

Multilateral Nuclear Export Controls After the A.Q. Khan Network
Jacob Blackford¹
Institute for Science and International Security (ISIS)
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Summary

This paper assesses the strengths and weaknesses of the existing multilateral nuclear export control regime, which includes the Nuclear Non-Proliferation Treaty, the Zangger Committee, the Nuclear Suppliers Group, the Additional Protocol, and United Nations Security Council Resolution 1540. It looks at two recent cases related to the so-called A.Q. Khan network of illicit nuclear suppliers in which states, Malaysia and South Africa, did not adequately implement nuclear export controls. This paper identifies six major problems with the current system: weak and inconsistent implementation, the lack of universality, the lack of legitimacy, the lack of enforcement, the lack of verification of dual-use exports, and the lack of information-sharing needed to identify clandestine programs. This paper proposes three interim steps to address some of these problems: universal adoption of the Zangger Committee's trigger list; assistance to states that need help implementing their nuclear export controls; and revising the Additional Protocol to require that supplier states report certain dual-use transfers to the International Atomic Energy Agency. As an ultimate solution to the problems identified, this paper proposes a nuclear export control treaty.

Text:

The exposure of the so-called A.Q. Khan network and its key assistance to the clandestine nuclear programs of Libya, Iran, and North Korea revealed a series of flaws and failures in the system of multilateral nuclear export controls. It showed that a system that is not universal risks being undermined from the outside. It showed that with the proper designs and know-how, emerging supplier states outside of the existing export control arrangements can make some of the most advanced nuclear equipment. It showed that enforcement needs improvement even in states that adhere to multilateral export controls. And it showed that export controls might not always slow proliferation long enough for other tools, such as IAEA safeguards, to do their part. Iran and Libya, while under IAEA full-scope safeguards—but not the Additional Protocol—nearly acquired production-scale uranium-enrichment plants before the world found out and was able to respond. While Libya has given up its program, Iran and North Korea may now be able to develop the capability to enrich uranium on an industrial scale with little further outside help. Many of the Khan network's members and suppliers have been arrested or put out of business, but the information at its core—the centrifuge designs and the know-how to

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build them—is still out there, in Iran, North Korea, and perhaps elsewhere. As Khan turned from seeker to supplier of nuclear technology, so might his clients.

The exposure of the Khan network should serve as a global call to action to reevaluate and improve the system of multilateral nuclear export controls. Along with other recent cases, the Khan network clearly points to the need for the system to be improved and supplemented, if not totally changed. The first question is whether the current system, which relies primarily on informal, consensus-based arrangements—the Nuclear Suppliers Group and the Zangger Committee—should be saved at all. If the system can nearly allow the transfer of a secret “turnkey” enrichment plant and centrifuge factory to an aspiring nuclear power, perhaps a new approach is needed. It was a new tool, the Proliferation Security Initiative, that facilitated the interception of centrifuge parts bound for Libya, which many credit with convincing the Libyan leader to reveal much more about his secret nuclear program.² In the light of these failures, an assessment of multilateral export controls would seem predetermined to find the system deeply flawed, perhaps unsalvageable. The system serves a vital function, however, though its limits must be understood. One has only to imagine the world without it to see its importance, a world where supplier states felt that if they did not sell something, someone else would. Rolling back the current system is not an option; it must be improved. The question is whether it can be adequately improved with incremental steps, as has been done in the past, or whether a dramatic change is needed.

Multilateral export controls involve the coordination of the laws and practices of dozens of governments. A true assessment of such a large and varied system is difficult and inherently highlights the failures. While the system’s successes often take the form of mid-level bureaucratic decisions, the failures and near misses are often dramatic tales that capture headlines. And while each export denied represents a potential success, no one can be certain that all sensitive exports are stopped, especially when interpretations differ over what should be stopped and to whom. Despite the problems highlighted by the Khan network, if multilateral export controls were not at least partially successful, Iran and Libya—both NPT states parties—might not have needed the Khan network in the first place and could have purchased the equipment from established suppliers. The traditional nuclear suppliers have not exported a complete enrichment or reprocessing facility since the 1970s. The problems with the system, then, though large, seem mostly to be at the margins: new supplier states that do not participate; poor implementation by existing members; and difficulties in detecting and stopping clandestine networks. As the Khan network showed, however, these problems are large enough to potentially undermine the entire system, not only the system of export controls but also IAEA safeguards and the entire nuclear nonproliferation regime.

The Present System

The present system of multilateral nuclear export controls is based on a web of legal obligations and political commitments, stemming from the NPT, IAEA safeguards, and the international norm of nonproliferation. The arrangements most closely associated

² Some disparity apparently exists in official U.S. statements on whether the interception of the *BBC China* was carried out as part of the Proliferation Security Initiative. See Wade Boese, “Key U.S. Interdiction Initiative Claim Misrepresented,” *Arms Control Today*, July/August 2005, http://www.armscontrol.org/act/2005_07-08/Interdiction_Misrepresented.asp, (accessed 1 August 2005).

with multilateral nuclear export controls are the Nuclear Suppliers Group and the Zangger Committee.³ Both are informal and consensus-based with no official enforcement mechanism. The groups have agreed on items to control and the conditions under which they will be exported. The participating states have also agreed, informally and with no international legal commitment, that they will arrange their national export control systems and laws to enforce these arrangements. The arrangements seek for all participating states to enforce their export controls consistently to prevent proliferators from shopping around and to prevent states from gaining an unfair commercial advantage by allowing exports denied by other states. While the NSG and Zangger Committee form what are traditionally considered multilateral nuclear export controls, the system includes other international agreements and instruments that are key to assessing the system as a whole.

The Non-Proliferation Treaty

The NPT was the original form of multilateral nuclear export controls. It is legally binding and nearly universal. But it is also vague. In the second paragraph of Article III, the treaty requires that no State Party transfer source or special fissionable material or “equipment or material especially designed or prepared for the processing, use or production of special fissionable material” to any non-nuclear-weapon state unless the material is under IAEA safeguards. The treaty does not specify exactly what equipment this includes. The treaty, however, makes a clear link between safeguards and export controls, a mutually supportive relationship that is still key to the success of both. Libya and Iran no doubt sought technology from the Khan network in large part to avoid putting their enrichment facilities under IAEA safeguards. The treaty says nothing about denying exports, only that certain ones are allowed only under safeguards. This places the burden of preventing proliferation on safeguards, not export controls. A major weakness in the safeguards and export controls defined by the NPT is that they focus only on special fissionable material and the equipment that makes it. Carlton E. Thorne describes this shortcoming: “The firebreak at special fissionable material has long since been overcome and the Treaty does not control items for the development, production or testing of nuclear weapons.”⁴ This limitation in IAEA safeguards was highlighted in the IAEA’s November 2004 report on Iran. The report said that while the IAEA is following up on open-source reports on Iran’s nuclear program (probably indirectly referring to reports of possible weaponization activities at Parchin), “it should be noted that the focus of Agency Safeguards Agreements and Additional Protocols is nuclear material, and that, absent some nexus to nuclear material, the Agency’s legal authority to pursue the verification of possible nuclear weapons related activity is limited.”⁵

³ For a detailed discussion of the development of multilateral nuclear export controls see Carlton E. Thorne, “Multilateral Nuclear Export Controls: Past, Present, and Future...as seen in mid-1999,” in Carlton E. Thorne, ed. *A Guide to Nuclear Export Controls 1999-2000, second edition*, (Burke, VA: Proliferation Data Services, 1999).

⁴ Thorne, p. 3.

⁵ International Atomic Energy Agency, “Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran, Report by the Director General,” GOV/2004/83, 15 November 2004, p. 24, http://www.iaea.org/Publications/Documents/Board/2004/gov2004-83_derestrict.pdf, (accessed 1 August 2005).

Despite the NPT's vague and limited language on export controls, its near universality and status as international law cements the link between export controls and the non-proliferation norm. The NPT might serve, then, as the legal and normative basis for improving and expanding effective nuclear export controls. Although states may not see its agreements as legally binding, the NPT review process has also played a role in recognizing the need and legitimacy of export controls, as the NPT review conferences define the evolving consensus of treaty members. The 2000 NPT Review Conference called on NPT states to "establish and implement appropriate national rules and regulations" to "ensure that the States parties are able to give effect to their commitments with respect to the transfer of nuclear and nuclear-related dual-use items...."⁶ Earlier review conferences recognized the work of the Zangger Committee.

The Zangger Committee

The Zangger Committee was formed in 1971, soon after the NPT entered into force, by a small group of nuclear supplier states that were party to the NPT.⁷ It was originally known as the NPT exporters committee, and its self-imposed mandate was to interpret Article III, paragraph 2, of the treaty, specifically to determine what equipment should be controlled. The committee agreed to a "Trigger List" of items whose export would trigger IAEA safeguards, just as would the export of source or special fissionable material.⁸ Although the committee's interpretations are non-binding and apply only to its adherents, Fritz Schmidt, the longtime chairman of the committee, asserts that because the trigger list is based on the NPT, its commitments are shared by all NPT states parties.⁹ The original list was limited to equipment directly involved in producing special fissionable material: nuclear reactors; non-nuclear materials for use in nuclear reactors, such as heavy water and nuclear-grade graphite; fuel fabrication plants; isotope separation plants; and plutonium reprocessing plants. Items often associated with the nuclear fuel cycle but not directly involved in making fissile material, such as plants to convert natural uranium to uranium-hexafluoride, were not originally included. As the consensus has broadened, the list has been updated and elaborated over the years. Conversion plants have been added, as have plants for producing heavy water.¹⁰ This is

⁶ 2000 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, "Final Document, Parts I and II," New York, 2000, p. 15; cited in Fritz Schmidt, "NPT Export Controls and the Zangger Committee," *The Nonproliferation Review*, Fall-Winter 2000, p. 145.

