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Nuclear Security 2012

: Challenges of Proliferation and Implication for the Korean Peninsula

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Nuclear Security 2012

: Challenges of Proliferation and Implication for the Korean Peninsula

Ⅴ. Three States, Three Stories:

Comparing Iran, Syria and North Korea's Nuclear Programs

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1. Introduction: Three of a Kind?

Two regions of the world draw the most concern from analysts worried about the spread of nuclear weapons: the greater Middle East and East Asia.[1] In the Middle East, Israel possesses nuclear weapons, Iran is seeking to master the fuel cycle (which would, in principle, provide with a weapons capability), and Syria built a clandestine nuclear reactor that was later destroyed by Israeli aircraft. In East Asia, the Democratic People's Republic(DPRK) or North Korea has maintained a nuclear weapons program despite increasing isolation and pressure from the international community.

American pundits tend to ignore Israel's program and lump Syria, Iran, and North Korea together.[2] Neither practice is wise. Israel is on of the few nuclear weapon states that might plausibly use its weapons, and lumping Syria, Iran, and North Korea together is convenient but conceptually dangerous.

It is understandable that the three are treated as a set given the fact that North Korea assisted Syria with its nuclear reactor and the ongoing rumors of Iranian-DPRK collaboration. The problem is that these linkages (real or imagined) do not mean that these countries have the same nuclear profile or that nonproliferation polices geared

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[1]– The author is indebted to a number of people who assisted with the research, commented on ideas, and provided suggestions for this chapter. They include Jae H. Ku, Jack Walsh, Brennan Foxman, Alisa Deychman and Marlene Cole.

[2]– On Israel's nuclear program, see Avner Cohen, *Israel and the Bomb* (New York: Columbia University Press, 1998) and more recently, Avner Cohen, *The Worst Kept Secret: Israel's Bargain with the Bomb* (New York: Columbia University Press, 2010).

to one country will be appropriate for the others. It is true that what happens in one region can have political spill-over effects and consequences for other regions. For example, it was the International Atomic Energy Agency's failings in Iraq with Saddam Hussein that spurred the agency's get-tough approach with North Korea in the early 1990s.[3] Nevertheless, the tendency to view the three states as members of the same group invites intellectual and policy errors that could have consequence.

This chapter tries to look at Syria, Iran, and North Korea with greater factual precision and conceptual clarity. In what ways are these countries' nuclear efforts similar? In what ways are they different? What are the connections between them, and do developments in one area effect events in another? What do the histories and trajectories of these three states' nuclear endeavors suggest for policy-making and for the study of nuclear decision-making?

The analysis begins with a brief primer on bomb programs. It then provides profiles of the Syrian and the Iranian nuclear efforts, including their history, present status, and future prospects. Following that, the three countries are compared. This chapter concludes with a look forward and how lessons drawn from experiences with these three countries might by applied in future policymaking and scholarship.

3– John Park, "An Examination of the IAEA's Special Inspections in North Korea, 1992－1994," (Ph. D. dissertation, Cambridge University, 2001).

2. Building the Bomb: Distinguishing a "Nuclear Program" from a Nuclear Weapons Program

Before reviewing the status and possible future of Syria's, Iran's, and North Korea's nuclear efforts, it makes sense to take note of the important differences between various kinds of nuclear programs: ① a civilian nuclear program that is technically unable to produce nuclear weapons, ② a civilian program that is technically capable of producing nuclear weapons given a decision by the political leadership, and ③ a dedicated weapons program. These three possibilities represent very different situations with very different prospective outcomes, but public discussions of proliferation often lump them together.

At its most basic, building a nuclear weapon requires at least one of two materials: highly enriched uranium(HEU) or plutonium(PU).[4] Neither substance exists in nature. They must be created by human effort and technology. There are many other aspects of nuclear technology that have almost nothing to do with the production of HEU and PU or with nuclear weapons. Put another way, the possession of these other technologies does not appreciably advance a country's ability to build the bomb. Nuclear materials and technology are used in medicine (e.g., to treat cancer), in agriculture (e.g., to kill insects and diseases), and in industry. Few of these applications are relevant to a weapons program. Thus, in principle, a country could

4– For a more detailed introduction to the fuel cycle and its relationship to nuclear weapons, see P. D. Wilson (ed.), *The Nuclear Fuel Cycle: from Ore to Wastes* (Oxford: Oxford University Press, 1996).

have a large and robust nuclear program and yet no practical ability to become a nuclear weapons state. For a nuclear weapon, the key is HEU or plutonium.

