the assessment of various cooperative programs sometimes differs in the United States and Russia, several of them are viewed as very successful and effective by both sides. Among them are the improvement of border security and the establishment of a system of training specialists in various aspects of nuclear security. The depth of historical and specialized knowledge built through this multi-decade collaboration can serve as a unique and particularly well-suited mechanism to significantly advance and accelerate nuclear security in Southeast Asia, especially if combined with the regional and multilateral mechanisms described in the previous chapter. In the view of a number of experts, many features of the joint Second Line of Defense (SLD) program could be specifically adapted to requirements unique to Southeast Asia, and the approach of the

SLD program could foster development of standardized training and organizational practices in the region.[115]

As part of the SLD program between the Russian Federal Customs Service and the U.S. DOE, 383 border crossings and international mail exchanges were equipped with radiation detection systems.[116] This equipment includes Yantar monitors, a fixed-position system that can screen passengers, luggage, international mail, cars, trucks, and railway carriages for radiation. There are also several man-portable versions of the device. The program is an example of partnership that includes the development and use of indigenous technology. The SLD relies on Russian-designed and Russian-made technologies and equipment certified under IAEA and U.S. standards. Another feature that contributed to the success of the program is its joint financing by both the U.S. and Russian governments from the start. These technologies have also been used by various U.S. and IAEA-sponsored projects in other countries. Russian-made radiation detectors have been installed at border crossings in Albania, Armenia, Egypt, Jordan, Kazakhstan, Qatar, Lebanon, Serbia, Uzbekistan, and Ukraine.[117] They have also been chosen for the installation at the passenger terminal of the Hanoi airport as part of an IAEA pilot project in Vietnam. Cooperation with Russian specialists as part of the project has also enabled U.S. companies making similar devices to upgrade their technology.

Another area of successful cooperation is the return of HEU fuel that was earlier supplied to third countries and conversion of research reactors to LEU fuel. The first Russian-U.S. nuclear security project in Southeast Asia was the conversion of the IVV-9 reactor at the Dalat Institute of Nuclear Research in Vietnam. In 2007, the core of the reactor was partially converted through cooperation with specialists from the two countries, enabling the use of mixed HEU-LEU fuel. A complete conversion was finished in late 2011; since this was implemented, the reactor uses only LEU fuel. In late 2013, spent HEU fuel from the reactor (enriched to 36 percent) will be repatriated to Russia. Fresh HEU fuel was removed as part of a joint Russian-U.S. operation with the involvement of the IAEA in September 2007.

As noted in Chapter Three of this report, Washington has been working to improve security at Southeast Asian seaports as part of the Megaports Initiative. Meanwhile, Russia is actively pursuing cooperation with countries such as Vietnam and Myanmar in training nuclear energy and nuclear research specialists, and has already received some experience in nuclear security-related training of experts from the region, as well as in strengthening border controls in Southeast Asia. Both countries have experience working in the region on these issues; taking a collaborative approach could leverage

[115] Discussions and presentations from the International Workshop on Prospects for Nuclear Security Partnership in Southeast Asia, Vienna, Austria, 31 October 2011.

[116] "Outcomes of cooperation under the Second Line of Defense program to equip border checkpoints with radiation detectors," (in Russian) 22 September 2011, http://customs.ru/index.php?option=com_content&view=article&id=14909:-l-r-&catid=40:2011-01-24-15-02-45.

[117] Over 6,000 Yantar fixed automated radiation detectors have been installed at border checkpoints in Russia and other countries.

each countries' comparative advantage in certain aspects of creating a robust nuclear security framework in the region and more efficiently utilize limited resources. For a number of significant issues related to building an effective nuclear security infrastructure, national authorities would also do well to create close ties to the relevant domestic industry. Russian and U.S. authorities have a history of providing a framework for industry outreach.

