



Chapter eight

Policy options for preventing a proliferation cascade

The danger of a proliferation cascade in the Middle East, while real, is not imminent. Although some countries may be positioning themselves to be able eventually to produce fissile material, no country is known or seriously believed to be pursuing a nuclear-weapons programme as a result of Iran's activities. Syria's nuclear motivations are unclear but were not likely to have been driven by concerns about Iran. Israel's programme long predates the Iranian nuclear threat. Apart from Israel, Iraq before 1991, Iran and, on a far smaller scale, Egypt and Algeria (which possess small-scale hot-cell complexes), no country in the region is known to have uranium-enrichment or plutonium-reprocessing capabilities. Over time, Iran's programme could become a powerful regional proliferation driver, building on regional rivalry, security concerns and one-upmanship. For the time being, these considerations are contributing to a regional surge in interest in nuclear energy. The question is how to keep this interest confined to purely civilian nuclear programmes.

The time frame inherent in such programmes helps. Although power-plant construction can take as little as four to five years, the preparatory requirements mean that nuclear-energy aspirations in the Middle East are at least ten to 15 years away from fulfilment.¹ The conditions needed for the introduction of nuclear power – including electricity grids, trained personnel, safety regulations and a framework establishing legal responsibility – are lacking or underdeveloped in the region. For many of the countries concerned, financial means remain limited in relation to the huge capital costs involved in the building of nuclear power plants and their associated physical and regulatory infrastructure and manpower requirements. The delays typical to the industry and the competing demand from better-

prepared customers in larger markets elsewhere in the world will probably lengthen the timeline further. Barring shortcuts supplied by black-market or other foreign assistance, nuclear-weapons development timelines can be expected to be longer still.

The introduction of nuclear energy into the Middle East should not be seen as a foregone conclusion. As of the publication date of this dossier, no commercial contracts had been signed; no irreversible decisions had been made, and most of the national plans were limited to feasibility studies. There is time, therefore, to put in place a robust regime of policies and practices that can serve as a bulwark against a proliferation cascade in the region, especially since nuclear power is not indispensable for economic growth, at least not in the short term, and will not become available on a significant scale before the long term.

The absence so far of nuclear power from the region, apart from the plant soon to come online in Iran, provides an opportunity to establish firm non-proliferation guidelines from the outset. The policies and practices adopted by the next states to embark on nuclear-power projects can set a new standard to help correct the damaging Iranian precedent. Central to this new standard should be a shared understanding that the proliferation risks of nuclear energy are manageable as long as countries accept full transparency with enforceable verification and concentrate on the technologies they really need, while staying away from the sensitive parts of the fuel cycle.

Many of the policy suggestions for preventing a nuclear-proliferation cascade in the Middle East are not region-specific. Although proliferation challenges are greatest in the Middle East, shoring up the nuclear non-proliferation regime is a global task. Rules and constraints that are not universal in their

Non-proliferation treaties and conventions in the greater Middle East										
State	Nuclear Non-Proliferation Treaty (NPT)		Comprehensive Test Ban Treaty (CTBT)		Chemical Weapons Convention (CWC)		Biological Weapons Convention (BWC)		Pelindaba Treaty (African NWFZ)	
	Signed	Ratified	Signed	Ratified	Signed	Ratified	Signed	Ratified	Signed	Ratified
Algeria		1995 (a)	1996	2003	1993	1995	2001	2001 (a)	1996	1997
Bahrain		1988 (a)	1996	2004	1993	1997		1988 (a)	n/a	
Egypt	1968	1981	1996		Non-party		1972		1996	
Iran	1968	1970	1996		1993	1997	1972	1973	n/a	
Iraq	1968	1969	Non-party		Non-party		1972	1991	n/a	
Israel	Non-party		1996		1993		Non-party		n/a	
Jordan	1968	1970	1996	1998		1997 (a)	1972	1975	n/a	
Kuwait	1968	1989	1996	2003	1993	1997	1972	1972	n/a	
Lebanon	1968	1970	2005		Non-party		1972	1975	n/a	
Libya	1968	1975	2001	2004		2004 (a)		1982 (a)	1996	2005
Morocco	1968	1970	1996	2000	1993	1995	1972	2002	1996	
Oman		1997 (a)	1999	2003	1993	1995		1992 (a)	n/a	
Qatar		1989 (a)	1996	1997	1993	1997	1972	1975	n/a	
Saudi Arabia		1988 (a)	Non-party		1993	1996	1972	1972	n/a	
Syria	1968	1968	Non-party		Non-party		1972		n/a	
Tunisia	1968	1970	1996	2004	1993	1997	1972	1973	1996	
Turkey	1969	1980	1996	2000	1993	1997	1972	1974	n/a	
UAE		1995 (a)	1996	2000	1993	2000	1972		n/a	
Yemen	1968	1979/1986	1996		1993	2000	1972	1979	n/a	

(a) = accession

application can too easily be rejected as unfair and illegitimate – unless they are arrived at voluntarily as part of a regional arrangement, which would have to include shared and balanced commitments.

Transparency

Encourage adoption of the Additional Protocol

IAEA comprehensive safeguards do not provide sufficient transparency. At a minimum, they must be buttressed by the Additional Protocol. This measure is not a panacea against proliferation. The Additional Protocol cannot stop a determined proliferator, nor does it address threats associated with nuclear smuggling. It does, however, give the IAEA further access rights and requires additional information from signatory states that together help the agency to provide credible assurances regarding the absence of undeclared nuclear material and activity. While not yet a universal legal requirement, the Additional Protocol has become the international norm for confirming a state's non-proliferation credentials. Countries that seriously consider adopting national nuclear-power programmes should therefore ratify and implement the Additional Protocol to their IAEA safeguards agreement as one of their first steps.

Correspondingly, countries considering supplying nuclear-power technology should require the Additional Protocol as a condition of supply. France and the US can be expected to impose this requirement for most buyers, although they do not always do so explicitly, so as to avoid provoking resentment. However Russia may be less inclined to insist on the protocol, and is able to point to America's willingness to relax export-control rules for nuclear assistance to India as a precedent. To overcome such complications and set the right precedent for the future, it will be important to ensure that the first post-Bushehr nuclear-reactor deals in the Middle East are limited to states with an Additional Protocol in force. This will reinforce the non-proliferation norm and encourage other states in the region to follow suit.