The HEU Route

The HEU path to the bomb does not require a nuclear power plant. All it requires is that a country have an enrichment technology and a source of feedstock that can be enriched. Enrichment technologies come in several varieties, the most common being the centrifuge. Historically, weapons states have developed an enrichment capability for their bomb programs prior to having built nuclear power plants for the generation of electricity, because their primary objective was developing a nuclear weapon.

As civilian nuclear power plant technology developed over the decades, the model that came to dominate the market was the light water reactor, a design that uses low enriched uranium(LEU) as a fuel for electrical power generation. A country cannot make a nuclear weapon with low enriched uranium, typically defined as uranium enriched to 3－5% and no more than roughly 20%. Nuclear weapons by require HEU, which as a practical matter has meant uranium enriched to a level of 90% or greater.

The problem, however, is that the very same technology that enables a country to produce LEU for a power plant can be turned around and used to produce HEU for a bomb. Again, one does not need a power plant, but a power plant can provide justification or

cover for the acquisition of technology that could then be used for weapons production. One of the reasons the Iranian program has drawn scrutiny is that, unlike most countries in the modern nuclear energy business, it launched a sizeable enrichment program before having completed a single power plant.

The Plutonium Route

To build a plutonium bomb, a country needs a source of PU - typically a nuclear reactor – and the ability to reprocess the nuclear waste or spent fuel the reactor generates during the course of its operation. Reprocessing or recycling, in this context, means treating the spent fuel chemically so as to extract or separate out the plutonium from the other waste products. Again, a nuclear reactor by itself, be it a power plant or a research reactor, cannot by itself be used to build the bomb. It requires the reprocessing technology to capture the bomb material from the waste.

Today, reprocessing is generally viewed as a thing of the past, though advocates and some countries such Russia (and South Korea) still argue for it on economic and even environmental grounds. For potential proliferators, it was attractive, because the technology is less challenging that many forms of enrichment. Weighing against that, however, is the fact that it is a dirty and dangerous business that is easier for outsiders to detect. Moreover, since most civilian plants run on LEU and not fuel that is mixed with plutonium, interest in reprocessing almost always draws international suspicion. As a consequence, the

reprocessing route has proven less attractive over the decades, a major exception being North Korea's weapons program, which went the plutonium/reprocessing route in the 1980s.

Given the requirement that a bomb program have either enrichment or reprocessing, it is possible to distinguish between the three types of nuclear "programs." A purely civilian program can possess many kinds of nuclear assets including a power plant, but if it does not have enrichment or reprocessing, then it cannot be used for nuclear weapons. On the other end of the spectrum are dedicated bomb programs that pursue enrichment or reprocessing, not as part of a civilian program but expressly for the purpose of weapons acquisition. Most of the pre-1970 weapons states, together with Pakistan and North Korea fall into this category.

The third category consists of countries that have not made the "bomb decision" but have acquired enrichment or reprocessing capability justified in terms of their civilian nuclear aspirations. The good news is that, historically, countries that stake out this position typically do not end up as weapons states.[5] Instead, successful proliferators tend to be countries that make the bomb their top priority. The bad news is that this gray area of bomb- sensitive technology in the service of

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5– During the nuclear age, more than twenty countries considered acquiring the bomb but did not become nuclear weapons states. Many of these countries wanted a bomb option without having to fully commit to constructing a weapon. For more on these nonproliferation success stories, see Mitchell Reiss, *Bridled Ambition* (Washington D.C.: Woodrow Wilson Center Press, 1995) and Jim Walsh, "Learning from Past Success: The NPT and the Future of Nonproliferation," *WMDC Paper,* No. 41 (Oslo: Weapons of Mass Destruction Commission, 2006).

a supposedly civilian program provides an opportunity for countries to get into the weapons game.