Recommended Areas for Collaboration in Southeast Asia:

A Set of Preliminary Suggestions

Based on an examination of challenges, mechanisms, and opportunities for cooperation specific to nuclear security development in Southeast Asia, our research suggests the following areas as particularly suited for bilateral and multilateral collaboration:

- ***A Southeast Asian Second Line of Defense***

Russia and the United States could offer the Southeast Asian countries a joint initiative to address key nuclear security challenges under a Southeast Asia Second Line of Defense (SEASLD) program. The aim would be to secure these countries' borders to prevent illicit trafficking of nuclear and radioactive materials, including through the provision of radiation detection equipment at border areas.

As part of a SEASLD program, the U.S. and Russian governments could coordinate efforts to install much needed equipment at ports and border stations throughout the region. Within the context of the October 2011 workshop, numerous experts from the region noted that securing borders and improving detection capacity at border areas was important for improving domestic infrastructure. One participant noted, for example, the need for equipping regional airports with radiation detectors. This type of project would fit well in an overall Russia-U.S. supported SLD for Southeast Asia.

In fact, the U.S. DOE's Second Line of Defense program—in addition to its activities in regional Megaports—has already worked with countries in the region to equip ports and border crossings with radiation detection equipment.[118] Russia could build on this, providing technology and partly financing the installation of radiation detection systems, particularly in countries it hopes to develop nuclear cooperation with, such as Vietnam and Myanmar. Continued interest from the Vietnam General Department of Customs in receiving donations of equipment of this nature suggests such an

[118] See "U.S. and Cambodia Agree to Secure Seaport Cargo," on the U.S. DOE/NNSA website, http://nnsa.energy.gov/mediaroom/pressreleases/12.14.09c; "Radiation Detection Tech Fully Operational at Cambodian Port," Global Security Newswire, 9 September 2011, http://www.globalsecuritynewswire.org/gsn/nw_20110909_3564.php; and "U.S. and Malaysia Agree to Secure Seaport Cargo," on the DOE/NNSA website, http://www.nnsa.energy.gov/mediaroom/pressreleases/02.27.08

arrangement would be both highly pragmatic and feasible.[119] The costs will be negligible compared to the price of the two commercial energy reactors in Vietnam (about US$9 billion)[120] and of the nuclear research center in Myanmar (about US$250-500 million)[121].

Both the U.S. and Russian governments have experience in training regional specialists on issues related to nuclear safety and security and are making a significant investment in doing so. For example, the Russian training program for 100 specialists from Vietnam, is costing at least half a million US dollars a year. Some of the financing of additional training programs could come from the Russian contribution to the IAEA voluntary Nuclear Security Fund. The rest of the funding could come from the host countries themselves and from Japan, which plans to build two nuclear energy reactors in Vietnam, and possibly via U.S.-funded projects such as the SLD or similar nonproliferation initiatives. In addition, a sizable contribution could be made by the European Union, which is also contributing to the provision of equipment and to the training of border guards. To make the project more sustainable, authorized organizations from the countries involved could draw up a roadmap for equipping border checkpoints at Southeast Asian countries with radiation detectors. U.S. authorities could also be brought in to assist with configuring a domestic framework that will strengthen the host country's ability to sustain efforts at securing their trade and assuring no illicit transportation of nuclear or radioactive materials.

Training of customs officials is also an area where past SLD related cooperation could be tapped to assist Southeast Asian states. The U.S. Export Control and Related Border Assistance (EXBS) program is active in many countries in Southeast Asia and, in collaboration with the host country, trains customs and licensing officials on methodologies for detection of WMD-related materials. Likewise, the U.S. DOE's Commodity Identification Training (CIT) has been offered to customs officials throughout Southeast Asia and these programs should be expanded. Complementing existing training programs in the host country, Russia could also train customs officials from the countries in the region at the Russian Customs Academy branches in St. Petersburg and Vladivostok. Both branches already have the specialized training centers and recent experience of training specialists from other countries. The first groups of trainees could be recruited from among the specialists who have studied at the MEPhI National Nuclear Research University in the past. The Russian customs training centers could also help in the development of textbooks and other training materials for use in Southeast Asia's own national or regional training centers.