To protect suppliers against undercutting by competitors, making implementation of the Additional Protocol a condition of supply is best established as a rule applicable to all sellers. The 45-member Nuclear Suppliers Group (NSG) has been considering adding this condition to its guidelines, which do not have the force of international law or treaty but are taken seriously by the concerned parties. Opposition from Brazil, which

Nuclear conventions in the greater Middle East						
State	Convention on the Physical Protection of Nuclear Material (CPPNM)		Convention on Early Notification of a Nuclear Accident (NOT)		Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (ASSIST)	
	Signed	Ratified	Signed	Ratified	Signed	Ratified
Algeria		2003 (a)	1987	2004	1987	2004
Bahrain	Non-party		Non-party		Non-party	
Egypt	Non-party		1986	1988	1986	1988
Iran	Non-party		1986	2000	1986	2000
Iraq	Non-party		1987	1988	1987	1988
Israel	1983	2002	1986	1989	1986	1989
Jordan	Non-party		1986	1987	1986	1987
Kuwait		2004 (a)		2003 (a)		2003 (a)
Lebanon		1997 (a)	1986	1997	1986	1997
Libya		2000 (a)	Non-party			1990 (a)
Morocco	1980	2002	1986	1993	1986	1993
Oman		2003 (a)	Non-party		Non-party	
Qatar		2004 (a)		2005 (a)		2005 (a)
Saudi Arabia	Non-party			1989 (a)		1989 (a)
Syria	Non-party		1987		1987	
Tunisia		1993 (a)	1987	1989	1987	1989
Turkey	1983	1985	1986	1991	1986	1991
UAE		2003 (a)		1987 (a)		1987 (a)
Yemen		2007 (a)	Non-party		Non-party	

(a) = accession

is not yet ready to accept the Additional Protocol itself, has thus far prevented the consensus-based NSG from taking this step. This opposition does not appear to be implacable, however, and may be overcome by the time states which have opposed the Additional Protocol, such as Egypt, are in a position to try to negotiate a nuclear-power-plant deal.

Pending an NSG rule change, the G8 countries could decide as a group that, as far as they are concerned, concluding the Additional Protocol will be a condition of supply of nuclear technology. The G8 has so far only declared a commitment to working towards establishing the Additional Protocol as a new standard. A decision by the G8 members to make it a prerequisite for their own exports would be an important step, as they account for most of the nuclear-reactor exporting business. Member countries can of course also make independent national decisions on this point.

To date, only four countries in the greater Middle East have Additional Protocols in effect: Jordan, Turkey, Kuwait and Libya. Of these, the IAEA has been able to draw conclusions for Jordan and Kuwait that all nuclear material remains in use in peaceful activities,² and it may be able soon to draw similar conclusions for Turkey and Libya. Three other states

in the region – Morocco, Tunisia and Iran – have made a positive move by signing the Additional Protocol. Algeria has negotiated such a document but has not yet signed it (see chart in Introduction, p. 15). Prompt ratification would constitute an important confidence-building measure and provide a good example for other countries in the region. In the case of Algeria, bringing the agreement into force would regularise IAEA inspection of the Ain Oussera nuclear complex. The Additional Protocol is particularly important for states that have significant nuclear activities, such as Algeria, Egypt and Syria. The UAE, which, Iran excepted, is the Middle Eastern country closest to producing nuclear power, has signalled its intention to accept the Additional Protocol and to adopt other non-proliferation norms. Its doing so would set an important precedent and help to erase the proliferation stain brought about by Dubai's central connection with the A.Q. Khan network and the use of its port to ship black-market nuclear wares to Iran.

Promote acceptance of the modified Small Quantities Protocol (SQP)

An additional transparency norm is also needed, whereby those countries with an SQP to their IAEA

safeguards agreement adopt, as Lebanon has done, the modified version of this protocol as promulgated by the IAEA in September 2005. Acceptance of a modified SQP is of particular relevance to Saudi Arabia, whose request for an SQP when it negotiated its safeguards agreement in the first half of this decade exacerbated concerns about the proliferation loopholes in the protocol. Since an SQP is only applicable to countries without significant nuclear activity, it is obviously inappropriate for any country that seriously wishes to pursue nuclear power. Bahrain accepted the new SQP when it signed a safeguards agreement in September 2007, and Morocco rescinded its SQP altogether in November 2007.

Verification

Improve the IAEA safeguards regime

With the support of several member states, the IAEA Secretariat is developing advanced technologies for the detection of undeclared nuclear activities, including laser methods for the rapid on-site analysis of isotopes. Wide-area environmental sampling (WAES) is another prospective new verification tool that IAEA inspectors have studied. This technique involves the collection of environmental samples (e.g. from air, water, vegetation and soil) at a variety of locations to assist in drawing conclusions about the absence of undeclared nuclear material or activities across a large area. Inspectors have put the technique to use in Iraq. However, in contrast to location-specific environmental sampling, the IAEA board of governors has not yet approved the use of WAES outside Iraq, and its technical feasibility and cost-effectiveness are still questionable except in cases where the IAEA already has a tip-off as to the location of a suspect site. Effective IAEA verification therefore requires the cooperation of states with national intelligence capabilities.

Recent efforts to improve safeguards have been unsuccessful. An IAEA board special committee on strengthening safeguards considered a number of useful proposals in 2005–2007, but reached a political impasse. Representatives of Egypt and several other non-nuclear-weapons states in the Non-Aligned Movement called for a balance between non-proliferation and disarmament obligations, and for existing non-proliferation obligations to be fulfilled throughout the Middle East before new controls were imposed. Most of the recommen-

dations, which otherwise had broad support, would not in fact have imposed new obligations. Rather, they were intended to expand the agency's technical capabilities, including in the area of satellite-imagery analysis, and to call for voluntary actions, such as asking exporting states to provide the IAEA with information on exports of specified dual-use equipment, procurement inquiries and export denials.