3. Syria's Nuclear Program

Origins

Syria's nuclear program, such as it was, got a late start. Damascus did not establish its national nuclear agency until 1976 (more than two decades after Egypt, for example.)[6] Since it possessed a limited scientific and industrial infrastructure, Syria had to depend on technical assistance from the IAEA and other governments. And as with many countries in the region, Syria's nuclear program was characterized by grand pronouncements of projects that never materialized. At different points in the 1980s, Syria appeared to have concluded deals with foreign countries for joint nuclear projects (e.g., Argentina), but nothing came of them, whether because of opposition from the United States and Israel, or because the parties could not agree on the terms.[7]

6– On Egypt's nuclear program, see Jim Walsh, "Bombs Unbuilt: Power, Ideas and Institutions in International Politics," (Ph. D. dissertation, MIT, 2000); Robert J. Einhorn, "Egypt: Frustrated But Still on a Non-Nuclear Course," Kurt M. Campbell, Robert J. Einhorn and Mitchell B. Reiss (eds.), *The Nuclear Tipping Point* (Washington D.C.: Brookings Institution Press, 2004), pp. 43－82; Etel Solingen, *Nuclear Logics: Contrasting Paths in East Asia & the Middle East* (Princeton, N. J.: Princeton University Press, 2007), pp. 229－246; and "Egypt," in Mark Fitzpatrick (ed.), *Nuclear Programmes in the Middle East: in the Shadow of Iran* (London: IISS, 2008), pp. 17－34.

7– On Syria's nuclear efforts, see Leonard Spector and Deborah Berman, "The Syrian Nuclear Puzzle," in William Potter and Gaukhar Mukhatzhanova (eds.), *Forecasting Nuclear Proliferation in the 21st Century: A Comparative Perspective* (Palo Alto,

It was not until the 1990s that Syria acquired its first major nuclear asset, a miniature neutron source reactor(MNSR), constructed by China and completed in 1996. This small reactor was intended for experiments, training, and isotope production and was too small to be useful for a weapons program. In 1997, with the help of IAEA, Syria acquired a pilot plant for the purification of phosphoric acid. One byproduct of this purification process is triuranium octoxide(U3O8) or yellowcake, which in theory could provide starter material for the eventual production of uranium fuel.[8]

Most of Syria's nuclear work is located in Damascus at the Der Al-Hadjar Nuclear Research Center (where the MNSR is located) and the Scientific Studies and Research Center. And yet, its most famous nuclear facility, the Al-Kibar reactor, was located not far from the border with Iraq.

The Al-Kibar reactor was a secret, 20－25MW reactor in the process of being constructed with assistance from North Korea, when an Israeli air strike destroyed it in September of 2007. Three days later, to the consternation of the IAEA, Syria bulldozed the sight and carted off the debris, further raising suspicions about project. Seven months later, American intelligence officials told journalists that they could

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CA: Stanford University Press, 2010); Ellen Laipson, "Syria: Can the Myth Be Maintained Without Nukes?" in *The Nuclear Tipping Point*, pp. 83－110; "Syria," in *Nuclear Programmes in the Middle East*, pp. 73－82, and Nuclear Threat Initiative (NTI), "Syria Profile," <http://www.nti.org/e_research/profiles/Syria/Nuclear/index.html>.

8– Though not suited for a bomb program, it is worth noting that the reactor was fueled with 980 grams of HEU (90%), but this amount has progressively been burned up in the course of the reactor's operation.

find no evidence of a reprocessing plant at the site, and thus could not conclude with high confidence that it was part of a weapons program, though use of the appearance of reactor design similar to North Korea's Yongbyon reactor certainly invited such concerns.[9]

Eventually, IAEA was allowed to visit the site and discovered trace amounts of "anthropogenic" uranium, which suggested that, contrary to Syria's denials, the facility was intended to house a reactor. In any case, the finding offered strong evidence that Syria was engaged in nuclear activities that it had not declared in accordance with its IAEA safeguards obligations.

Role of North Korea and Other Countries

North Korea certainly appears to have played a central and surprising role in Syria's clandestine efforts, though it is still unclear how far the DPRK was willing to go. On past occasions, North Korean officials have gone out of their way to stress to American policymakers that they would not make weapons-related exports to

9– On the Syria reactor, see IAEA, "Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic," Report by the Director General, GOV/2010/47 (6 September, 2010), pp. 1－5; IAEA, "Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic," Report by the Director General, GOV/2010/29 (31 May, 2010), pp. 1－4; IAEA, "Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic," Report by the Director General, GOV/2009/75 (16 November, 2009), pp. 1－3; IAEA, "Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic," Report by the Director General, GOV/2009/36 (5 June, 2009), pp. 1－4; IAEA, "Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic," Report by the Director General, GOV/2008/60 (19 November, 2008), pp. 1－4. See also numerous reports by David Albright, *et al.* <http://isis-online.org/isis-reports/category/syria/#2010>.