- ***Training of Specialists and the Next Generation of Scientists***

Russia and the United States could invite countries in the region to make use of the training infrastructure and programs already developed through joint efforts in Russia,

[119] Project researcher's interviews with officials in Vietnam, March 2011.
[120] Project researcher's interview with Vietnamese government officials, Hanoi, December 2011.
[121] Dmitry Konukhov and Anton Khlopkov, "Russia, Myanmar And Nuclear Technologies," Center for Energy and Security (CENESS) website, http://ceness-russia.org/data/doc/MyanmarENG.pdf.

mostly at MEPhI and at training facilities in Obninsk—the Interdepartmental Special Training Center (MSUTs). These facilities are already being used for a number of IAEA- and U.S. DOE- sponsored training programs for third country specialists. This practice could and should be expanded, and include both academic and professional development training. For example, specialists from Southeast Asia – especially those already studying in Russia – could take courses at MEPhI on topics such as physical protection, control and accounting of nuclear materials, safe and secure management of nuclear materials, and nuclear and radiation safety. These programs have been developed at MEPhI in cooperation with the then Russian Ministry of Atomic Energy (now Rosatom state corporation) and the U.S. DOE. Similar programs have also been launched at the Tomsk Polytechnic University and at the Sevastopol National University of Nuclear Energy and Industry in Ukraine. Members of the Pakistan Atomic Energy Commission have expressed interest in rolling out such programs in their own country.[122] The costs could be shouldered by Russia and the United States or other international partners and organizations.

Russia could also offer Southeast Asian countries post-graduate programs for nuclear and radiation security and safety specialists at MSUTs at Obninsk. The Institute is part of the MEPhI structure. It pursues a number of joint projects with the IAEA; some of these projects have already involved representatives from Southeast Asia. In June-July 2011, the Institute held an international training course on physical protection inspections at nuclear facilities for specialists from several countries, including Indonesia, Malaysia, Thailand, and Vietnam.[123] Other courses offered by the Institute include Security of Radioactive Sources and Practical Operation of Physical Protection Systems at Nuclear Facilities.

Yet another institution which can train specialists from Southeast Asia is the Central Institute for Continuing Education and Training (TsIPK) in Obninsk, home of the world's first nuclear power plant. On 19 September 2011, TsIPK signed an agreement on cooperation in training nuclear infrastructure and NPP operation specialists with the IAEA. It has already delivered courses to specialists from Vietnam, Bangladesh, and Egypt on drawing up contract terms and documents for NPP construction; identifying the sites for nuclear power plants; design and specifications of nuclear fuel; and physical protection of nuclear materials.[124]

Within the region, a potential new mechanism for training that could be supported by Russian-U.S. bilateral cooperation is the establishment of the Thailand Chulalongkorn Institute for Safety, Security and Safeguards. Additionally, the IAEA has been supporting the "International Nuclear Security Education Network" (INSEN), which is a partnership between the Agency and about 60 educational/research institutions and competent

[122] Project researcher's interview with Pakistani government officials, Islamabad, March 2011.
[123] "All countries are invited!" International IAEA course (in Russian), 24 June 2011, http://www.infib.ru/show_new.phphttp://www.infib.ru/show_new.php
[124] "Advancing Human Resource Development and Training for New Nuclear Power Programmes," 22 September 2011, http://www.scicet.ru/en.php/content/science

national authorities. INSEN is meant to support nuclear security efforts by developing, sharing, and promoting excellence in nuclear security education.

Along with the IAEA and other international partners, Russian-U.S. collaboration should focus on the training of the next generation of nuclear specialists. Much of the work on nuclear security in the region that will need to be done are at the operational level of nuclear authorities, and the younger generation of experts are likely to be key to creating a lasting nuclear security capacity and culture over the long-term. They will also be most able to create a sustainable network of experts focused on this area of work and encourage other up and coming experts. In collaboration with relevant NGOs, Russian and U.S. support could be used to create a program aimed at training the next generation of nuclear experts. This collaboration could include facilitating access of these young scientists to international seminars and training programs.