Other safeguards improvements should be considered. In cases where states have violated their safeguards agreements, former IAEA Deputy Director General for Safeguards Pierre Goldschmidt argues persuasively that the IAEA should be granted an automatic increase in its inspection authority, with immediate and unfettered access at any time to any place, data or person.³ The right to such access is in fact already anticipated in the IAEA statute in regard to all member states, although not incorporated in regular safeguards practice.⁴

Require back-up safeguards

In view of the possibility of a technology recipient breaking out of the NPT and nullifying its IAEA full-scope safeguards agreements, nuclear suppliers should insist on item-specific bilateral safeguards agreements as back-up arrangements that would retain their validity under any circumstances. Facility-specific safeguards (which are usually enumerated in an INFCIRC/66-type agreement; see Introduction) ensure that sensitive facilities remain under IAEA monitoring even if a country withdraws from the NPT and invalidates its comprehensive safeguards agreement. Russia had been urged to make such an agreement with Iran in connection with completing work on the Bushehr reactor and providing its fuel, but no such agreement is known to be in place.

Enforcement

Rules need to be rigorously enforced if the benefits of nuclear energy are to be enjoyed without proliferation risk, yet the international record on enforcement is poor. Violators of NPT-required safeguards agreements, export-control regulations and UN Security Council mandates on non-proliferation have faced few real penalties. The problem is worst in the Middle East, the region with the largest number of NPT violators. Of these, two countries – Iraq and Libya – were proven to have pursued

nuclear weapons while they were NPT members, and another, Iran, systematically violated its safeguards agreements over an 18-year period in what many believe to have been a weapons-development effort. Such violations are among the impediments to bringing about a nuclear-weapons-free zone (NWFZ) in the region.

Inadequate effort in enforcing Security Council resolutions regarding Iran may give others in the region reason to believe that they, too, could 'get away with it' and enjoy the same proximity to a weapons capability. Persuading Iran to suspend enrichment and construction of its plutonium-producing reactor at Arak is the most effective step states could take to stop the spread of dual-use technologies elsewhere in the region.

UN Security Council Resolution 1540 (UNSCR 1540), adopted unanimously in April 2004, requires all states to criminalise the proliferation of nuclear, chemical and biological weapons and their means of delivery. The Security Council is authorised to apply sanctions in the event of non-compliance, but the resolution provides for no verification mechanism that would trigger enforcement measures. Nor does it specify standards of compliance to which states should conform. Any future attempt to improve UNSCR 1540 should address these shortcomings.

In the case of IAEA safeguards non-compliance, the agency's board has statutory authority to suspend IAEA assistance and membership, neither of which has been seriously considered in the Iranian case. In addition to applying this provision, the agency could also adopt a generic criteria-based rule banning all nuclear assistance from any country to those states not in compliance.⁵

To strengthen enforcement, the UN Security Council should consider establishing country-neutral rules for NPT violators. One such rule recommended by many experts would require countries that violate safeguards provisions and withdraw from the NPT to give up the nuclear material, facilities and technology they obtained as members of the NPT. Any facilities so acquired would be subject to mandatory dismantlement, with enforcement by the Security Council under Chapter VII of the UN Charter. The NSG could in addition agree that nuclear-technology-transfer agreements include a provision outlawing the use of transferred items in the event of NPT withdrawal.⁶ It has

also been suggested that states in safeguards non-compliance should 'automatically' be blocked from leaving the NPT, and that any withdrawal from the NPT by a state after it is found to be in safeguards non-compliance should be referred to the Security Council as a threat to international peace and security under the terms of Chapter VII.⁷

Regulating enrichment and reprocessing

A major weakness of the global non-proliferation regime and a key factor in the current stand-off with Iran is that there is no legal prohibition on enrichment and reprocessing. The proliferation dangers of these technologies have been a source of widespread concern since the 1970s, when Albert Wohlstetter described them as a sword of Damocles hanging over the world,⁸ and the US stopped its own reprocessing. Since then, Washington has also energetically discouraged other suppliers from transferring sensitive fuel-cycle facilities. The erosion of technical barriers to nuclear weapons and the widespread proliferation of enrichment technologies by black-market networks have magnified the problem. However, many states still accept the idea that the inalienable right to nuclear energy for peaceful purposes affirmed by Article IV of the NPT includes the right to enrichment and reprocessing – an interpretation over which there is heated debate. Taken to its extreme, this reading of the language of Article IV would allow states to produce highly enriched uranium and separated plutonium right up until the point at which they are fashioned into weapons. A consensus is gradually emerging, at least among supplier states, that these technologies do need to be controlled, in order to overcome what IAEA Director General Mohamed ElBaradei has called the NPT's 'Achilles heel'. By one means or another, this loophole must be closed. In the case of the Middle East, this will certainly be necessary if nuclear power is ever to flourish there in a manner that does not engender proliferation.

In an October 2003 *Economist* opinion piece, ElBaradei called for the exclusive restriction of reprocessing and enrichment to facilities under multinational control.⁹ Four months later, in February 2004, US President George W. Bush called on supplier countries not to sell enrichment and reprocessing equipment to any country that did not already possess operating facilities for such

technology, and for all states currently working to acquire such enrichment capabilities to renounce those efforts.¹⁰ Neither demand elicited widespread support, but in highlighting the problem, ElBaradei and Bush did spur other initiatives to stop the expansion of these sensitive technologies.

Encourage voluntarily forgoing of sensitive fuel-cycle technologies

Most of the proposals for regulating sensitive fuel-cycle technologies have been based on positive incentives to encourage states to decide of their own sovereign will not to pursue the full nuclear fuel cycle. States that agree voluntarily to purchase fuel-cycle services on the international market rather than develop indigenous facilities will find that the international route considerably eases their path to nuclear power. It will be far less costly, in both economic and political terms, and using foreign fuel-cycle services will shorten the time frame for bringing nuclear power online. Realising this, both the UAE and Bahrain in early 2008 affirmed an intention to forgo sensitive indigenous fuel-cycle technologies.