third parties. For example, DPRK representatives made these claims in late 2004. Given the timeline, it is conceivable that the North had already made a commitment to Syria before arriving at that policy. It may also be that the Foreign Ministry was unaware of the Syrian arrangement or that DPRK officials were simply dissembling.[10]

Syrian-North Korean cooperation began with missiles, not reactors. Damascus purchased scuds from Pyongyang starting in the early 1990s. One can imagine that this relationship provided a ready avenue for discussions about other forms of cooperation, including nuclear.[11]

Pakistan and its frequent flyer, Abdul Qadeer Khan(A. Q. Khan), may have also contributed to Syria's program. U.S. intelligence reports have suggested that Khan may have aided the program. President Assad confirmed that Khan had approached the Syrian government but maintained that Syria refused the offer of help.[12]

Current Status

The Syrian nuclear program is, for all intents and purposes, frozen. It continues to have technical cooperation projects with the IAEA and carry out nuclear research at the Der Al-Hadjar Nuclear Research

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[10]– The author was witness to these exchanges between DPRK and American officials.

[11]– On North Korea's Scud program an its ties to Syria, see Daniel A. Pinkston, *The North Korea Ballistic Missile Program* (Carlisle, PA: Strategic Studies Institute, United States Army War College, February 2008), <www.dtic.mil/ cgi-bin/ GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA477526>.

[12]– Bruno Tertrais, "Kahn's Nuclear Exports: Was There a State Strategy?" Henry D. Sokolski (ed.), *Pakistan's Nuclear Future: Worries Beyond War* (Carlisle, PA: Strategic Studies Institute, United States Army War College, 2008), pp. 15－51.

Center. Still, the discovery of the Al-Kibar reactor, Syria's refusal to cooperate with IAEA's investigations, and the widening set of questions about undeclared activities involving the MNSR and fuel production-related activities means that ① Syria is under the microscope with little room for maneuver and ② potential international partners may be deterred from collaboration. Absent outside support, it is difficult to imagine how Syria could make progress with its nuclear program.

Future Prospects

The future prospects for Syria's nuclear program are not promising. It has limited resources and little indigenous potential. Damascus will likely continue to stonewall the IAEA, and its continuing status as violator and suspect will all but cripple the program, as potential partners shun it. Of course, there are other scenarios. It could admit its transgressions and settle up with the IAEA, just as Libya and others have done. This might happen within the narrow context of resolving outstanding nuclear issues or within some broader framework of changing relations with Israel and the U.S. following a diplomatic resolution of regional issues. Still, the most likely outcome for the near and intermediate term is more of the same: intense scrutiny and suspicion about Syria's past activities, denials, and a program that goes nowhere and atrophies over time.

Unanswered Questions

Not surprisingly, there are many unanswered questions about the program and Syria's intentions. Was there a reprocessing facility? Did the North Koreans promise to build one? Was the phosphate purification facility to be used as a source of nuclear material that might be used to fuel a clandestine reactor or to be enriched in its own right for military purposes? Does Damascus have a reserve of undeclared nuclear material and undeclared sources that are producing that material? Do the growing number of discovered undeclared activities associated with the MNSR suggest laxity or a broader, deliberate program of concealment? Given Syria's substantial cooperation with IAEA on the issues involving the MNSR, it seems more likely that issues with the MNSR reflect more error than intention. This would, in turn, imply that Syria had set up separate tracks, one that was secret and one that was clean. That is how it appears now, but firm conclusions would be premature at this point.

Challenge to NPT

At one level, of course, the Syrian story is a challenge to the NPT. The country appears to have violated its safeguards agreements, and its continuing refusal to cooperate in the investigation of those violations is an affront to the agency and the Nuclear Non-Proliferation Treaty(NPT). The fact that a third party, Israel, intervened militarily to stop a program about which the agency was not aware or could not

muster the political support to investigate would appear to be a direct challenge to the non-proliferation regime. On the other hand, these events and IAEA's active investigation appear to have essentially ended any chance that Syria will have a substantial nuclear program - which is actually a victory for Vienna and the regime. The lesson: you cheat, you get caught, and you deny? Well, your program is dead. If governments take that conclusion to heart, it is not at all clear that the Syrian file has weakened the regime.