- ***Building Nuclear Security Norms and Infrastructure***

As illustrated in Table 5 of this report, there is a mixed level of implementation of major nuclear security-related conventions and treaties in Southeast Asia. These international agreements, including the Code of Conduct on Safety and Security of Radioactive Sources, the related Guidance on Import and Export or Radioactive Sources, and the Convention on the Physical Protection of Nuclear Material are key agreements that could help in the formation of a nuclear security norm in the region. Implementation of these and other agreements should be a clear goal for any collaboration between international partners in the region.

Further engagement of Southeast Asian countries via the Nuclear Security Summit process can assist in building positive momentum for the full implementation of these international agreements. Currently, Indonesia is playing a key role by taking the lead on creating model legislation related to nuclear security, but further support is needed in translating that model legislation into domestic law in individual states. As noted by one Indonesian official, a problem for many smaller countries is that due to the myriad of international treaties and conventions related to nuclear security and safety, creating domestic legislation is a challenge.[125] The continued support given by Russian, U.S., and other international experts is one important method for strengthening related norms and domestic infrastructure in the region. According to one Vietnamese official, the shortage of qualified specialists is holding back the inter-agency approval of the decision on whether the country should join the Convention on Nuclear Safety and ratify the IAEA Additional Protocol. Although the Vietnamese government is demonstrating the political will to complete all the required procedures before the Nuclear Security Summit in Seoul in 2012, this goal was not met owing to the shortage of qualified specialists at VARANS. International assistance could have a role to play in speeding up this process in Vietnam[126].

[125] Project researcher's interview with officials in Indonesia, February 2011.
[126] Project researcher's interview with Vietnamese government officials, Hanoi, December 2011.

Creation of model legislation should be followed by regional workshops, potentially in cooperation with ASEAN and/or ARF, aimed at assisting national authorities with establishing frameworks for their unique domestic systems. This kind of intervention has been done with ASEAN previously in the counter-terrorism field, with expertise provided by the UN Office on Drugs and Crime's Terrorism Prevention Branch, and funding from international partners. In the proposed scenario, international expertise on building security infrastructure (particularly from the U.S. and EU experiences) would be a key ingredient to this sort of regional outreach. Russia's experience with building and strengthening its own systems in the last few decades would be instructive for Southeast Asian officials looking to set up their own systems. All international actors could speak on the importance of having a strong, independent regulatory body—pointing to the Indonesian system as a local example.

Regional experts pointed to the need for cooperation and assistance in developing and updating relevant legislation and regulations related to nuclear security plans. These plans would include developing legal frameworks, reviewing nuclear security plans, and creating effective implementation plans to build human capacity. Assistance from the United States, Russia, Japan, the EU, and others would be vital when drafting domestic laws, regulations, and relevant implementation plans. International partners have already undertaken this type of activity as part of assisting in implementing the UNSCR 1540 in Asia. For example, U.S. officials helped Malaysia with the writing of its Strategic Trade Control Act, while Russia assisted Vietnam in developing the regulations governing the choice of NPP sites and outlining the requirements these sites must meet.[127] When addressing the strengthening (and in some states, creation) of nuclear security infrastructure, the practical experience of regional states will be beneficial, and collaboration among these states could assure that resources are well spent and assistance is efficiently allocated.

- ***Improving Radiological Source Security***

International partners, particularly the Russian Federation and the United States, could create additional opportunities for improving radiological security, ranging from legal and regulatory enhancements to the fostering scientific collaboration. Assisting with the development of legal frameworks and the promotion of scientific collaboration are areas where Russia-U.S. cooperation was seen as potentially useful in Southeast Asia. As already noted, the region has a mixed record of adhering to and implementing key international instruments on radiological security, most notably the non-binding 2003 Code of Conduct on the Safety and Security of Radioactive Sources and related measures. Moreover, the U.S. Nuclear Regulatory Commission last year assessed that only a limited number of countries "have developed and implemented radioactive source security measures through various means (e.g. codes of practice, incorporating guidance documents into license conditions, or regulations)."[128] Indonesia and Vietnam were cited as among those countries which had done so. Beyond licensing and codes of conduct,