⁷ For a detailed analysis of the Zangger Committee, see Fritz W. Schmidt, "The Zangger Committee: Its History and Future Role," *The Nonproliferation Review*, Fall 1994; and Fritz Schmidt, "NPT Export Controls and the Zangger Committee," *The Nonproliferation Review*, Fall-Winter 2000; and Thorne, pp. 3-6.

⁸ International Atomic Energy Agency, "Communication Received from Members Regarding the Export of Nuclear Material and of Certain Categories of Equipment and Other Material," INFCIRC/209, 3 September 1974, <http://www.iaea.org/Publications/Documents/Infcircs/Others/inf209.shtml>. The parties to this notification were Australia, Denmark, Canada, Finland, the Netherlands, Norway, the Soviet Union, the United Kingdom, the United States of America, and West Germany.

⁹ Schmidt, 1994, p. 41.

¹⁰ International Atomic Energy Agency, "Communications of 15 November 1999 Received from Member States Regarding the Export of Nuclear Material and of Certain Categories of Equipment and Other Material," INFCIRC/209/Rev.2, 9 March 2000, <http://www.iaea.org/Publications/Documents/Infcircs/2000/inf209r2.pdf>.

important because it shows that the consensus on what equipment must be placed under safeguards has broadened.

Many question today's relevance of the Zangger Committee because of the existence of the Nuclear Suppliers Group, which has almost the same membership, has adopted the trigger list, and, most importantly, controls dual-use items, which the Zangger Committee does not. Despite its limitations, the Zangger Committee has some clear strengths that may enable it to play a future role in improving export controls. Although its membership is nearly identical to the NSG, the Zangger Committee is rooted directly in the NPT and therefore most states see it as a more legitimate arrangement. The work of the Zangger Committee has been recognized by name by the NPT review conferences in 1990 and 1995, demonstrating its wide acceptance among NPT states parties.¹¹ Based on this, many states would probably accept the need to control the export of trigger list items from their own borders, even if they are not members of the committee and even without a clear legal obligation to do so under the NPT or elsewhere.

The Nuclear Suppliers Group

Because it controls dual-use items as well as trigger list items, the NSG is more relevant than the Zangger Committee to controlling nuclear exports today. It was formed by seven nuclear supplier states in response to India's nuclear explosion in 1974.¹² Today it includes 45 members, with China an important recent addition and Croatia the newest member. Unlike the Zangger Committee, the NSG does not limit itself to interpreting Article III of the NPT, and its original members included two states that were not yet parties to the treaty, France and Japan. The NSG adopted a trigger list similar to the Zangger Committee and eventually agreed to full-scope safeguards as a condition of supply for these items. Unlike the Zangger Committee, the NSG also controls the technology to develop, make, or use any of the items it covers. This would include the centrifuge blueprints that Khan smuggled out of the Netherlands and used as the basis of his clandestine network.

The revelations of Iraq's secret nuclear program after the first Persian Gulf War provided the momentum for the NSG to agree to control dual-use items. The list of dual-use items was published as Part 2 of IAEA INFCIRC/254 and has been revised several times.¹³ The dual-use list includes items that can be used to make the equipment that

¹¹ Schmidt, 2000, p. 138. For an extensive history of references to and discussion of the Zangger Committee and its activities at past NPT Review Conferences, see the Zangger Committee's working paper submitted at the 2005 Review Conference: 2005 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, "Multilateral nuclear supply principles of the Zangger Committee," Working paper submitted by Argentina, Australia, Austria, Belgium, Bulgaria, Canada, China, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, the Netherlands, Norway, Poland, Portugal, the Republic of Korea, Romania, the Russian Federation, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom of Great Britain and Northern Ireland and the United States of America as members of the Zangger Committee, NPT/CONF.2005/WP.15, 27 April 2005.

¹² For a detailed analysis of the NSG, see Tadeusz Strulak, "The Nuclear Suppliers Group," *The Nonproliferation Review*, Fall 1993; and Thorne, pp. 4-15.

¹³ International Atomic Energy Agency, "Communications Received from Certain Members Regarding Guidelines for Transfers of Nuclear-related Dual-Use Equipment, Materials, Software, and Related Technology," INFCIRC/254/Rev.5/Part 2, 16 May 2003, <http://www.iaea.org/Publications/Documents/Infcircs/2003/infcirc254r5p2.pdf>.

makes fissile material, that is, to make the equipment on the trigger list. But because the NSG does not limit itself to interpreting Article III of the NPT, its dual-use list also includes items that can be used to make nuclear weapons themselves. Because the dual-use list goes beyond the NPT, developing countries have called the NSG discriminatory and contrary to Article IV of the treaty, which guarantees access to the peaceful use of nuclear technology. Despite this, the NSG has an important role in IAEA safeguards. Its trigger list was adopted by the IAEA Board of Governors in 1993 as the basis for the Universal Reporting Scheme, in which states agreed to voluntarily report the transfer of these items to the IAEA. In 1997 this list was incorporated into the Additional Protocol as Annex II, which specifies the items that states must report to the IAEA when exported.

While the Zangger Committee's conditions for export are clear—full-scope safeguards—the NSG's conditions for export are subjective, both for trigger list and dual-use items. This gives individual NSG members an important role in deciding whether to export an item. The NSG requires, at a minimum, full-scope safeguards as a condition of supply for trigger-list items. The NSG's Non-proliferation Principle, adopted in 1994, adds an extra condition: no export is allowed unless the supplier is "satisfied that the transfers would not contribute to the proliferation of nuclear weapons or other nuclear explosive devices or be diverted to acts of nuclear terrorism."¹⁴ Dual-use controls are inherently subjective. So as not to interfere with legitimate trade, a dual-use export is generally allowed unless the supplying state believes there is a risk it will be misused. The NSG's Basic Principle prohibits the export of dual-use items if they will be used in a nuclear explosive, un-safeguarded nuclear fuel-cycle activity, or nuclear terrorism, or if there is an "unacceptable risk" of diversion to such use. The one concrete condition for dual-use items is that the recipient must give a statement of the item's end use and location, and a declaration that it will not be put to a proscribed use. The NSG's adoption of subjective conditions of export—the Non-Proliferation Principle in 1994 and dual-use controls—were an acknowledgement that full-scope safeguards of trigger list items was not enough to guarantee that a state was not clandestinely pursuing nuclear weapons. The NSG adopted dual-use controls in a period of reduced confidence in IAEA safeguards, in the wake of revelations of Iraq's secret nuclear program and before the IAEA's adoption of the Additional Protocol gave the agency much greater powers to uncover clandestine programs.

Subjective conditions for export add flexibility needed to deal with a variety of proliferation threats. But they also open the way for differing interpretations and disagreements, resulting in inconsistent practices and implementation. States may judge the proliferation risk of a given export differently, depending on the information available and their interpretation. The United States opposes Russia's cooperation with Iran's Bushehr nuclear power plant based on its belief that Iran is seeking nuclear weapons, but Russia disagrees. NSG members inform each other when they deny an export, so proliferators cannot shop around. They also share information on suspicious end users and procurement patterns. But ultimately, each state makes its own decision on whether to allow an export based on its judgment of the information available. In effect, NSG members must rely on the intelligence gathering and law enforcement capabilities of the

¹⁴ International Atomic Energy Agency, "Communications Received From Certain Member States Regarding Guidelines for the Export of Nuclear Material, Equipment and Technology," INFCIRC/254/Rev. 6/Part 1, 16 May 2003, <http://www.iaea.org/Publications/Documents/Infcircs/2003/infcirc254r6p1.pdf>.

other members. States with less capable intelligence services and law enforcement might not get the information they need to convince their decision-makers that an export should be denied. They can also misjudge an end user's intentions or allow other interests to override their concerns. In short, implementation of dual-use controls can vary.

Another fundamental problem is the lack of verification of its dual-use controls. While trigger list items are by definition subject to IAEA safeguards, suppliers have few ways of ensuring that a dual-use item will not be misused. As of 2000, only the United States did any regular post-shipment verification of items shipped under license.¹⁵

The Additional Protocol

The Additional Protocol, where in force, plays an important role in controlling the transfer of trigger list items and certain dual-use items. In its goal of enabling the IAEA to detect clandestine nuclear activities, the protocol integrates the mutually supporting systems of export controls and safeguards. It requires states to report to the IAEA the export of trigger list items, as specified in Annex II of the protocol.¹⁶ For the first time, this puts a clear legal obligation on those supplier states to control the export of these items by reporting their export to the IAEA. While a similar obligation is implied in Article III, paragraph 2, of the NPT, the Additional Protocol clearly states what items must be reported and provides a mechanism for enforcement in the IAEA's authority to report noncompliance to the U.N. Security Council. In addition, recipient states that have an Additional Protocol in force are obligated to confirm the receipt of a transfer, if asked to do so by the IAEA.