Moreover, the episode puts the agency and nonproliferation advocates in an even stronger position to argue that the Additional Protocol and related instrumentalities for strengthening safeguards are necessary, and that those that fail to adopt them warrant additional concern. Syria's refusal to cooperate might also finally push the IAEA to revisit the notion of special inspections. The agency has always had the power to demand access under the special inspections concept but has been reluctant to use this power. It might be argued that, like muscles, safeguards are only strong when exercised. If that is the case and the Syrian controversy leads to greater use of the special inspections authority, then Syria's actions will have had the paradoxical effect of strengthening the regime.

Finally, as a matter of outcomes, there is no evidence that Syria's behavior has triggered a broader abandonment of the regime. For potential proliferators, it would appear to be more of a cautionary tale that an encouragement. In any case, there has been no break for the bomb, no "let's follow Syria's example," at least so far. If these early results hold, they would be consistent with the historical record,

which strongly suggests that problem countries more often spur a strengthening of the regime, rather than its degradation.

4. Iran's Nuclear Program

Origins

Iran's interest in things nuclear began under the reign of Shah Mohammad Reza Pahlavi. The Shah ascended to the thrown in 1941 but did not fully take command of the state apparatus until after the 1953 British and American led coup. The mid-1950s was a period that coincidentally marked the dawn of Atoms for Peace. Iran signed a civil nuclear cooperation agreement with the U.S. in 1957 and became host to the regional Institute for Nuclear Science in 1959. That same year, the Shah established a nuclear research center at Tehran University and told the visiting President Eisenhower that he wanted a "crash program" to obtain highly mobile forces with atomic weapons, long-range missiles, effective anti-aircraft missiles, additional air bases, and improved aircraft."[13]

Iran's actual progress in the nuclear field was modest, however. It was not until 1967 that Tehran's first reactor went critical, a modest

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13– On the Shah's declaration to the Eisenhower administration that it was interested in nuclear weapons, see U.S. Department of State, "Memo of Conversation, President's Goodwill Trip to Tehran, December 14, 1959," in *Foreign Relations of the United States, 1958–1960. Near East Region; Iraq; Iran; Arabian Peninsula,* Vol. 12 (Washington D.C.: U.S. Government Printing Office, 1993), p. 659, Footnote. 2.

5MW research reactor supplied by the United States – along with 5.58kg of 93% enriched uranium. Nuclear technology remained a secondary priority for the king until the 1970s, when flush with oil revenues and at the urging of the U.S., he embarked on a plan to rapidly expand Iran's nuclear civilian program.

A key year was 1974, when the Shah created the Atomic Energy Organization of Iran(AEOI) and bought a 10% stake in Eurodiff, the European enrichment consortium. By 1975, AEOI was reported to have 150 personnel "trained in physics." In the two years from 1974 to 1976, AEOI's budget increased from roughly $39 million a year to more than a billion dollars a year. Iran also received help from other countries. Argentina, South Africa, West Germany, France, India, and the United States all contributed to the Iran's nuclear program, though India's 1974 'Peaceful Nuclear Explosion' or PNE complicated international nuclear commerce.

On at least two occasions in the 1970s, the Shah publicly raised the possibility that Iran would one day possess nuclear weapons – statements that were quickly retracted. Despite the denials, Iran's membership in the NPT, and Iran's support for a regional nuclear weapons free zone, those around the Shah believed that his aspirations went beyond power plants and included nuclear weapons as well.

By 1978, however, visions of nuclear grandeur were put aside, a victim to financial difficulties, domestic political instability, and scandal. When the Shah left Iran in search of medical treatment, the dream of a nuclear Iran went with him – at least for a time. Iran's

nuclear effort had been slow off the mark and ended before it had completed any of its major projects.

The 1979 revolution brought a halt to the Shah's nuclear project, as both the demand for and supply of nuclear technology ended. Western countries abruptly canceled their nuclear transfers even as the Islamic Republic moved to withdraw from Eurodiff and other joint projects. Khomeini's government had multiple reasons for freezing the nuclear program. To begin with, it was the Shah's program, and thus tainted by association. Add to that a scarcity of funds, the emigration of nuclear and other scientists fleeing the revolution, a distrust of foreigners (who had a visible role in the program), and the more immediate challenges of domestic political consolidation and governance, and it is little wonder the program was suspended.