[127] Project researcher's interview with Vietnamese government officials, Hanoi, December 2011.
[128] James T. Wiggins, "Memo to NRC Commissioners: International Radioactive Source Security Efforts," Nuclear Regulatory Commission, SECY-10-0066, 20 May 2010.

some have also suggested mandatory participation in the IAEA Illicit Trafficking Database as an additional method for enhancing global source monitoring while also improving outreach, global cooperation, and awareness.[129]

Legal measures, however, are not the only path to improved radiological source security. Creating venues for scientific collaboration and exchange of ideas with source users in the region, and tapping inherent incentives for secured or reduced radioactive source usage, could also motivate and engage local experts at the ground level. Specifically, laboratories in the United States and Russia engaged in research or practice ranging from radiography and radiotherapy to well logging, could work together with colleagues in Southeast Asia. Potential topics could include feasible and effective methods for improved storage, and accountability or procedures for minimizing necessary usage. A particularly useful project could involve the establishment of research and development collaborations of scientists and engineers investigating and implementing tracking devices or even alternatives to radiological sources.

National laboratories in Russia and the United States could also collaborate with their colleagues in Southeast Asia in developing appropriate courses, training modules, and textbooks on radiation source security and nuclear forensics to produce end products that would incorporate both the lessons learned in more experienced countries together with the nuances of applying them in various localities. Countries in Southeast Asia lack institutional and financial resources for indigenously developing nuclear forensics expertise comparable to the level available through Russia and the United States.[130] Further, a report by the National Research Council, published in 2010, noted that a declining U.S. nuclear weapons budget, and the economic and demographic realities of today's nuclear forensic scientists, reinforces the desirability of engaging professionals already working in complementary fields.[131] Collaborations between Russia, the U.S., and Southeast Asia could thus provide mutually beneficial outcomes in terms of the sustainability of workforce, streamlining of procedures and tools, and trans-border organization.

Technological solutions provide a third avenue for improving radiological source security in Southeast Asia, and one that emphasizes forward-thinking innovation rather than reactive incident reporting. The efforts of national laboratories and institutes already developing methods for tracking radiological sources could provide primers for extending

[129] Charles Streeper, "Preventing Dirty Bombs," *Nonproliferation Review*, November 2010, p. 537.
[130] In the United States, nuclear forensics capabilities historically developed within well-funded nuclear weapons programs, whose budgets are themselves now in decline. See National Research Council, *Nuclear Forensics: A Capability at Risk (Abbreviated Version)*, (Washington, DC: National Academies Press, 2010), p. 6.
[131] Specifically, "a substantial fraction of the experienced personnel are retired, now eligible for retirement, or nearing retirement age." In addition, "most nuclear forensics work is not continuous, so the majority of current practitioners must be occupied with other work for much of their time" … "it would be desirable if other work in which personnel were engaged were complimentary to nuclear forensics work. Fields such as environmental remediation, advanced fuel-cycle research, and nuclear medicine development and production are examples of relevant related work for radiochemists." See National Research Council, *Nuclear Forensics: A Capability at Risk (Abbreviated Version)*, (Washington, DC: National Academies Press, 2010), p. 7.

such efforts into Southeast Asian countries, which could serve either as development partners or implementation case studies. Specific technical solutions could include tracking radiation sources using medical technology or limited impurities, and developing security-by-design for new instruments or equipment. Additionally, efforts by Russian and U.S. experts to create secure radioactive source storage could lead to effective assistance to Southeast Asian countries dealing with their own materials. The containers would need to be low cost, requiring minimum levels of outside security and maintenance.