The Additional Protocol also indirectly controls dual-use items that can be used to make certain key trigger list items. States are required to make expanded declarations of their nuclear activities, which include the manufacturing or assembly of certain trigger list items, as specified in Annex I of the protocol.¹⁷ The list specifies that states must declare the manufacture of key components for the different methods of enriching uranium, such as the rotors for gas centrifuges, diffusion barriers for gaseous diffusion, and aerodynamic separation nozzles. Activities that must be declared also include the assembly of centrifuges themselves and electromagnetic isotope separators. The protocol also requires states to declare the manufacture of key components for nuclear reactors, such as zirconium tubes, heavy water, nuclear grade graphite, and reactor control rods. And it requires states to declare the manufacture of key items for the separation of plutonium, such as hot cells and machines to chop up irradiated fuel elements.

By declaring such activities a state would also reveal the existence and location of dual-use items needed to make the related trigger list items. If a state reported it was making centrifuge rotors, it would reveal that it has a flow-forming machine and special high-strength metals, such as aluminum alloy or maraging steel—as well as the designs and know-how—needed to make the rotors. Also, because this requirement makes states legally responsible for reporting such activities, they should feel compelled to better

¹⁵ Michael Beck, "Reforming the Multilateral Export Control Regimes," *The Nonproliferation Review*, Summer 2000, p. 99.

¹⁶ See Article 2.a.(ix), International Atomic Energy Agency, "Model Protocol Additional to the Agreement(s) Between State(s) and the International Atomic Energy Agency," INFCIRC/540 (Corrected), December 1998, <http://www.iaea.org/Publications/Documents/Infcircs/1998/infcirc540corrected.pdf>.

¹⁷ See Article 2.a.(iv), INFCIRC/540 (Corrected).

monitor what happens within their borders, to ensure there is not a clandestine factory, as there were in South Africa and Malaysia. Yet despite having an Additional Protocol in force, South Africa's export controls need improvement and may not have been capable of detecting even major transfers of trigger list items. Despite the reporting requirement, the protocol is probably not a major factor yet in convincing states to improve export controls.

Also, the expanded authority that the Additional Protocol grants to the IAEA to look for clandestine activities might deter states from attempting to illicitly acquire nuclear-related items, either dual-use or trigger list, for fear of getting caught. And it might deter them from failing to declare related activities to the IAEA or making false declarations. This shows the mutually supporting nature of IAEA safeguards and export controls. Stronger safeguards make for stronger export controls.

UNSCR 1540

The United Nations Security Council adopted Resolution 1540 in April 2004, in the wake of the public exposure of the A.Q. Khan network.¹⁸ Though it explicitly focuses on the threat posed by non-state actors, UNSCR 1540 is the first measure to hold all states accountable for their export controls. Because the resolution is explicitly based on Chapter VII of the UN Charter, it implicitly carries the threat of UNSC sanctions or military force in cases of noncompliance.¹⁹ The resolution calls on all states to refrain from any form of support to non-state actors to acquire, develop, manufacture, transport, transfer, or use nuclear, chemical or biological weapons. Operative paragraph 3 requires all states to establish effective border controls and law enforcement to prevent the illicit trafficking of such items and to have "effective national export and transshipment controls over such items." The resolution recognizes the use of national control lists, but does not specify what items should be covered. The resolution could be read to include any item, if it were to be used by a non-state actor to make, use, or transfer a weapon of mass destruction. This lack of specificity leaves an opening for differing interpretations based on circumstances and could make enforcement difficult. A state could argue that a transfer, especially of dual-use items, did not violate the resolution.

The importance of the resolution in regards to export controls is its clear requirement that states must "establish domestic controls to prevent the proliferation" of WMD, including effective border and export controls. Perhaps significantly, operative paragraph 3 of the resolution, which requires these controls, makes no mention of non-state actors, and by itself could be read to require state controls to prevent proliferation to either state or non-state actors. This makes sense, because illicit traffickers often use front companies and deception that can make it impossible to determine the real end user. Although UNSCR 1540 is based on the threat posed by non-state actors, by effectively implementing the resolution, states would also prevent illicit trafficking aimed to help state actors.

¹⁸ United Nations Press Release, "Security Council Decides All States Shall Act to Prevent Proliferation of Mass Destruction Weapons," SC/8076, 28 April 2004, <http://www.un.org/News/Press/docs/2004/sc8076.doc.htm>.

¹⁹ Cassidy Craft, "Challenges of UNSCR 1540: Questions about International Export Controls," *CITS Briefs*, Center for International Trade and Security, University of Georgia.

The resolution recognizes that some states will need assistance in implementation and invites other states to help them. This acknowledges that all states do not now conform to the resolution's requirements. Although it properly calls for states to assist each other in establishing controls, it does not provide a clear path for states that need to improve their systems. It does not specify what a system should look like other than by stating what kind of transfers should be prevented. There can be no verification that a state's system is adequate—and no enforcement of this—until after a violation has occurred, and that may be too late to stop proliferation.

Perhaps the resolution's main importance is the establishment of the principle that states are accountable for what leaves their borders. States can no longer claim innocence when dangerous items cross their borders that effective controls would have stopped. This places a new burden on states such as Pakistan that, as a state outside the NPT and all export control arrangements, previously had no explicit international commitment to control their exports. And it places a new burden on states such as the United Arab Emirates, which serves as a transit and transshipment hub and previously had little clear obligation to scrutinize what was coming and going across its borders. Perhaps the most important element of the resolution is its universal application. The Khan network showed that the system of multilateral export controls and nonproliferation can be undermined by states that are not in the system, and UNSCR 1540 brings all states into the system, which is an important improvement.

Because the resolution was adopted by the Security Council and not the General Assembly, however, some states see the resolution as an imposition rather than acknowledgement of a global norm. This may hurt the chances for the resolution to be implemented adequately by all states, and the lack of universal and consistent implementation is one of the major problems facing multilateral export controls. And because it focuses on non-state actors and is vague on what items are covered, it may not be adequate to prevent states from pursuing a clandestine nuclear program through the acquisition of dual-use items, which is one of the major proliferation threats, as recently demonstrated by Iran's secret program.

[Note: Table 1 follows on next page.]

Table 1: Multilateral Nuclear Export Control Measures

Control measure	Items controlled	How controlled	Adherents	Legally Binding?
NPT Article III, paragraph 2	“equipment or material especially designed or prepared for the processing, use or production of special fissionable material”	IAEA “system of safeguards” must be in place on the material	188 ²⁰	Yes
Zangger Committee	Trigger list items	Full-scope safeguards as condition of supply	35	No
NSG Part 1 Guidelines	Trigger list items	Full-scope safeguards as condition of supply; and the supplier state determines the export does not violate the NSG’s Non-Proliferation Principle.	45	No
NSG Part 2 Guidelines	Dual-use items used to make trigger list equipment or nuclear weapons	The supplier state determines the item will not be used in nuclear weapons, a clandestine nuclear fuel cycle, or nuclear terrorism, and there is no “unacceptable risk” of diversion to such use. The recipient must state the item’s end use and location and that it will not be used in a weapon or clandestine fuel cycle.	45	No
Additional Protocol: Annex I	Dual-use items used to make certain key trigger list items	Recipient state must describe to the IAEA their activities to manufacture certain key trigger list items. (Article 2.a.iv)	102 signed, 69 in force ²¹	Yes
Additional Protocol: Annex II	Trigger list items	Supplier state must report exports to IAEA and the recipient state must confirm upon IAEA request (Article 2.a.ix)	102 signed, 69 in force	Yes
UN Security Council Resolution 1540, OP3	Nuclear, chemical, biological weapons, and their means of delivery	All states must implement effective border controls, law enforcement, and export controls “to prevent the proliferation” of these items.	191 (all UN members)	Yes

²⁰ All UN members are party to the NPT except India, Israel, North Korea, and Pakistan.

²¹ International Atomic Energy Agency, “Strengthened Safeguards System: Status of Additional Protocols,” 19 July 2005, http://www.iaea.org/OurWork/SV/Safeguards/sg_protocol.html, (accessed 2 August 2005).

Malaysia and the problem of emerging supplier states

The key role of a Malaysian company in the Khan network highlights the problem of emerging supplier states that do not participate in informal multilateral export control arrangements such as the NSG. Previously, Malaysia had not been a major supplier of nuclear-related technology. Thorne describes the ubiquity of the problem: “At a minimum, any country that has a machine tool shop could be the supplier of especially designed or prepared components from the Trigger List.”²² The Malaysian firm SCOMI Precision Engineering (SCOPE) made thousands of high-precision aluminum centrifuge parts, including the casings and molecular pumps, that were bound for Libya when they were found on the ship *BBC China* in October 2003.²³ The parts SCOPE had contracted to make accounted for about 15 percent of the total number of components the Khan network sought to supply to Libya.²⁴ Malaysia is a signatory to the NPT, but it does not participate in the Zangger Committee or NSG. According to a report by Malaysian police, the components seized on the *BBC China* were not controlled by Malaysia’s Atomic Energy Licensing Act, and therefore SCOPE broke no Malaysian law.²⁵

Soon after the exposure of SCOPE’s role in the Khan network, Malaysia released a public report of its police investigation into the company’s activities and the Khan network. The Malaysian police report is important for several reasons, besides that it was the first detailed public account of the Khan network’s activities, which was based largely on interviews with a key figure in it, BSA Tahir. The report’s public release showed that Malaysian officials were embarrassed by SCOPE’s activities and were concerned about their country’s image in the international community in regards to its control of nuclear-related items. In attempting to deflect any criticism of the Malaysian role in the network, the report highlighted the involvement of companies and individuals from other countries, including European countries that are NSG members.