If a state's primary motivation for seeking nuclear power is energy security (rather than strategic security or national pride), then it should concentrate on the technologies it really needs for this purpose. Its focus should be on reactors, nuclear safety and waste disposal. To the extent that there is concern about fuel supply, states may also wish to consider indigenous fuel fabrication, as Turkey has indicated it wants to do, and as some in Egypt have suggested. Because reactor fuel is highly specific to reactor type, there may only be one or two outside suppliers of fuel for a given reactor, in contrast to generic LEU, which is produced by several suppliers. But there is no economic need for indigenous enrichment for states newly entering the nuclear-power field.

Guarantee fuel supply

Pursuing the logic of positive incentives and focusing on the most urgent issue of the front end of the fuel cycle, a number of states and other bodies have tabled at least 12 different proposals to guarantee the supply of enriched uranium fuel. These proposals include a fuel bank under IAEA auspices, and a Russian plan to donate LEU worth \$300 million produced by its international enrichment facility

at Angarsk as guaranteed supply to any country meeting criteria determined by the IAEA. The difficulties of such multilateral fuel-cycle arrangements include the need not to distort existing commercial markets for fuel procurement, which function well. The growing consensus in the supplier states on the urgency of the issue, however, suggests that these difficulties will be overcome.

With the exception of a Saudi proposal on behalf of the Gulf Cooperation Council (GCC) for an extra-regional enrichment centre, all of the ideas for guaranteed fuel supply have emerged from the ranks of existing technology holders. To gain the support of the technology 'have-nots', fuel-cycle guarantee programmes should involve prospective users in the decision-making process and offer realisable short-term benefits, as well as long-term goals.¹¹ To enhance perceptions of legitimacy, such programmes may also need to adopt the vision that multilateral control of sensitive fuel-cycle activity would also eventually apply to current technology holders, as proposed by ElBaradei in his 2003 *Economist* article, and as first proposed in 1946 by then-US Undersecretary of State Dean Acheson and Tennessee Valley Authority Chairman David Lilienthal.

Take back spent fuel

Unless it wants to maintain a weapons option, the knowledge that spent fuel can be returned can be a powerful motivator for a state to forgo reprocessing. Having the option of returning spent fuel would relieve a state of the safety and environmental hazards of storing radioactive waste and the financial cost and technological difficulty of constructing a permanent disposal facility, for which some countries do not have the appropriate geological conditions in any case. The ideal arrangement would be fuel leasing, whereby suppliers provide the enriched fuel, take back the spent fuel and arrange for final disposition of vitrified waste. However, few supplier countries are ready to take another country's nuclear waste, both for political and environmental reasons. France takes back spent fuel to reprocess the plutonium but cannot keep the nuclear waste. The political issues associated with nuclear-waste disposal in the US and elsewhere are magnified if the fuel is of foreign origin, even though the amount would typically be minuscule in comparison with domestic nuclear waste. The

security and environmental dangers involved in shipping spent fuel add to the difficulties.

Long-term storage of vitrified nuclear waste in an international repository would be the best solution for managing the back end of the fuel cycle, if the significant political hurdles in the way of creating such a repository could be overcome. Russia and the US have negotiated an agreement under which the US would allow Russia to accept spent fuel from US-supplied reactors around the world, Russian domestic law permitting. However, the Russian nuclear establishment is less interested in this prospect than it was in the past, and the US has held up final approval of the deal pending an assessment of Russia's nuclear ties to Iran. This hold-up would seem to be short-sighted, in light of the proliferation risk presented by weapons-usable plutonium accumulating in spent fuel in unstable regions such as the Middle East.

Conditions of supply

In the event that guaranteed fuel-cycle services do not persuade recipient states to forgo enrichment and reprocessing, the responsibility for ensuring that nuclear energy in the Middle East does not become a proliferation risk will have to be borne by suppliers. Strengthening the NSG guidelines is the best way for suppliers to meet this responsibility.

Require the forgoing of sensitive fuel-cycle facilities

In addition to refusing to supply enrichment and reprocessing technology, exporting states could decide not to supply nuclear power plants unless the buyer makes a commitment to forgoing enrichment and reprocessing. It may be politically difficult to write such a restriction into a state-to-state agreement that will undergo public scrutiny. However, a supplier state can make it clear in bilateral discussions that assistance with nuclear power will not be forthcoming if the recipient does not also agree to purchase fuel-cycle services from abroad. This conditionality can be reinforced in government-approved commercial contracts. The UAE's nuclear-energy white paper published in April 2008 and Bahrain's memorandum of understanding on nuclear-energy cooperation with the US of the previous month are good examples of how no-enrichment or reprocessing commitments can be made.

The eschewal of sensitive fuel-cycle technologies is in fact an implicit condition of some of the proposals for guaranteeing fuel supply, even if in practice this conditionality has been left vague for the time being. Allowing states that have their own enrichment facilities also to partake of guaranteed fuel-cycle service arrangements would defeat the purpose of such arrangements.

The industrialised states are conscious of the need, when setting conditions of supply, not to enable the legitimate quest for nuclear energy to morph into a nationalistic campaign of defiance against the West. Many developing countries are sceptical about Western intentions and claim that efforts to restrict enrichment and reprocessing technologies would unfairly negate their rights and create new categories of 'haves' and 'have-nots'. The desire to depoliticise the issue of enrichment and reprocessing may explain why France has not publicly insisted on non-proliferation conditions in its recent negotiation of nuclear-cooperation agreements with several states in the Middle East.

Concerns about exacerbating political tensions also contributed to the NSG's rejection of President Bush's February 2004 proposal to prohibit the transfer of enrichment and reprocessing technologies to new countries. Most NSG members disagreed, but not until April 2008 did the US join other NSG members in supporting an alternative approach of establishing criteria for regulating the export of sensitive technologies. The actual criteria had not yet been agreed as of May 2008. One criterion that should be considered is whether the importer's nuclear programme is economically feasible and sensible. Given the ready availability of enriched uranium fuel on the international market, enrichment does not make economic sense for states that have fewer than five to 10 reactors.¹² Reprocessing is an expensive operation subject to large economies of scale, and is unjustified on economic grounds in most cases. Establishing economic criteria to determine states' eligibility for supply would thus be an effective and reasonable way of controlling the expansion of these technologies.