By the mid-1980s, however, the government's attitude changed. Despite the war with Iraq or perhaps because of it, Iran's leadership decided to reconstitute the nuclear program. In 1984, it opened a research center at Isfahan and began encouraging Iranian nuclear experts to return home. Despite the renewed interest, however, the program suffered a number of problems. In 1984 and again in 1985, Iraq bombed Iran's reactor site at Bushehr. Most foreign suppliers were skittish about working with Iran, especially at a time when it was at war with Iraq. Last but certainly not least, the nuclear program appeared to suffer from poor internal management. Despite help from A. Q. Khan, which began in 1989, Iran's nuclear program drifted without significant accomplishment.

Finally in 1997, the head of nuclear program was replaced. Gholam

Reza Aghazadeh, a well-regarded program manager, took the reins and progress followed soon after. By 2003, it became apparent that size and scope of Iran's nuclear program was far greater than outside analysts had believed.

Level of Development

Iran's has announced plans for a very ambitious civilian nuclear program, and its efforts span a broad spectrum of activities across the fuel cycle, though some aspects are more advanced than others. On the front end, it has mined, milled, and processed indigenous deposits of uranium. It has a small, aging research reactor that is used to produce medical isotopes and that is fueled by uranium enriched to a little under 20%. Its first power reactor, the long delayed Bushehr plant, began initial start up activities in August of 2010.

The Bushehr plant, a project that date's back to the end of the Shah's reign, was built by Russia. Russia has also provided the LEU fuel for the plant, and by agreement, will take back the spent fuel at the end of the process. Russian technicians will stay on the ground working with their Iranian colleagues to operate the reactor for at least three years. Iran's atomic energy agency has announced intentions to build 20 additional power plants in the coming years, but these projects have not progressed beyond the planning stage. Much will likely turn on how well the Bushehr plant performs. It was originally of German design, then reconfigured by Russia, and built over a 15-year period characterized by multiple work stoppages. Given the

unique history of the project, it would not be surprising if there are technical problems going forward, which in turn could affect plans for additional plants.

Iran has put most of its indigenous effort into a centrifuge program. AEOI has built roughly 9,000 centrifuges and prototyped a series on upgraded centrifuge designs. The Iranian technical record here is mixed. On the one had, Iran has made real, substantial progress over time and has produced more than 3,000 kilograms of LEU. Moreover, one should expect that Tehran will continue to progress and become more proficient over time. That said, there are continuing reports that the program has experienced technical setbacks and that its rate of progress is slower than might have been expected. Despite having prototype advanced centrifuge models, it has yet to build any of them in significant numbers. Much remains unknown about the program, so precise estimates of its true status are difficult.

More recently, Iran has moved to go beyond producing LEU with the standard enrichment rate of less than 5% and embarked on producing uranium to a level of just under 20%. Iran claims that it needs to do so because it is having trouble finding a country to re-supply the fuel rods for its medical reactor, and so it must do so on its own. There is a real question whether Iran ① has the technical capability to take that enriched fuel and fashion it into fuel rods, ② could do so within a relevant time frame, and ③ then operate the reactor without problems. Those issues lead some to suspect that the real motivation for going to 20% is that it would substantially enhance Iran's ability to produce bomb grade uranium at a later point if it

chose to do so. It also has to be said, however, that of all the issues in play concerning Iran's nuclear efforts, Tehran has shown the most flexibility on a negotiated solution to the TRR issue under which they would not produce the fuel for the reactor.

Role of North Korea and Other Countries

While rumors persist about North Korean involvement in Iran's nuclear program, to date there has been no evidence of collaboration.[14] Indeed, the Islamic Republic has gone out of its way to distinguish itself from North Korea and insists that it is not seeking nuclear weapons. More telling is that the Iranian focus has been on enrichment and not reprocessing, while the DPRK program is based on reprocessing. The North Koreans are suspected of having an interest in enrichment but if anything, the Iran is ahead of them in that area. There is reason to suspect that the Pyongyang has assisted Tehran with its missile program or other non-nuclear military projects, but unlike the Syrian case, it does not appear that cooperation in one area created the grounds for nuclear cooperation. It has to be said, however, that this conclusion would be substantially stronger if the IAEA had full access

14– On possible missile and trade business between North Korea and Iran, see, United Nations, *Report to the Security Council from the Panel of Experts established Pursuant to Resolution 1874(2009)* (New York: United Nations, 2010), pp. 17－19. The study authors refer to possible DPRK-Iran exchanges regarding missile technology but not with respect to nuclear technology. The North's November, 2010 announcement that it has a functioning enrichment facility with 2,000 centrifuges has nevertheless invited speculation regarding an Iran-DPRK nuclear relationship, but so far, there are no facts to support the suspicions.

to Iran's heavy water plant and other facilities and personnel related to reprocessing.