The report is also important because it details what Malaysia sees as the limits of its commitments to nonproliferation and export controls. The report notes that although Malaysia is a party to the NPT, the treaty “has no control over nuclear equipments such as centrifuge components. As such SCOPE or Malaysia has not broken any of the NPT rules, as it is not among the listed items of the NPT.” The report also notes that other states implicated in the Khan network were NSG members, a reminder to the world that Malaysia is not a member of the NSG and not bound by its guidelines. The report also notes that because Malaysia was not party to the Additional Protocol, it was not obligated to report the exports to the IAEA. It also incorrectly states that even if Malaysia did sign the Additional Protocol, the components did not have to be reported because they were “basic components and not complete centrifuge unit....” While the manufacturing of the centrifuge parts would not have been covered by Annex I of the protocol, which specifies a state’s internal activities that must be reported to the IAEA, Annex II of the protocol

²² Thorne, p. 11.

²³ Polis Diraja Malaysia, “Press Release By Inspector General of Police in Relation to Investigation on the Alleged Production of Components for Libya’s Uranium Enrichment Programme,” 20 February 2004, http://www.rmp.gov.my/rmp03/040220scomi_eng.htm.

²⁴ David Albright and Corey Hinderstein, “Uncovering the nuclear Black Market: Working Toward Closing Gaps in the International Nonproliferation Regime,” Institute for Science and International Security, Prepared for the Institute for Nuclear Materials Management (INMM) 45th Annual Meeting, Orlando, FL, 2 July 2004, http://www.isis-online.org/publications/southasia/nuclear_black_market.html.

²⁵ Polis Diraja Malaysia, p. 10.

clearly covers the components seized on the *BBC China*. Had Malaysia been adhering to the Additional Protocol, it would have been required under its terms to report to the IAEA the transfer of these components.

The Malaysian report's statement that the NPT does not control centrifuge components because they are not listed in the NPT highlights the need for universally agreed lists that specify what items are covered by the treaty. No participant in the Zangger Committee could plausibly argue that centrifuge components do not constitute "especially prepared or designed equipment," as stated in Article III, paragraph 2, of the NPT. But as Malaysia is not a member of either the Zangger Committee or NSG and because the NPT is not explicit in what items are covered, Malaysia can plausibly argue that it has not violated any of its nonproliferation commitments. The wide acceptance of the work of the Zangger Committee at the NPT review conferences, however, makes it likely that most states would see Malaysia's transfer of centrifuge components as improper and counter to the nonproliferation norm, even if it broke no specific commitments. The views of the review conferences are not legally binding and have no enforcement power, though violating the consensus can carry political costs.

The Malaysia case shows the need for spreading adherence to the export control norms embodied in the NSG. The most direct way is to expand the membership of the NSG to emerging suppliers, such as Malaysia, but this carries with it a number of potential problems. Emerging supplier states such as Malaysia may not want to join. Malaysia is a prominent member of the Non-Aligned Movement, and has long criticized the NSG as discriminatory. Because the NSG is voluntary with no enforcement, there is no way to ensure new members will fulfill their export control obligations. Also, new members can only be asked to join by consensus, and existing members may not want a new member that has questionable commitment to effectively implementing export controls.

Another fundamental problem is the consensus-based nature of the NSG. By expanding to include members that might not agree on what items to control and how, the NSG risks losing the ability to make improvements in its guidelines to respond to developments. A single contrary state can prevent consensus. Some have suggested that states could adhere to the guidelines of multilateral export control arrangements without actually being members. A report by the University of Georgia's Center for International Trade and Security suggests a two-tiered system of membership of multilateral export control arrangements, with adherents becoming full members once they have demonstrated the capability to enforce export controls.²⁶ This is a useful suggestion, but many states will not be willing to adhere to the guidelines without having a say in determining what they are. One analyst, Harald Müller, likens such a system to taxation without representation, a system bound to fail.²⁷ Besides, Müller asserted in 1997, new members have not been the problem with managing the NSG: "It is the older members that appear to cause the major problems and controversies."²⁸ As more and more

²⁶Michael Beck, Cassidy Craft, Seema Gahlaut, Scott Jones, "Strengthening Multilateral Export Controls: A Nonproliferation Priority," Center for International Trade and Security, University of Georgia, September 2002.

²⁷Harald Müller, "The Future of Export Controls in International Nuclear Non-Proliferation," International Seminar on the Role of Export Controls in Nuclear Non-Proliferation, 7-8 October 1997, <http://www.nuclearsuppliersgroup.org/PDF/SeminarControl1.pdf>, p. 70.

²⁸Müller.

members are added, however, that could change. Pasi Patokallio, former chair of the NSG, has suggested that states can choose to follow the NSG norms unilaterally. “It is my belief,” he said in 1997, “that in the long run the norms set by the NSG, along with those set by the other export control regimes, will find general acceptance. The NSG has set open norms for open nuclear trade.”²⁹ The spread of the NSG norms is a key goal, but as the defensive and legalistic tone of the Malaysian police report suggests, some states may not feel bound by such norms unless they have made an explicit commitment to follow them. A state is likely to feel such a commitment to be most binding, explicit, and legitimate if it were a full member of the arrangement. Also, promoting a two-tiered system of adherence without membership could revive charges of discrimination against the NSG, especially from the Non-Aligned Movement, of which Malaysia is a prominent member and which includes many emerging supplier states.

The NSG must weigh the importance of spreading adherence to its existing norms, as embodied in its guidelines, against the risk that new members will make it more difficult to improve those guidelines. NSG members must decide if the future value of the NSG is as a deliberative body or as a vehicle to spread its norms. Fortunately, the consensus-based system works both ways: While it is difficult to make improvements, it is also difficult to roll back the existing rules, so NSG members do not need to worry about the guidelines being weakened. If the existing guidelines and item lists are adequate, then the NSG should focus on spreading them to all potential suppliers—that is, as widely as possible, and to all NPT members. If crucial changes to the guidelines need to be made and if there is risk that potential new members will prevent that, then the improvements should be made first and then spread to new members.

Two of the most pressing improvements being sought by some NSG members are to make the Additional Protocol a condition of supply for trigger list items and the adoption of “catch-all” controls. Both would be improvements to the NSG, and should be pursued and promoted. Setting the Additional Protocol as a condition for supply for trigger list items would help promote it as the standard for IAEA safeguards and would ensure that states with significant nuclear activities—at least those supplied by NSG members—have the protocol in force. But there are perhaps other, better forums to promote the Additional Protocol, such as the NPT review process and IAEA Board of Governors. As Malaysia has shown, states not even bound by the NSG’s current standard—full-scope safeguards—are capable of making and exporting trigger list items. The other proposed change in NSG guidelines is the adoption of catch-all controls. These would prevent the export of any item, regardless of whether it is on a control list, if it were going to be used in proliferation.³⁰ For this reason, they can also be called end-user controls. Their value has been demonstrated several times, including in 2003 when Germany denied an export of aluminum tubing to North Korea. The tensile strength of the tubing was below what is controlled by the NSG’s dual-use list, but Germany

²⁹ Pasi Patokallio, “The Future of Nuclear Export Controls,” International Seminar on the Role of Export Controls in Nuclear Non-Proliferation, 7-8 October 1997, <http://www.nuclearsuppliersgroup.org/PDF/SeminarControl1.pdf>, p. 65.

³⁰ For discussions of catch-all controls, see Carlton E. Thorne, “Nuclear Catch-All Controls As An Important Element of the International System of Nuclear Export Controls,” in Carlton E. Thorne, ed. *A Guide to Nuclear Export Controls 1999-2000, second edition*, (Burke, VA: Proliferation Data Services, 1999); and *NIS Export Control Observer*, “Export Control in Focus: Emerging Export Control Priority: Catch-All Controls,” March 2003, p. 15.

concluded it was going to be used by North Korea to make casings for the G-2-type uranium-enriching gas centrifuges, so the shipment was stopped.³¹ The principle of catch-all controls is important, but in practice they require excellent enforcement and intelligence-gathering that may be beyond the will and capacity of new supplier states and some current NSG members. Authorities must have specific information on the intended end user and use, as well as a good understanding of an item's proliferation potential. Even then, the authorities must have the political will to stop the shipment. Because they add subjectivity to export controls, catch-all controls can lead to more variation in enforcement and implementation, which is already a major problem. The NSG, then, might want to focus on expanding and improving adherence to its existing guidelines before further expanding them.