A current example of commercial radiological source tracking is the Global Radiological Source Sorting, Tracking, and Monitoring (GRadSSTraM) Project currently undertaken by the U.S. Department of Commerce and the EU, which uses RFID tags to monitor shipment of radiological sources.[132] A second example, more specifically motivated by the risk of malicious theft of radiological sources, is the GPS-based tracking system developed by the Korea Institute for Nuclear Security (KINS), which will soon be the subject of a pilot program in Vietnam.[133] Implementing comprehensive tagging and real-time tracking of radiological sources would dovetail with existing efforts to enhance radiological detection at ports and border crossings in both regions. While implementing technical solutions of this kind in lesser developed economies would present new and different challenges, and while financial and geographic design constraints will need to be re-evaluated and faithfully applied for implementation in Southeast Asia, technological solutions nonetheless provide an important avenue that could complement legal or outreach-based efforts. Developing sustainable improvements to radiological source security in specific locations in the two regions will also require attention and deference to the specific problems and priorities of the individual locales.

The Russian and U.S. governments could also work with regional partners to develop inventories of radiological sources in Southeast Asia. Russian, U.S., and local authorities could work together to create an accurate accounting of the number, type, and state of use of radiological sources. This type of detailed data will aid in creating an efficient regulatory system in the host country that effectively manages sensitive nuclear materials.

Additionally, efforts by Russian and U.S. experts to create secure radioactive source storage arrangements could lead to effective assistance to Southeast Asian countries dealing with their own materials. Bunker-type containers for radioactive waste and disused sources might be one of the solutions. Such containers for storage would need to be developed and supplied. They would need to be low cost and require minimum levels of outside security and maintenance.[134]

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[132] Randy Walker, David Hill, and Bryan Gorman, *Global Radiological Source Sorting, Tracing, and Monitoring Project Phase 1 Final Report* (Oak Ridge, TN: Oak Ridge National Laboratory, September 2010).

[133] See Korea Institute of Nuclear Safety, "Deployment of the Advance of Regulatory System: RadLot (Radiation Source Location Tracking System," http://www.kins.re.kr/english/deploy/dep_rsts.asp, accessed 21 July 2011; and Seong Ho, "National Regulatory Bodies and International Networks: Lessons Learned in Korea," 12th International Congress of the International Radiation Protection Association, Buenos Aires, 19-24 October 2008, available at http://www.irpa12.org.ar/special_sessions.php.

[134] Project researcher's interview with IAEA officials, April 2011.

- ***Preventing Illicit Trafficking of Nuclear and Radiological Materials***

The common problem in the region of weak strategic trade management is an area where Russian-U.S. collaboration could also be of assistance. The strengthening of relevant trade security systems in the region would benefit from joint international cooperation, including through Russian-U.S. partnership, and with the possible involvement of the 1540 Committee and other supportive countries. In collaboration with regional partners and regional organizations like ASEAN and ARF, international experts could assist with the development of legal frameworks specific to the management of strategic trade. Additionally, and in accordance with the ARF Plan of Action from the 2010 Hanoi meeting, the creation of efficient networks of intelligence sharing and collaboration of customs officials could be a key goal of international cooperative efforts. For these activities, the World Customs Organization (WCO) might be an ideal vehicle for guidance.

To increase awareness of illicit WMD-related trafficking, Russian, U.S., and regional governments could partner with multinational logistics firms and corporations in Southeast Asia who have strong export compliance programs. Such firms may already be training subcontractors and customers in the region on concepts such as "red flag checks" and "end-user checks." Related specifically to nuclear security, establishing a dialogue with foreign firms supporting nuclear energy development in the region would be a start. As part of their efforts to gain business in the region, many firms offer training in the area of nuclear facilities management as part of their overall sales package. The training these firms offer could be an ideal vehicle for creating awareness in the region of illicit trafficking networks and diversionary tactics.

In order to increase understanding of dual-use goods and the need for effective trade controls in the region, international partners should sponsor training on these issues that are scaled to the realities of the different countries' trading situation. One issue is that officials from developing states in Asia do not see themselves as manufacturers of dual-use goods with technology sufficient to trigger controls.[135] However, as foreign suppliers begin constructing nuclear facilities in countries such as Vietnam and Indonesia, there will almost certainly be a need to transfer dual-use materials to and from the supplier states. This presents an excellent opportunity to introduce responsible authorities to an actual, controlled dual-use item, and then "walk through" the process of exporting it from the regional state.