Restrict reactor types

The nuclear suppliers should come to an agreement that any nuclear reactors sold to the Middle East – or introduced anywhere – must be of the most proliferation-resistant variety. This means no heavy-water

moderated reactors that can be refuelled without reactor shutdown visible to international inspectors, and no research reactors fuelled by HEU. New research reactors should be limited in size in order to keep down the amount of plutonium they produce. No more than 10MWt is needed to manufacture isotopes for medical and industrial use, not the 40MWt of the research reactor Iran is building at Arak. Indeed, reactors are not needed at all for these applications; isotopes can be produced by particle accelerators (which can also produce plutonium, but only in small amounts). Alternatively, given the generally low utilisation rate of research reactors, a single regional reactor could suffice for the medical-isotope-production needs of the entire region. This reactor could operate as a combined project of all the countries in the region under strict safeguards, similar to the international synchrotron accelerator currently being built in Jordan.

Control fuel shipments

To reduce the risk of diversion of fresh LEU fuel, suppliers should limit the provision of power-reactor fuel to one reloading at a time (in contrast to the 2.25 loads Russia provided to Iran in December 2007–January 2008) and strictly adhere to a ‘just-in-time’ principle, sending it no more than three to six months ahead of the date when it will be used. The risk of diversion of spent fuel can be reduced if the fuel is returned to the supplier as soon as possible after unloading from the reactor. Although fuel typically needs to cool in the spent-fuel pond for at least three years before it is shipped, this can be reduced to as little as six to 12 months through the use of more protective shipping casks (though this would mean that more casks would be needed). Ideally, there should be no need for storage between the time the spent fuel is in the cooling pond and when it is sent back to the supplier for either recycling or vitrification and disposal.

Regional arms control

A functioning ban on nuclear weapons in the Middle East remains a remote, even idealistic, prospect. Notwithstanding the intense diplomatic efforts put into promoting a regional NWFZ, little has been achieved, and diplomatic momentum is moving in the opposite direction.¹³

An NWFZ in the Middle East will not be practical until there is a fundamental change in the political

environment, producing some sense of mutual trust and reconciliation. The concept of an NWFZ has been discussed with particular reference to Israel, which, as noted in chapter six, will not relinquish its nuclear-weapons programme until it no longer feels threatened by its neighbours. Similarly, an African NWFZ only became possible when South Africa experienced a fundamental change in its security situation that allowed it to give up its nuclear arsenal.

Modest arms-control measures could contribute to diminishing threat perceptions, but most such measures in the Middle East would require some modification of Israel’s nuclear-opacity policy. Any reduction in Israel’s sense of security brought about by changes to this policy undoubtedly would have to be compensated for by other security assurances. In particular, the Israelis would need to be able to be confident that their nuclear insurance policy would not be compromised before their security environment improved. Past efforts at producing confidence-building measures through the working group on arms control and regional security, set up under the 1991 Madrid peace accord, came to naught because of fundamental differences over whether a WMD-free zone should precede or follow the establishment of peace.

Disagreements over sequencing and priorities driven by intrinsic asymmetries continue to stand in the way of progress. These asymmetries include Israel’s sole possession of nuclear weapons and its sense of vulnerability. Until Israel comes to feel secure as a result of an enduring peace, it will not reduce its ultimate security guarantee. Asymmetries of transparency are another factor. Autocratic regimes can more easily conceal activities that violate arms-control agreements. Although a similar dichotomy did not prevent the US and the Soviet Union from reaching arms-control agreements with elaborate verification measures, the problem of ‘small numbers’ in the Middle East, where just one hidden facility could upset the strategic balance, along with the region’s long record of safeguards violations, increase the verification challenge.

Resume regional dialogue on conditions for an NWFZ

Rather than simply repeating demands for an NWFZ that appear to require unilateral disarmament, it makes sense to begin with a dialogue on the conditions necessary for such a zone. As recommended

by the Carnegie Endowment for International Peace, this discussion would have to address mutual recognition of sovereignty by all parties, security-related confidence-building measures, national transparency and intrusive verification procedures.¹⁴ Parties should focus on identifying a common set of interests and principles that would guide talks. Necessary conditions include progress towards resolving the Israel–Palestine question, without which Arab populations may be unwilling to accept any accommodation of Israeli security concerns.¹⁵

The call for a regional dialogue of governmental experts has been joined by Iran's former deputy nuclear negotiator, Hossein Mousavian, who in a September 2006 speech in London noted the need and difficulty of securing the participation of all states, including those that do not recognise Israel. A possible way of enabling full participation, he remarked, would be for such meetings to be held under the auspices of a UN organisation to which all belonged.¹⁶

The interim goals of a regional dialogue could conceivably include agreement on confidence-building measures and practical steps towards an NWFZ or a WMD-free zone. Countries of the region should understand that signing and ratifying the Chemical Weapons Convention (CWC) and Biological Weapons Convention (BWC) would help make the creation of an NWFZ a more realistic proposition. (Egypt, Iraq, Lebanon and Syria have not signed the CWC and Israel has yet to ratify it; Israel has not signed the BWC, and Egypt, Syria and the UAE have yet to ratify it.) Persuading Israel to accept verification measures for arms-control treaties and inducing it to overcome its fear of a slippery slope towards nuclear disarmament would require a corresponding improvement in its overall security situation. A meaningful arms-control discussion would also require some modification of Israel's nuclear-opacity policy.