As the NSG grows larger, more diverse and more institutionalized, it will become less a group of like-minded nations as originally intended. But other arrangements, such as agreements between the G-8 countries, which include the seven original NSG members plus Italy, can act as an NSG within the NSG to move forward on important issues and to respond quickly to emerging threats. For instance, in June 2004 the G-8 Nonproliferation Action Plan agreed, among other things, to promote the Additional Protocol as an NSG condition of supply and to a one-year suspension of the transfer of reprocessing and enrichment technologies to states that do not already possess them.³² Although largely symbolic, this showed the potential for the leading industrial countries to make specific and informal nonproliferation-minded export control agreements that set the example for all states. And as the G-8 includes the leading nuclear supplier states, agreements among them can have significant real effects on global nuclear trade.

South Africa and the problem of implementation

Adherence to multilateral export control arrangements is a two-part process. Besides simply joining, states must adequately implement and enforce their commitments. According to a report by the Center for International Trade and Security, recent studies of two dozen states suggest that enforcement is one of the least harmonized elements of multilateral export controls, largely because of resource limitations.³³ Implementation is a problem throughout the system, and no country should be singled out. The problem was made especially clear, however, by the major role of South African companies in making centrifuge parts for the Khan network. Unlike Malaysia, South Africa is a member of the Zangger Committee and the NSG, and, accordingly, has a non-proliferation law aimed at controlling the export of nuclear items. Yet South Africa was clearly targeted by the Khan network because it was seen as having facilities capable of making specialized centrifuge parts and weak controls that would allow the parts to be exported without detection. In the wake of another recent nuclear-related trafficking case, a South African analyst described the attraction of the country to illicit traffickers: "What you've got is a highly developed country—infrastructure, banking, communications, transport," Keith Campbell of Executive Research Associates in Pretoria told the Reuters

³¹ Mark Hibbs, "Procurement by Iran, DPRK Focuses Attention on 'Catch-All' Controls," *Nucleonics Week*, 29 May 2003, p.12.

³² *NIS Export Control Observer*, "G-8 Leaders Approve New Nonproliferation Action Plan at Sea Island Summit," June 2004, p. 10.

³³ Beck *et al*, p. 19.

news agency. “You've got all those positive things and then you've got a weak state enforcement system, immigration controls are weak, law enforcement is overwhelmed, the justice system is overwhelmed.”³⁴

A South African company, Tradefin Engineering, allegedly made the header piping and the feed-and-withdraw equipment for centrifuges destined for Libya. Tradefin was allegedly aided by another South African company, Krisch Engineering. Acting on information from the various international investigations of the Khan network, South Africa conducted its own investigation resulting in the seizure of eleven shipping containers of centrifuge parts in September 2004. Three people were arrested, two of whom face charges, Gerhard Wisser, a German citizen, and Daniel Geiges, a Swiss citizen. Although the parts were seized before they were allowed to leave the country, South African authorities apparently were unaware that a factory was illegally making centrifuge parts until they were informed by outside investigations of the Khan network. This makes it seem possible or even likely that the shipments would have been able to leave the country undetected, had the Khan network not been exposed. South Africa had previously allowed Tradefin to export a computer-controlled Spanish-made flow-forming lathe to Dubai, and it was later found in Libya. The lathe is controlled by the NSG's dual-use list, and Libya is believed to have acquired it in attempt to make its own centrifuge parts. The centrifuge parts found in South Africa are covered by the Zangger Committee and the NSG's trigger list, and, according to those guidelines should only have been exported under full-scope safeguards. In addition, South Africa has the Additional Protocol in force, which obligates it to report the transfer of such items to the IAEA. Had South Africa allowed the centrifuge parts to be exported without informing the IAEA, it would have violated Article 2.a.(ix) of the protocol, which requires states to inform the IAEA of the transfer of trigger list items listed in Annex II. (The parts are not covered by Annex I of the protocol, so South Africa was not required to report their manufacture to the IAEA.)

Geiges and Wisser were charged under South Africa's nonproliferation law for their alleged connection to the export of the lathe. But for the centrifuge parts, they were charged under the Nuclear Energy Act, which requires a license to possess such equipment. This shows the link between effective internal controls and export controls. If a state can adequately control the nuclear activities within its borders, it is more likely to be able to control what leaves the country.

The South Africa case also shows that NSG members can no longer export to each other under the assumption that the item is safe from misuse or retransfer. Another recent case emphasizes this point. In 2003, South African authorities allowed U.S.-made triggered spark gaps to be sent to Pakistan, apparently unaware that U.S. authorities were investigating the transaction and had already arranged for the parts to be disabled.³⁵ In this case, it appears the end user sought a broker in South Africa because of its perceived

³⁴ John Chiahemen, “US Team Sent to Probe Nuclear Link in SA,” Reuters, 12 February 2004; in Independent Online, <http://www.iol.co.za>, (accessed 26 August 2004). Executive Research Associates describes itself on its web site as a “South African-based socio-economic labour and political consultancy with an extensive local and international associate network.” See Executive Research Associates, “Profile,” <http://www.erassociates.co.za/profileindex.htm>, (accessed 1 December 2004).

³⁵ Jacob Blackford, “Asher Karni Case Shows Weakness in Nuclear Export Controls,” Institute for Science and International Security, 8 September 2004, <http://www.isis-online.org/publications/southafrica/asherkarni.html>.

weak export controls and because, as an NSG member, the items could be sent there from the United States without an export license. Had U.S. authorities not been tipped off, it seems likely South Africa would have allowed the retransfer of working spark gaps to Pakistan. Perhaps with these South African cases in mind, the NSG Plenary held in June 2005 in Oslo, Norway, agreed to “introduce the existence of effective export controls in the recipient state as a criterion of supply for nuclear material, equipment and technology and a factor for consideration for dual use items and technologies.”³⁶

The problem of implementation is complex and has many causes. A basic problem is that the NSG guidelines provide few concrete steps of how a state should implement export controls. For trigger list items, the main condition is that they are safeguarded. For dual-use items, the NSG calls on suppliers to establish export licensing procedures that include enforcement measures for violations. The guidelines suggest a number of factors to consider when authorizing a transfer, such as whether the stated end use is appropriate for the item, but no steps are provided for how to implement this.

Another fundamental problem is the voluntary and non-binding nature of the NSG. Because it is a political agreement with no threat of penalty, states may not feel compelled to invest the resources necessary to ensure compliance. UNSCR 1540 addresses this gap by carrying the threat of force, but it is vague on what items are covered and under what conditions. The Additional Protocol is also binding and carries possible referral to the UN Security Council, which might compel states to ensure they have effective export controls. Three NSG members, however, have neither signed nor ratified the protocol: Argentina, Belarus, and Brazil. They should be encouraged to do so, as should all potential supplier states. South Africa had the protocol in force, however, yet it came close to allowing the illicit transfer of trigger list items. This shows that the protocol may not yet be a major factor in convincing states to implement export control, but this could change if a state were to be found in violation of its safeguards agreement for failing to report a transfer.

One study uses a framework of costs and benefits to explain states’ implementation of export controls.³⁷ The study of 20 states found that states were driven primarily by economic and political considerations, rather than the diffuse fear of WMD proliferation. It concluded that economic considerations outweighed political, but found that appeals to responsible international behavior could be very effective for states that can afford to implement controls but had not. “Clearly,” the study says, “this suggests that the creation and maintenance of international norms regarding nonproliferation export controls may have an important impact on behavior.” The exposure of the Khan network could help strengthen this norm by serving as a warning to states such as Malaysia and South Africa and other non-traditional supplier states that proliferation can occur almost anywhere, and that all states must be vigilant even if they have not traditionally produced nuclear-related items. The Khan network showed that loose controls anywhere in the system can allow a secret network to turn one’s neighbor into a de facto nuclear power before the world is aware. This should help convince states not previously concerned with export controls and the threat of proliferation that they should be. The exposure of the Khan network’s

³⁶ NSG Plenary Meeting, Oslo, Norway, 23-24 June 2005, “The NSG—Strengthening the Nuclear Nonproliferation Regime,” <http://www.nsg-online.org/PRESS/2005-06-oslo.pdf>, (accessed 2 August 2005).

³⁷ Richard T. Cupitt, Suzette Grillot, Yuzo Murayama, “The Determinants of Nonproliferation Export Controls: A Membership-Fee Explanation,” *The Nonproliferation Review*, Summer 2001, p. 74.

activities in South Africa and Malaysia could also convince such states to adhere to export control norms by embarrassing them. Malaysia's prompt public release of its police report showed it was concerned about the damage done to its image. Embarrassment can raise the political costs of not implementing export controls, making them more attractive to states. Malaysia authorities apparently felt so embarrassed in the international community by the activities of the Khan network within the country, that they saw the potential for real harm and arrested Tahir without charge as a security threat. In a May 2005 press conference, Malaysian Deputy Internal Security Minister Datuk Noh Omar said Tahir's actions had opened Malaysia to possible economic sanctions and attacks by the "big powers."³⁸ Since the damage had already been done, it raises the questions of why he still poses security threat and whether he is being held to prevent him from revealing information that would further embarrass Malaysian authorities.