- ***Developing Internal Coordination and Improving Allocation of Resources***

Lack of interagency coordination is an overarching problem that impedes the development of a nuclear security capacity in many countries in Southeast Asia. Very often, policy-making organs do not coordinate activities with technical agencies, and the policy-makers do not place sufficient priority or resources into building a nuclear security

[135] Project researcher's interview with officials in region at Asian Export Control Conference in Tokyo, February 2011, as well as discussions in Vietnam and Indonesia in February and March 2011.

infrastructure and culture. Encouraging interagency cooperation on the relevant issues should be one key objective of all engagement in the region.

Russian and U.S. specialists could also organize table top exercises in the region that include both policy-making organs and technical agencies. In previous exercises sponsored by the U.S. DOE in the region, nuclear authorities worked with local enforcement agencies to coordinate simulations involving mock efforts to divert materials or attack facilities, and discussed tactics to counter them. An expanded exercise would broaden the scope of understanding of the needs related to nuclear security within the policy-making community, and illustrate the necessary cooperation (and resources) required to fully enable a nuclear security apparatus.

In the current political and financial environment, it would be remiss to ignore how the recent economic downturn may be affecting the allocation of resources to nuclear security in the region. One useful effort would be to assess the impact of the recent economic downtown on security-related budgets in the region and to identify whether this may affect the perception of controls related to trade as impeding economic development. If this perception is evident, developing a counter-strategy, including the possible provision of financial assistance, may be needed to ensure necessary resources are allocated by regional governments.

- ***Working at the Regional Level***

As ASEAN moves towards creating a closer community over the next few years, the interest in, and ability to cooperate on, transnational security issues such as nuclear security is likely to increase. The increased openness to cooperation in these areas could be fostered by cooperative activities with Russia and the United States, as well as with the other interested parties such as Australia, the EU, the IAEA, Japan, and South Korea.

Collaboration with Southeast Asian countries on nuclear security issues, especially if it entails direct interaction with ASEAN, will likely be facilitated if other nonproliferation concerns in the region are also addressed. International partners, especially the nuclear weapon states U.S. and Russia, could, for example, cooperate more closely with ASEAN on other priority nonproliferation issues in the region – particularly SEANWFZ. The ASEAN Secretariat staff (at the behest of their member states) has put the ratification of the protocols of the Bangkok Treaty by the NWS as a top priority. ASEAN Secretariat staff noted that efforts to advance ratification of the protocol expend a significant amount of the resources allocated for ASEAN's nonproliferation portfolio.[136] International partners should continue to promote dialogue on the issue of SEANWFZ aimed toward facilitating ratification of the protocols by the P-5. If the NWS were to ratify the protocols—which seems somewhat more likely (although still uncertain) after the negotiations in late 2011— the resources previously expended within the ASEAN secretariat on promoting the SEANWFZ protocols could be re-allocated for use in the area of nuclear security and strategic trade management.

[136] Project researcher's interview with ASEAN officials in Jakarta, February 2011.

Expanded nonproliferation-related engagement with ASEAN's Secretariat and policy making officials by international partners could enable the organization to take a more pro-active role on nuclear security. As noted previously, the Secretariat has limited personnel working on nonproliferation issues, and many of these officials have only limited knowledge of the subject matter. Creating programs that help build the Secretariat's capacity in this matter would have positive affects both within the organization and within member states. These types of programs could include short-courses, utilizing U.S. and Russian expertise as well as instructors from the IAEA and elsewhere, focused on general nuclear nonproliferation issues and issues specific to developing a nuclear security expertise and culture in the region. Additionally, working with ASEAN or a number of its member states to create a network of nonproliferation researchers in the region—or assisting in the establishment of a local NGO focusing on nonproliferation issues—could help build awareness of relevant issues in the region. An organization such as this could also raise the profile of nuclear security and related nonproliferation concerns through more public outreach, including through the media.