Encourage a regionwide moratorium on enrichment and reprocessing

The WMD Commission headed by former IAEA Director General Hans Blix recommended in 2006 that all states in the Middle East commit themselves for a prolonged period to not having any enrichment, reprocessing or other sensitive fuel-cycle activities on their territories. Such a commitment

would mean that all fuel-cycle services for future nuclear power plants in the Middle East would be provided by facilities outside the region.¹⁷ The proposal by the GCC to create a regional enrichment plant located outside the Middle East represents a nod in this direction and could, if adopted, create a de facto nuclear-enrichment-free zone in the Gulf. As part of this, a unilateral decision by the GCC to forgo enrichment, which would be advisable in any case on economic grounds and in view of conditions that may be attached to supplier agreements, would help to build confidence in states' non-proliferation bona fides and contribute to building an NWFZ. Attempts to formalise any such enrichment-free zone encompassing Iran and Israel, however, would run into many of the same verification and enforcement problems that have stymied the broader NWFZ.

The GCC idea is similar in concept to Russia's November 2005 proposal for a joint venture to enrich fuel for Iran on Russian soil. That proposal has now evolved into the regional enrichment centre at Angarsk, with participation from Kazakhstan and Armenia, and interest expressed by Uzbekistan, Ukraine, Mongolia and South Korea. Iran's response to suggestions for enrichment arrangements abroad is that it will consider any proposal for multilateral enrichment facilities, but not at the exclusion of enrichment on Iranian soil – a position which negates the non-proliferation purpose of the concept.

In addition to stopping enrichment in Iran, a commitment of the kind proposed by the WMD Commission would also stop plutonium reprocessing in Israel, the only state in the region that currently possesses an operational reprocessing facility. Such a moratorium would be equivalent to the unilateral decisions taken by France, Russia, the UK and the US and, it is assumed, China, to stop producing fissile material for weapons purposes. As with these decisions, this moratorium would not require safeguards on existing stockpiles. For Israel to announce a halt in plutonium production would be a significant departure from its opacity policy, whereby it currently makes no statements whatsoever about plutonium. But it presumably could formally preserve this policy by taking a similar tack to China and letting it be known, without officially saying so, that fissile-material production had stopped. It is even possible that Israel already has stopped separating plutonium at its Dimona

reactor. Unless the halt were confirmed, however, there would be little arms-control value in stopping production. The most important point would be to modify the opacity policy to allow discussion of the issue. Verification inspections at Dimona to confirm the moratorium would dent opacity further, although a 'neither confirm nor deny' policy could still be maintained with regard to nuclear weapons themselves.

If estimates of an arsenal of more than 100 nuclear weapons are correct, it might be argued that Israel has already produced all the weapons it needs for deterrence. But shutting down the Dimona reactor and the associated reprocessing facility could deny Israel a regular source of tritium, the isotope that is needed to maintain the boosted weapons in this arsenal and which has a half-life of only 12.3 years. Alternative sources of tritium are not inconceivable (for example, a new accelerator Israel currently has on order from Germany could theoretically generate tritium in addition to the civilian-use isotopes for which it is intended), but would be very difficult to arrange in view of the NPT's Article I prohibition on support for nuclear-weapons programmes other than those of NPT-recognised nuclear-weapons states. One question might be whether boosted weapons are necessary for deterrence. The answer depends on expectations about the adversary. If Iran obtains an advanced latent capability, Israel will be far less inclined to give up any of its strike options; indeed, the mood in Israel may swing in favour of 'maximum deterrence', threatening retaliation against all targets of value in Iran with the biggest bombs Israel can produce.

Although Israel emphasises that the Dimona reactor is in good operating condition and will last for many more years, at some point it will have to be decommissioned.¹⁸ If Israel were to decide that it had sufficient reserves of weapons-grade plutonium and no future need for tritium, a willingness to cease plutonium production and separation and to place the Dimona reactor and reprocessing plant under IAEA safeguards could be a strong bargaining chip in negotiations over a long-term solution to the Iranian nuclear issue and could be in persuading Egypt and other Arab states to accept the Additional Protocol and forgo enrichment and reprocessing.

Even without new verification procedures, a regionwide agreement to forgo enrichment and

reprocessing would be a significant political statement and a major step towards an NWFZ. Of course, negotiating such a measure and overcoming Israel's concerns about a slippery slope would require much more mutual confidence than now exists. Israel refuses to consider any proposal to stop plutonium production, either unilaterally or in a multilateral context, except under conditions of a lasting regional peace. In addition, Israel would not take such an important decision without a guarantee that Iran would not acquire nuclear weapons. Israel today sees no advantage to be gained from any deal with Iran, which it does not trust to honour any non-proliferation commitment. In fact, even discussing arms-control measures is seen by Israel as a dangerous distraction from the need to focus world attention on Iran's growing nuclear capabilities. However, as Iran gets closer to being able to produce a bomb and thereby removing Israel's nuclear monopoly, Israeli policymakers may need to consider under what circumstances a deal would be worth exploring.

Ratify Pelindaba Treaty and pursue sub-regional Gulf WMD-free zone

To the extent that interest in a Middle Eastern WMD-free zone is separable from policies towards Israel, this goal can be partially advanced by pursuing sub-regional zones. An NWFZ covering the North African portion of the Middle East has already been agreed in the 1996 signing of the Pelindaba Treaty, which covers the whole of the African continent. As of May 2008, the Pelindaba Treaty lacked four of the 28 ratification votes it needs for entry into force. Egypt Morocco and Tunisia are among the majority of African countries yet to ratify the treaty. For most of these countries, the delay is due to bureaucratic inertia and competing political priorities. In Egypt's case, the delay is part of a policy of not taking any additional non-proliferation steps without seeing some kind of reciprocal progress towards eliminating nuclear weapons from the broader Middle East as well. Ratifying the Pelindaba Treaty, however, would be a cost-free way for Egypt to address suspicions that it is keeping future weapons options open. With or without Egypt's ratification, the treaty is likely to come into force before long anyway. The creation of a WMD-free zone in the Gulf, as endorsed by

the GCC (see chapter two), would also be a useful confidence-building measure, although Iran shows no interest in a zone that does not include Israel.

Reassurance and deterrence

Non-proliferation goals can also be served by addressing the security concerns that contribute to the motivations of states seeking a nuclear hedge. If Iran succeeds in obtaining a latent nuclear-weapons capability, the security concerns of its neighbours will have to be allayed as part of the policy mix aimed at precluding them from following suit. To the extent that they are persuaded that powerful countries will act to counter any strategic advantage Iran might otherwise gain through acquiring a nuclear-weapons capability, other states in the region will have less reason to seek such a capability themselves.