Illicit technology transfers and the threat of prosecution

A key part of successful implementation of export controls is done at the level of individual companies and people. States must educate those in the commercial sector who deal with exports to make them aware that export control laws exist, what their responsibilities are, what items are covered, and the penalties for violations. Violators should not be able to claim ignorance of the law or that their product was going to be misused, as individuals in the Khan network have attempted to do. Germany, for example, has a strict system of corporate internal compliance that holds pre-designated company officials legally responsible for any improper exports from their company.³⁹ If individuals cannot be convinced to comply based on the goal of nonproliferation, they must be deterred from breaking the law by the threat of prosecution.

The threat of prosecution is important because individuals play a key role in illicit networks. The threat of criminal penalties are key to controlling the transfer of intangible technology, such as information that can be sent over the Internet or that exists in someone's head, because of the inherent difficulty of detecting and preventing these transfers before they happen. As its very name implies, a few key people played significant roles in the Khan network, especially the technology holders. Although Malaysia and South Africa had the industrial capacity to build centrifuge parts and the weak controls that allowed or might have allowed their export, the crucial ingredient came from outside: the centrifuge designs, knowledge of key manufacturing processes, and the organization. Khan and his lieutenants at Khan Research Laboratories provided the designs and prototypes, and other actors allegedly added their know-how and organizational skills—Urs Tinner, Gotthard Lerch, Daniel Geiges, Gerhard Wisser, and BSA Tahir. Most of these alleged participants have been arrested in various countries and face charges, though others might still be at large, unknown to the public or to authorities. Even though Malaysia did not have a nonproliferation law, Tahir, who is not a Malaysian citizen but who lived there, was arrested for allegedly threatening the country's national security, and is being detained without formal charges. These arrests may deter potential future violators by showing that they will be held accountable even—or especially—if they are successful in transferring controlled items. Even though Malaysia allowed a

³⁸ Hardev Kaur, "Tahir Posed A Threat to Security," *New Straits Times*, 30 May 2005.

³⁹ Michael Rietz, "Germany's Export Control Law in the New Millennium," Institute for Science and International Security, 8 April 2002, <http://www.isis-online.org/publications/expcontrol/rietz2002.html>.

massive illicit export of centrifuge parts, and South Africa might have done so if not for the exposure of the network, by detaining or charging those involved with serious crimes, these countries may have already improved their implementation of export controls, at least in the sense that they have deterred future violators.

Clandestine programs and dual-use controls

At its core, the Khan network is a new version of an old story—states attempting to become nuclear powers by clandestinely acquiring the capability to make trigger list items—the equipment that can produce fissile material and should be under safeguards. Despite the many improvements made in the systems of safeguards and export controls in response to Iraq’s secret program in the early 1990s, Iran was nearly able to build a large-scale uranium enrichment plant at Natanz before the IAEA knew about it.⁴⁰ Iran did not have the Additional Protocol in place, which might have allowed the IAEA to detect the site earlier. But clearly gaps remain in the system to control dual-use items that make trigger list items. The Khan network showed that the plans and know-how to build trigger list items are out there and difficult to control, so the system must make it more difficult for proliferant states to build trigger list equipment, even if they have the blueprints and know-how, by better controlling dual-use items. This is especially important while all states have not applied the Additional Protocol.

One main gap in dual-use controls is the lack of information that states need to make informed export license decisions. NSG members inform each other of export denials, but they do not routinely inform each other of approvals of dual-use licenses. To determine if a dual-use item is going to be used in a proliferation activity, supplier states need to know what other items the recipient state has procured. A flow-forming lathe can be used to make a variety of products, but if a state has also acquired maraging steel or high-strength aluminum, the lathe might be seen as part of a program to make centrifuge rotors. Knowing of other procurements related to centrifuge production could strengthen this conclusion.⁴¹ The challenge is that effective clandestine programs attempt to hide their true intentions with deceptive practices, including procuring items from multiple sources in multiple countries.⁴² In the 1980s, Iraq carried out an elaborate program to disguise the goal of its illicit procurement.⁴³ A supplier state might not have enough information on its own to draw a complete picture of a recipient state’s procurement intentions to judge if an export risks being misused or diverted.

Another problem is that exports are often informally denied before the exporter applies for a license. Often an exporter is convinced not to bother applying because the license will be denied. If the exporter is an illicit trafficker, they can shop around in other countries where authorities are unaware of the previous inquiry. One suspected trafficker,

⁴⁰ For an analysis of Iran’s centrifuge program, see David Albright and Corey Hinderstein, “The Centrifuge Connection,” *Bulletin of Atomic Scientists*, March/April 2004, pp. 61-66.

⁴¹ For a discussion of the importance of indicators to IAEA safeguards, see Mark H. Killinger, “Improving IAEA Safeguards Through Enhanced Information Analysis,” *The Nonproliferation Review*, Fall 1995.

⁴² Jennifer Hunt Morstein and Wayne D. Perry, “Commercial Nuclear Trading Networks as Indicators of Nuclear Weapons Intentions,” *The Nonproliferation Review*, Fall-Winter 2000, 77.

⁴³ For detailed case studies and analysis of past illicit procurement programs, see David Albright, Kate Buehler, and Corey Hinderstein, *Roadmap to Responsible Export Controls: Learning from the Past*, (Washington, D.C.: Institute for Science and International Security, 2003), <http://www.exportcontrols.org/index.html>.

Asher Karni, allegedly approached a French firm to buy triggered spark gaps for Pakistan.⁴⁴ When told he needed an export license for Pakistan, he went to a company in the United States and said the destination was South Africa, which did not require a license. No mechanism exists for reporting such informal denials, but knowledge of such inquiries could help persuade authorities to deny similar exports, as specified in the NSG guidelines.

Dual-use controls also lack verification. Once a state has deemed an export safe and has allowed it to leave, the state has little or no practical control over it, especially once it has reached its destination. The Spanish-made Denn flow-forming lathe found in Libya is an example of this. Spain most likely did not approve the lathe for export to Libya, and certainly not for use in making centrifuges, yet the large, expensive, and difficult-to-hide machine was found there. Little is known about the lathe's history and under what circumstances it left Spain, but it was allowed to pass through at least one other NSG state, South Africa, as well as Dubai.

Summary of problems

The existing system is a patchwork of legal and political commitments with varying adherents and application. Where one measure is strong, another is weak, and no measure is adequate by itself. The NSG is specific on what is covered and includes dual-use items, but it does not include many new supplier states, and it lacks the legal and normative status of a treaty and the threat of enforcement. Many states may not feel compelled to improve their export controls based on UNSCR 1540. None of the existing measures sets a clear standard for what makes an adequate system of nuclear export controls and none can verify and enforce that an adequate system is in place. And none of the measures provides verification of how dual-use items are used or requires obligatory information sharing on all relevant transfers that might help detect a clandestine program. In summary, the major problems identified are weak and inconsistent implementation, the lack of universality, the lack of legitimacy, the lack of enforcement, the lack of verification of dual-use exports, and the lack of information sharing needed to identify clandestine programs.

Interim recommendation: Universalize adherence to the Zangger Committee's trigger list

Just as the IAEA "system of safeguards" required by the NPT have a minimum acceptable standard, which is moving from full-scope safeguards (INFCIRC/153) to the Additional Protocol (INFCIRC/540), export controls under the NPT also require a minimum standard. All NPT states parties should declare their acceptance and adoption of the Zangger Committee's trigger list as the minimum standard for implementing the export controls required by Article III of the treaty. No NPT states party should be able to argue, as Malaysia did, that it did not violate the NPT by allowing the export of items on the trigger list when safeguards were not in place. The obligation not to export especially designed or prepared equipment should clearly apply to all states parties, not just those that met as part of the Zangger Committee. Article III of the NPT inextricably links states' obligation to control exports with their obligation to accept IAEA safeguards. Safeguards cannot be effective if states do not enforce export controls. States that feel the

⁴⁴ Blackford, "Asher Karni Case Shows Weakness in Nuclear Export Controls."

Zangger Committee is or was exclusionary or discriminatory would not need to join or even acknowledge it by name, but merely notify the IAEA in the form of an information circular that they will not export certain items—the same items in the trigger list—unless they are under safeguards. The NPT Review Conference is the appropriate forum for updating the international consensus of the treaty’s requirements. In fact, two working papers submitted to Main Committee II of the 2005 Review Conference called on all states parties to adopt the Zangger Committee’s trigger list, but a final document was not agreed by the conference.⁴⁵ Though some states may not like that the trigger list was negotiated by a handful of traditional supplier states without their participation, the need to control the items on the list is clear and non-controversial, and no responsible NPT member should export them without IAEA safeguards. By publicly declaring their acceptance of the Zangger Committee’s trigger list, states would acknowledge that allowing their export without IAEA safeguards violates the NPT. The norm of nuclear export controls would be strengthened, as would awareness of them and their perceived value, and state implementation should improve as a result.