Other existing regional mechanisms could also serve to facilitate nuclear security expertise and culture in the region and would benefit from increased support from international partners. The Japanese sponsored entities—including ANSN and FNCA—could work with Russian and U.S. counterparts to extend capacity building and information sharing efforts with regional partners. Additionally, universities and national laboratories in the United States and Russia could coordinate training and outreach with Japan's Integrated Support Center for Nuclear Non-Proliferation and Nuclear Security.

As mentioned previously in this report, another possibility to create a sustainable solution to build nuclear security expertise in the region is the establishment of a regional training center, which could be an efficient method of disseminating expertise. The IAEA would be an ideal vehicle for supporting this, along with additional resources from key international partners. As an interim solution, experts from the IAEA or national laboratories from Russia or the United States could be stationed in countries in the region as they establish and strengthen their nuclear frameworks. In the short-term, this could be particularly useful to countries like Vietnam and Indonesia, who are most advanced in their civilian nuclear energy development, allowing them to tap experts working closely with them on building domestic capacities. Existing regional law enforcement training centers could also be utilized to deliver training programs on issues such as border security and illicit trafficking.

Creating a "model" in the region for other countries to follow would be another collaborative way to build a nuclear security capacity and culture. Vietnam and Indonesia could be prime candidates for this; as noted by many analysts looking at the dynamic relationship between ASEAN states, the competition between Southeast Asian countries is particularly evident when one ASEAN state receives positive attention or benefit for some activity it has undertaken. If the strengthening of its nuclear security capability garners positive international attention as well as notable benefits, then neighboring countries will not want to be seen as lagging behind. The "model" country would also be able to pressure the ASEAN Secretariat to place the issue of nuclear security and related

secure trade issues on the ASEAN and ARF agendas, helping create within the bodies a level of "peer pressure" that could move the issue forward. However, care would need to be taken to ensure this kind of model did not lead to a nuclear energy race in the region, where countries accelerate nuclear energy plans to the detriment of proper safety and security.

Lessons Learned (and to Be Learned) from Nuclear Security Collaboration

Any program aimed at strengthening nuclear security in Southeast Asia must be measured on its suitability and sustainability. In order to make these judgments, international partners should look to past cooperation in the Former Soviet Union and how the Russian and U.S. authorities were able to build a viable and sustainable framework after the end of the Cold War. Although the nature of nonproliferation challenges facing countries in Southeast Asia is different from the problems in Russia or, for example, Central Asia after the fall of the Soviet Union, the comprehensive experience of Russian-U.S. cooperation could help create an effective and sustainable set of activities to assist the nuclear security framework in Southeast Asia.

Russian and U.S. experience working together on securing nuclear materials and borders, particularly as part of the original SLD program, gives us numerous areas where the lessons learned could be applied in Southeast Asia in the short to near-term. The combined knowledge of these partners, and their understanding of each other's relative expertise and advantages, can help facilitate logical and efficient division of labor in activities aimed at building nuclear security infrastructure, and establishing a robust nuclear security culture in the countries of Southeast Asia.

Collaboration would also benefit from—and would likely require—additional input from individual states in the region, regional mechanisms such as ASEAN, ARF, or ANSA, international organizations such as IAEA and WCO, and other major partner countries, such as Japan, South Korea, Australia, and the EU. It should be noted that projects and activities should tap indigenous technology and knowledge, have some level of cost-sharing between all partners, and have a clear "exit strategy" that would allow for tangible benefits even after initial financing ends.

For nuclear security frameworks to be sustainable, regional states must internalize relevant international norms and standards. To attain that level of commitment, international partners (individual states and international organizations) must work collaboratively with regional states and take their concerns and individual needs into account when undertaking projects and activities aimed at strengthening nuclear security in Southeast Asia. The initial recommendations set forth above look to use past experience and established expertise to create mechanisms that improve the capacity of domestic actors, address the unique needs of the states in the region, and create a regional framework that can be realized in the short to near-term, while still assuring long-term success.