For Turkey, the NATO nuclear umbrella is the ultimate defensive shield. Any apparent advantages in one day removing NATO nuclear weapons from Turkey should be weighed against the potential impact on proliferation drivers in the Middle East. It will be very important that the Turks themselves have a major say in the decision either way. But the nuclear umbrella may not provide sufficient assurance for Turkey in any case, if other forces tug it in the direction of seeking its own deterrent. Support for Turkish accession to the EU and the demonstration by Western powers of an understanding of Turkish national interests, for example in relation to Kurdish issues, could bring important dividends by reducing Turkey's sense of vulnerability and concerns about self-reliance, and thus its belief in the need to obtain an independent deterrent. Turkey, which has too many historical reasons to doubt that NATO solidarity would be automatic, should also be clearly and publicly assured by its Alliance partners that it will have the full support of NATO in the event of an Iranian threat.

Providing a US or NATO nuclear umbrella to Israel by way of a formal defence alliance or declaratory policy has been proposed both as a measure to contain Iran and as a way to give Israel an additional security guarantee that would allow it to accept arms-control measures. Under current circumstances, however, NATO member states would be highly reluctant to tie their nuclear policies to the volatile politics of the Middle East. Israelis them-

selves are not enamoured of the idea of NATO membership or even of a more official defence alliance with the US, both of which they fear would compromise Israel's freedom of action.

Overtly extending a nuclear umbrella to friendly Arab countries in the region would be even more problematic and less credible. These states are not formal US allies and, after the war in Iraq, the American public is not prepared to take on new defence obligations in the Middle East, especially with countries seen as not sharing the same values of democracy and civil rights. Public opinion in most Arab states is strongly opposed to the US nuclear posture, and a nuclear assurance could damage rather than bolster such states' security by sparking domestic upheaval and possibly terrorist attacks.¹⁹

Cooperation on ballistic-missile defence, early-warning radars and other tangible manifestations of conventional deterrence are better ways to reassure countries in the region that feel threatened by Iran. Washington's Gulf Security Dialogue, arms sales, economic assistance and joint training exercises help build defence capacity, provide a basis for future regional collective-security arrangements and serve as visible demonstrations of Western resolve against any Iranian intimidation. The increased tempo of US carrier forces in the Gulf serves this purpose as well. Although the Iranian threat is more nuanced and wide-ranging than that of a simple outright military attack on Gulf states, US, French and British forces in the Gulf could perform a *de facto* tripwire function in the event of such hostilities. Expanding existing defence agreements and declaratory policies may also be considered. Declarations of readiness to assist any state threatened by Iran could reinforce the existing positive security assurances provided in the NPT, whereby nuclear powers promise to come to the aid of non-nuclear-weapons states in the event of a nuclear attack. NATO involvement in such declarations could increase both their credibility and legitimacy.²⁰

Ultimately, defence commitments must be based on a solid political foundation. Some states, such as Saudi Arabia, may be reluctant to rely on the US because of domestic opposition, but they understand the value of maintaining strategic relationships, both with the US and with other powers. French President Nicolas Sarkozy's January 2008 visit to the Gulf reinforced the message of Western engagement

and support. His offers of nuclear-energy assistance combined with military cooperation help to shore up the broad strategic relationships that, by removing the need for independent deterrents against an ascendant Iran, can contribute to strengthened non-proliferation norms within the region.

Finally, as an additional element in a multi-pronged strategy to deter a proliferation cascade in the region, powerful states may employ what might be called 'political deterrence' by discreetly cautioning any friends or allies who show signs of acquiring weapons capabilities. They should make it clear that pursuit of nuclear weapons, no matter what the motivations, would severely damage relations. Such friendly warnings might also involve the imposition of penalties, including reductions in

financial and military assistance. The US effectively employed a political deterrence strategy vis-à-vis South Korea and Taiwan in the 1970s to curb their pursuit of fissile-material capabilities. The strategy did not work in the case of Pakistan, partly because of Islamabad's determination to match India, and partly because Pakistan did not view a US nuclear guarantee as a credible substitute for a national deterrent, since the US had not come to its aid in 1965 or 1971. Perhaps the most important factor, however, was that the US gave higher priority at the time to maintaining Pakistan's role in ousting the Soviet Union from Afghanistan. To keep the Middle East from going the way of South Asia, the major powers will have to place firm emphasis on non-proliferation as a priority.

Summary of policy options

Transparency

- Encourage adoption of the Additional Protocol
- Promote acceptance of the modified Small Quantities Protocol

Verification

- Improve the IAEA safeguards regime
- Require back-up safeguards

Enforcement

- Persuade Iran to adhere to UN Security Council resolutions on suspension
- Establish verification and standards of compliance for UNSCR 1540
- Suspend nuclear assistance to countries in non-compliance
- Impose penalties for NPT withdrawal by states in non-compliance

Regulating enrichment and reprocessing

- Encourage voluntary forgoing of sensitive fuel-cycle technologies
- Guarantee fuel supply
- Put fuel-cycle facilities under multilateral control
- Take back spent fuel

Conditions of supply

- Require the forgoing of sensitive fuel-cycle facilities
- Agree NSG criteria for supply of sensitive fuel-cycle technology
- Restrict reactor types

Regional arms control

- Resume regional dialogue on conditions for an NWFZ
- Encourage a regionwide moratorium on enrichment and reprocessing
- Ratify Pelindaba Treaty
- Pursue a sub-regional Gulf WMD-free zone

Deterrence and reassurance

- Confirm assurances for Turkey
- Reinforce conventional deterrence
- Strengthen strategic ties
- Employ 'political deterrence' to discourage nuclear hedging