Interim recommendation: Help states improve implementation

Many programs already exist to provide assistance with implementing export controls. The United States has a number of programs focused mainly on assisting the former Soviet Union. Japan, the European Union, Canada, and the Organization for Security and Cooperation in Europe also have significant programs to assist the implementation of export controls. At the NSG’s international seminar in 1999, the French former official Georges Le Guelte detailed a number of ways NSG members could assist each other and potential new members.⁴⁶ These include exchanging information on export regulations and the process of deciding whether to grant an export license, and the training of customs officials to spot controlled items. The IAEA might also play an important role. It has the advantage of being an international organization with near-universal membership, and it has long experience in facilitating nuclear-related assistance through its Technical Cooperation Programme. Germany made a proposal at the 2004 Prepcom that should be seriously considered.⁴⁷ In a working paper, it suggested that the IAEA, using experts from member states, could confidentially assess a country’s export controls and make recommendations for improvement. The working paper asserts the model for this would be the IAEA’s International Physical Protection Advisory Service (IPPAS), which assists states in assessing their physical protection system. The program could be justified to help states implement their obligation to report trigger list transfers under the Additional Protocol. The case of South Africa shows that parties to the protocol need such help.

⁴⁵ 2005 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, “Article III and preambular paragraphs 4 and 5, especially in their relationship to article IV and preambular paragraphs 6 and 7 [Export Controls],” Working Paper for submission to Main Committee II by Australia, Austria, Canada, Denmark, Hungary, Ireland, the Netherlands, New Zealand, Norway, and Sweden,” NPT/CONF.2005/WP.14, 27 April 2005; and NPT/CONF.2005/WP.15.

⁴⁶ Georges Le Guelte, “A Commentary on Further Cooperation,” 2nd NSG International Seminar on the Role of Export Controls in Nuclear Non-Proliferation, 8-9 April 1999, pp. 77-80.

⁴⁷ Preparatory Committee for the 2005 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, “Working Paper on Export Controls Submitted by Germany,” NPT/CONF.2005/PC.III/WP.14, 29 April 2004.

The requirement in UNSCR 1540 for states to implement adequate export controls might make it more likely for states to seek out and accept help. The resolution could serve as the basis for an ambitious program to provide that help. Because UNSCR 1540 does not set specific standards for what a state's export control system should look like, a neutral international organization could fill that role. The organization could be an informal body created by wealthier states to help less wealthy states that have little experience with export controls. It would have the advantages that it would not be linked to the NSG and participation would not be dependent on good relations between the states giving and receiving the help. This might make states on both sides more likely to participate. Such an organization could set international standards of export controls, assess a state's system of export controls, provide states with help in complying with the standards, including funding, and certify that a state is in compliance. A state could point to this certification as tangible proof that it is working to comply with UNSCR 1540. Because the organization would be voluntary, the standards that it sets and verifies would not be internationally binding or enforceable, and universal participation would be unlikely. Developing states that are generally wary of or uninterested in export controls could be enticed to participate, however, by the assistance provided through the organization, including funding to implement effective export controls. The main burden of such an organization—funding—would fall on the wealthier nations. While such assistance can help improve implementation, however, it does not address the other main problems of the export control regime.

Interim recommendation: Revise the Additional Protocol to require supplier states to report the export of key dual-use items to the IAEA

With the help of member states, the IAEA can play a role in filling the information and verification gaps in dual-use controls, especially where the Additional Protocol is in force. If all NSG states—or even all IAEA members—were to report the transfer of key dual-use items to the IAEA, perhaps even beyond the NSG's dual-use list, the agency would be able to draw a more complete picture of states' nuclear activities. In states with the Additional Protocol in force, the IAEA could use this information to determine if a state's declaration is complete and correct and help to detect clandestine activities. With complementary access, the IAEA could seek to verify whether these items are being used in the activities specified in Annex I of the protocol, which involve the manufacture and assembly of certain key trigger list items and which must be reported to the IAEA. The precedent for such voluntary reporting would be the Universal Reporting Scheme. Approved by the IAEA Board of Governors in 1993, that plan called on states to voluntarily report to the IAEA the transfer of trigger list items, and it became an obligation under Annex II of the Additional Protocol. States are generally wary of reporting on the activities of their private sector, but states might be willing to report key dual-use transfers to the IAEA if it were done confidentially, as are state declarations under the Additional Protocol. Such a scheme would only be truly effective, however, if all states participated. But even if only NSG members participated, many important transfers would be reported.

One of the most immediate problems facing export controls and IAEA safeguards is that authorities do not know who might have the centrifuge designs stolen and then at least partially disseminated by A.Q. Khan. To address this, states might at least report to

the IAEA key transfers related to centrifuge production, such as certain types of computer-controlled machine tools and such high-strength materials as maraging steel and high-strength aluminum alloy. Such reporting would preferably include historical information and transfers to all states, not just states suspected of receiving help from Khan.

Because such a scheme would be voluntary, states could not be required to report dual-use exports, and there could be no enforcement if they did not live up to their commitment. Also, IAEA verification would only be possible in states where the Additional Protocol is in force, and would only cover the activities required by the protocol, with limited authority to look for weaponization activities absent nuclear material. As the IAEA director general said in his November 2004 report on Iran, “the focus of Agency Safeguards Agreements and Additional Protocols is nuclear material, and that, absent some nexus to nuclear material, the Agency’s legal authority to pursue the verification of possible nuclear weapons related activity is limited.”⁴⁸

The best way to formalize a requirement that states report to the IAEA the export of certain dual-use items would be to revise the Additional Protocol so that such exports must be reported to the IAEA, as the protocol already requires for trigger list exports under Article 2.a.(ix). Key dual-use items could be added to Annex II of the Additional Protocol, which identifies what items must be reported to the IAEA. If dual-use exports were reported to the IAEA and adherence to the Additional Protocol were near universal, the IAEA would have a strong capability to detect clandestine programs through analysis of transfers and its strengthened inspection authority under the protocol. Because such a system would rely on reporting and verification of exports rather than denial, it might be seen by some states as more legitimate than informal arrangements such as the NSG. Because it would not rely on denying exports, it might be seen as complying with Article IV of the NPT, which guarantees access to nuclear technology. The requirement in UNSCR 1540 for states to implement effective controls to prevent WMD proliferation could serve as the basis for revising the protocol. Accepting a revised protocol would be a specific and freely accepted measure states could take to help comply with UNSCR 1540.

Adherence to the Additional Protocol is already far from universal, however, and key states such as Pakistan and other states outside of the NPT are almost certain never to sign it. Some current adherents may not agree to the revision as they may already see the protocol’s current reporting requirements as too heavy a burden. The increased burden of reporting dual-use items could also make it less likely for new states to sign and ratify the protocol. In February 2004, in the wake of the SCOPE revelations, the director general of the Malaysian Institute for Nuclear Technology Research said Malaysia would not sign the protocol because it did not have the capability to fulfill its reporting requirements, in part because its customs officials were not qualified to identify nuclear components.⁴⁹ Revising the Additional Protocol would fill many of the gaps in export control regime, but it would do little to move closer to universality, and could in fact move the regime further away. Universality is key to success, because, as the Khan network showed, an export control regime that is not universal can be undermined from the outside.

[Note: Table 2 follows on next page.]

⁴⁸ International Atomic Energy Agency, “Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran: Report by the Director General,” GOV/2004/83, 15 November 2004, p. 24.

⁴⁹ *New Straits Times* (Malaysia), “Malaysia not keen to sign more nuclear protocols,” 25 February 2004.

Table 2: How A Revised Additional Protocol Would Address the Problems With Multilateral Nuclear Export Controls

Problem:	Solution:
Weak implementation:	<ul style="list-style-type: none"> • Sets a concrete standard for export controls in the requirement to report transfers of certain items. • Verifies and enforces compliance with reporting requirements through IAEA inspections and verification activities. • Relies on reporting and verification of transfers rather than export denial decisions by individual states.
Lack of universality:	<p>(Potentially harmful:)</p> <ul style="list-style-type: none"> • Non-NPT states cannot participate. • May make it less likely for states to accept the Additional Protocol. • Existing adherents to the protocol have to accept the revision.
Lack of legitimacy:	<ul style="list-style-type: none"> • Moves towards fulfilling Article IV of the NPT by relying on reporting and verification of exports rather than denial. • Specific and freely accepted measure that states can take to help comply with aspects of UNSCR 1540.
Lack of verification of dual-use exports:	<ul style="list-style-type: none"> • IAEA verifies the location and use of dual-use items. • Increases the chances that clandestine programs are detected or deterred, especially where the Additional Protocol is in force.
Lack of information sharing:	<ul style="list-style-type: none"> • IAEA would get reports of all nuclear exports, both single-use and certain dual-use items, from states that adhere to the protocol.
Lack of enforcement:	<ul style="list-style-type: none"> • Enforcement mechanism in IAEA reporting non-compliance to the U.N. Security Council.