Notes

- 1 The IAEA, which has identified 20 preparatory steps a state has to take when building its first nuclear power plant, estimates that on average 15 years of sustained national commitment are needed for the first plant. IAEA, 'Considerations to Launch a Nuclear Power Programme', GOV/INF/2007/2, April 2007, p. 7, http://www.iaea.org/NuclearPower/Downloads/Launch_NPP/07-11471_Launch_NPP.pdf.
- 2 IAEA, 'Safeguards Statement for 2006 and Background to the Safeguards Statement', June 2007, para. 15, <http://www.iaea.org/OurWork/SV/Safeguards/es2006.html>.
- 3 Pierre Goldschmidt, 'The Urgent Need to Strengthen the Nuclear Non-Proliferation Regime', Carnegie Endowment for International Peace, Policy Outlook no. 25, 10 January 2006, http://www.carnegieendowment.org/files/PO25_Goldschmidt.FINAL2.pdf.
- 4 Article XII.A.6 of the IAEA statute specifies that the agency's rights in applying safeguards with respect to any IAEA project or other arrangement include the right 'to send into the territory of the recipient State or States inspectors ... who shall have access to all places and data and to any person who ... deals with materials, equipment or facilities which are required by this Statute to be safeguarded'.
- 5 Among those who have suggested this measure is Henry Sokolski, 'Getting Ready for a Nuclear-Ready Iran: Report of the NPEC Working Group', in Henry Sokolski and Patrick Clawson (eds), *Getting Ready for a Nuclear-Ready Iran* (Carlisle, PA: Strategic Studies Institute, 2005), p. 13.
- 6 *Ibid.* See also George Perkovich and Jessica Mathews et al., *Universal Compliance: A Strategy for Nuclear Security* (Washington DC: Carnegie Endowment for International Peace, 2005), pp. 54–7.
- 7 Goldschmidt, 'The Urgent Need to Strengthen the Nuclear Non-Proliferation Regime'.
- 8 Albert Wohlstetter, 'Spreading the Bomb Without Quite Breaking the Rules', *Foreign Policy*, Winter 1976–1977.
- 9 Mohamed ElBaradei, 'Towards a Safer World', *Economist*, 16 October 2003.
- 10 'President Announces New Measures to Counter the Threat of WMD', speech by George W. Bush at National Defense University, Washington DC, 11 February 2004, <http://www.whitehouse.gov/news/releases/2004/02/20040211-4.html>.
- 11 Chaim Braun, 'Technical Review of Fuel Assurance Proposals', presentation to the conference 'New Framework for the Utilization of Nuclear Energy in the 21st Century: Assurance of Supply and Nonproliferation', IAEA, Vienna, 20 September 2006, www-pub.iaea.org/mtcd/meetings/PDFplus/2006/cn147-braun.pdf.
- 12 A 2003 MIT study calculated that domestic uranium production becomes economically competitive with LEU sold on the international market when a state has a 10GWe reactor capacity (equivalent to ten medium-sized reactors). If the price of uranium were to reach \$200 per kilogramme, the break-even point would be 5GWe. John Deutch and Ernest J. Moniz et al., 'The Future of Nuclear Power: An Interdisciplinary MIT Study', Massachusetts Institute of Technology, 2003. See also Sharon Squassoni, 'The Realities of Nuclear Expansion', Congressional Testimony to the House Select Committee for Energy Independence and Global Warming, Carnegie Endowment for International Peace, 12 March 2008.
- 13 A 15-year-long consensus on an IAEA general conference resolution in favour of a Middle East NWFZ broke down in 2006 when Israel and the US voted against the resolution and three other states abstained. The resolution was further weakened the following year, when as the number of abstentions rose to 47 (due to a decision by most EU members and aspiring members to abstain, reportedly at the urging of France).
- 14 Perkovich and Mathews et al., *Universal Compliance: A Strategy for Nuclear Security*, pp. 181–3.
- 15 *Ibid.*, p. 43.
- 16 Transcript of presentation by Dr Hossein Mousavian to conference on 'The Middle East Weapons of Mass Destruction Free Zone', Centre for International Studies and Diplomacy, School of Oriental and African Studies, University of London, 7 November 2006, <http://www.cisd.soas.ac.uk/Editor/assets/wmdcon%2006-%20transcript%20unedited.pdf>, p. 30. In making this suggestion, Mousavian was not representing the Iranian regime, which in spring 2007 arrested him on unrelated espionage and other charges. He was found not guilty of spying, but was later convicted of breaching national security in a retrial and given a suspended sentence.
- 17 Weapons of Mass Destruction Commission, *Weapons of Terror: Freeing the World of Nuclear, Biological and Chemical Arms* (Stockholm: Weapons of Mass Destruction Commission, June 2006), p. 72. Similar proposals have been made by others, including a UN Experts Group that in 1990 advocated applying safeguards to Israel's Dimona reactor as a practical interim step towards achieving an NWFZ in the Middle East. See James Leonard, Jan Prawitz and Benjamin Sanders, 'Study on Effective and Verifiable

Measures which would Facilitate the Establishment of a Nuclear-Weapon-Free Zone in the Middle East', Annex to Report of the Secretary-General to UN General Assembly, A/45/435, 10 October 1990, <http://domino.un.org/UNISPAL.NSF/9a798adb322aff38525617b006d88d7/61ed0442418a2e9c052567d0005c1b48!OpenDocument>, pp. 31–3.

¹⁸ Nuclear power reactors are typically licensed for 40 years and then decommissioned. Dimona was completed in 1963, but reactors whose purpose is not power production usually last longer because they are operated less intensely. A senior Dimona official assured the Israeli public in August 2007

that the reactor was safe, and that it periodically undergoes renovation. Yuval Azoulay, 'Nuclear Center Exec Avows Safety of Dimona Reactor', *Haaretz*, 23 August 2007.

¹⁹ See Lewis A. Dunn, 'Deterrence Today: Roles, Challenges and Responses', Institut français des relations internationales (IFRI), Proliferation Papers, no. 19, Summer 2007, p. 12, http://www.ifri.org/files/Securite_defense/Deterrence_Today_Dunn_2007.pdf.

²⁰ See Richard L. Russell, 'Arab Security Responses to a Nuclear-Ready Iran', in Sokolski and Clawson (eds), *Getting Ready for a Nuclear-Ready Iran*, pp. 45–6.