Recommendation: Nuclear Export Control Treaty

While the current system should be improved incrementally, these improvements should not take the place of more far-reaching reform. The Khan network showed the possibility that weak export controls anywhere in the system can undermine the entire nonproliferation regime. Implementation of export controls must be universal and consistent. The industrial capability to make key nuclear equipment is no longer the monopoly of the leading industrial states, and this capability can spread faster than adherence to informal groups such as the NSG. This is especially true if someone like Khan supplies the blueprints. IAEA Director General Mohamed el Baradei said in a January 2004 interview with *Der Spiegel*, “export controls must be dramatically improved and, in contrast to the past, must be carried out within an international framework.”⁵⁰ The world should recognize that events have shown that export controls are essential to preventing proliferation, and their implementation must become universal and obligatory. Their importance should be clearly recognized by a negotiated treaty that

⁵⁰ “Nuclear War is Getting Closer,” interview by Erich Follath, Juergen Kremb, and Georg Mascolo, *Der Spiegel*, 26 January 2004; in “IAEA Director General: Danger of Nuclear War ‘Has Never Been Greater Than Today,’” FBIS Document EUP20040124000085.

would include states that are not willing to adhere to informal arrangements such as the NSG, which they may view as discriminatory. A selling point for developing countries is that such a treaty should facilitate freer and more open trade, a key demand of the states that historically oppose the NSG. As suggested in a working paper on export controls submitted at the 2005 Review Conference, “effective export controls are ... central to cooperation in the peaceful uses of nuclear energy, which depends on the existence of a climate of confidence about non-proliferation.”⁵¹ Supplier states should be more willing to export sensitive items if they feel confident that they will not be used in nuclear weapons. And states would still be able to deny exports unilaterally or based on informal agreements, such as among the G-8 nations, if they felt it necessary to do so to prevent proliferation.

By giving all states a voice and a sense of ownership, the negotiation process would be key to enhancing the membership and legitimacy of the treaty. But a treaty would not have to be negotiated from scratch. Much hard multilateral negotiation has already been done on the issue of nuclear export controls dating back to the NPT. The Zangger Committee, the NSG, the Additional Protocol, and UNSCR 1540 have all built on the NPT’s nonproliferation principle to establish the principle that nuclear-related exports must be controlled. All of these agreements have established specific practices and principles that can serve as the basis for key elements of a treaty. UNSCR 1540 established the principle that all states are responsible for controlling their WMD-related exports, based on Chapter VII of the UN Charter. The Zangger Committee and NSG have established the use of lists to control items. The work of the Zangger Committee has been recognized by the NPT review conferences, and all NPT states parties should already agree that items on the trigger list should only be exported under safeguards. The Additional Protocol sets the precedent that key exports must be reported to the IAEA. It also sets the precedent for intrusive inspections and the need for more comprehensive information collection to detect clandestine activities. And the NSG set the precedent for controlling dual-use items, which are the key to clandestine programs.

A treaty should build on these principles to create a system where all states must report the import and export of nuclear-related items, including key dual-use items, to a neutral international organization. States could be found in noncompliance for inaccurate or incomplete reports of their import or exports. This system would move away from the current system in which states unilaterally deny exports based on informal agreements with other states. Rather than relying on the denial of certain exports to control proliferation, the new system would rely on verifying the use of certain exports, and this should make trade easier. The IAEA is the logical organization to collect, analyze, and verify these reports, given its role in implementing the safeguards system of the NPT. Its credentials for nuclear expertise, professionalism, and impartiality are well established, and its involvement would reassure states that might otherwise be skeptical. The IAEA’s role is also logical because its role in collecting information on transfers and verifying their use would be directly linked to its safeguards mission. By knowing every key item that goes into a state, the IAEA would better be able to detect a clandestine program and determine the completeness and accuracy of a state’s declarations. The precedent and need for such reporting have been established by the IAEA’s investigations of the illicit procurement activities of Iran and Libya. These investigations include taking inventories

⁵¹ NPT/CONF.2005/WP.14, p. 2.

of all centrifuge equipment and components in Iran and Libya and verifying their accuracy and completeness. These investigations involve receiving more information from states on their exports than those states are required to report under the Additional Protocol.

A treaty should give the IAEA the authority to verify that an item is being used according to its stated end use. As in its enforcement of the Additional Protocol, the IAEA would not necessarily check this on a routine and regular basis, but based on indicators that it was being used in an undeclared nuclear use, such as reports that a state has imported related items that could add up to a clandestine fuel cycle. States would have to report to the IAEA the end use and location of their imports. The practice now under the NSG for export licenses is that the end user, not the recipient state, makes a declaration of the item's end use and location. Requiring states to make such declarations would make states responsible for the accuracy of the information reported to the IAEA and for implementing internal controls to account for how sensitive items are being used. A key feature of a treaty would be to establish clear standards for export controls. The IAEA would verify the compliance of a state's system, including the adequacy of its laws and policies and the commitment of adequate resources for good enforcement. A state could be found in noncompliance and face penalties for not complying with the standard. As recognized in UNSCR 1540, some states need assistance in implementing export controls. The treaty should include a role for the IAEA in facilitating this, based on the model of the IAEA's Technical Cooperation Programme, and it should include expert and financial assistance from other states party to the treaty.

A treaty is certain to be controversial and difficult to negotiate. To embark on the long and difficult road of treaty negotiations, states must be convinced of several things. First, they must see the benefits of a treaty as worth enduring the process of negotiation. Second, they must see a treaty as possible to negotiate. Third, they must assess whether the risk of attempting and failing to negotiate such a treaty would help or hurt the cause of improving nuclear export controls. States of the Non-Aligned Movement might use the process of negotiation as an opportunity to bring other, mostly intractable, issues to the table, such as total nuclear disarmament, which could block negotiation and perhaps even worsen the international environment for cooperation on export controls. The NPT Nuclear Weapon States might see a clear and time-bound promise to disarm as too high a price for an export control treaty, and may prefer to avoid negotiations if they were seen as merely providing a platform for the NAM to berate them on the disarmament issue with no hope of achieving results on export controls. Another potential roadblock is that many or all states are unwilling to give up their sovereign right to deny certain exports to certain states. To avoid being undercut, many states might also be unwilling to give up their right to coordinate export denials with other states through informal arrangements like the NSG. Yet, the elimination of such informal arrangements and a pledge to allow unhindered exports might be key treaty demands of some states, especially developing countries.

The risks that some states may see in negotiating a treaty might be minimized if talks were to begin informally as an airing of views on the issue and an exchange of information. This could be done at an international conference, perhaps hosted by IAEA, which could serve to identify areas of consensus that could provide the basis for negotiation and help convince states that a treaty is possible. Even if such a conference

did not lead to formal negotiations and a treaty, it would at least help improve export controls by giving them a higher international profile and by raising awareness. Yet the goal of such a conference should be to move toward a treaty, whether or not that goal is explicit.

The benefits of a treaty would be significant and mutually reinforcing. While some of these problems can be solved without a treaty, certain problems may not be solvable without addressing others. Without a treaty, the problems of universality, legitimacy, and verification and enforcement of export controls may never be solved satisfactorily. A system that relies on denial of exports will always have problems of legitimacy and universality, and the case of Malaysia shows the danger that states on the outside can undermine the regime. Developing countries are not going to participate in a system that they see as being based on denying them technology. By relying on verification of exports rather than denial, the treaty would be seen as more legitimate than the current system because it would move towards fulfilling Article IV of the NPT, which provides for access to peaceful nuclear technology. States that feel the current system stifles their legitimate imports and exports might therefore be more likely to participate. These states would probably include reluctant participants of the current informal system, such as Russia and China. While UNSCR 1540 brings every state into the export control system, that system lacks the ability to establish, verify, and enforce specific standards of export controls. It also does not specifically establish what items should be controlled and does not facilitate the information sharing needed to identify possible clandestine fuel cycle programs, gaps that a treaty could address. UNSCR 1540, however, could serve as the political basis for a treaty to regulate export controls. With UNSCR 1540, the UN Security Council has acknowledged the importance of strong export controls for enhancing international security, and a treaty could establish the international regulatory system for states to ensure compliance with their obligations under UNSCR 1540.

END TEXT

[Note: Table 3 follows on next page.]

Table 3: How a treaty would address problems with multilateral nuclear export controls:

Problem:	Solution:
Weak implementation:	<ul style="list-style-type: none"> • Sets clear standards for national export control systems. • IAEA verifies that states meet these standards and reports non-compliance. • Helps states implement effective export controls with advice, training, and funding. • Sets a concrete standard for export controls in the requirement to report transfers of certain items. • Verifies and enforces compliance with reporting requirements through IAEA inspections and verification activities. • Relies on reporting and verification of transfers rather than export denial decisions by individual states. • Eliminates subjectivity and varying implementation of export controls. • Eliminates problem of informal denials.
Lack of universality:	<ul style="list-style-type: none"> • All states can participate, even states outside the NPT. • Non-discriminatory: Rules are the same for all states. • Lowers the cost of participating. • Raises the cost of not participating.
Lack of legitimacy:	<ul style="list-style-type: none"> • Treaty has status as international law. • Treaty is negotiated and ratified by its participants, not imposed on some states by other states. • Strengthens the international norm and importance of nuclear export controls. • Moves towards fulfilling Article IV of the NPT by relying on reporting and verification of exports rather than denial.
Lack of verification of dual-use exports:	<ul style="list-style-type: none"> • IAEA verifies the location and use of dual-use items. • Increases the chances that clandestine programs are detected or deterred, especially where the Additional Protocol is in force.
Lack of information sharing:	<ul style="list-style-type: none"> • IAEA serves as the global clearinghouse for reporting of all nuclear transfers, both single-use and certain dual-use items.
Lack of enforcement:	<ul style="list-style-type: none"> • Sets clear standards for national implementation of export controls. • Enforcement mechanism in IAEA reporting non-compliance to the U.N. Security Council.