The country that seems to have made the greatest contribution to Iran's nuclear program is not North Korea but Pakistan. A. Q. Khan provided assistance beginning in the 1990s, and Iran's centrifuge enrichment program is based on the Pakistani P-1 centrifuge. Iran has doubtless relied on other networks and countries for parts and materials, but Pakistan appears to have played a critical role in its nuclear development.[15]

Current Status

As of today, Iran's nuclear program continues to grow in size and to advance technically. It has already acquired the knowledge of how to construct and operate centrifuges and produce LEU. That is a significant milestone, and there is no turning that back. Military strikes against Iranian facilities, for example, would not alter the fundamental reality that Iranian technicians can build a centrifuge.

At this stage, however, the program does not appear to represent a short-term proliferation threat, even if one assumes that Iran is intent on producing nuclear weapons. It is important to underline that the worst-case assumption - that Iran is racing for a bomb - is viewed with skepticism in much of the analytical community. The predominant view is that Iran seeks a capability but has not taken a command

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15– Sharon Squassoni, "Iran's Nuclear Program: Recent Developments," *CRS Report for Congress* (22 February, 2007).

decision to build nuclear weapons, a distinction that has proven important in the history of nuclear proliferation.[16]

Future Prospects

Over time and absent other changes, Iran will have sufficient technology and material that it could initiate a weapons program if it decided to do so. There are number of events that could alter that trajectory, including leadership changes, changes within the AEOI, natural disasters (such as earthquakes), or a Chernobyl-scale nuclear disaster at Bushehr that would de-legitimize the program. These are all low probability events.

Does this mean that it is inevitable that Iran will build the bomb? No. Japan and other countries have enrichment-related capabilities but have not crossed that line. Moreover, there are diplomatic agreements and institutional arrangements (rules for greater transparency, confidence building measures, multi-nationalization of the sensitive parts of the program, etc.) that would reduce the likelihood that any Iranian technical capability would later translate into actual weapons. These mechanisms would not reduce the risk of an Iranian bomb to zero, but they could discourage an Iranian government from going down that path.

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[16]– Dennis C. Blair, "Annual Threat Assessment of the U.S. Intelligence Community for the Senate Select Committee on Intelligence," (Washington D.C.: Director of National Intelligence, 2 February, 2010), p. 14. The agency assesses that Iran is " … keeping open the option to develop nuclear weapons."

Unanswered Questions

Iran has been subject to over 40 IAEA inspections since March of 2003. It is also the object of intense interest by various national intelligence agencies. Still, there is much that is not known about the program, in part because of the limitations Iran has imposed on the IAEA and Tehran's refusal to abide by the Additional Protocol.

The real unknowns, however, are political, not technical. What are the intentions of the leadership? Have those intentions changed following the controversial 6·12 presidential election in 2009? In what ways and to what extent have changes in the decision-making group post-6·12 affected nuclear policy? What is the relationship between the nuclear engineer or scientist and his or her employer (the AEOI), and what is the relationship between AEOI and the Supreme Leader? This last question arises because following the 6·12 election, the AEIO's very competent director, Mr. Aghazeda, resigned. All these factors have the potential to influence the pace and direction of the program. Indeed, they are as likely as or more likely than technical factors to determine whether Iran becomes a nuclear weapons state at some point in the future.

Challenge to NPT

Iran is a member of the NPT and is obliged to abide by its safeguards agreements. Discrepancies and unanswered questions relating to its nuclear program have resulted in a series of negative findings by the IAEA and a referral of its case by the IAEA Board of Governors to

the UN Security Council(UNSC). Subsequently, Iran has been the subject of a series of UNSC resolutions, some of which have imposed sanctions. Tehran has often responded to these actions with retaliatory actions that have further diminished its cooperation with the IAEA.

The program has drawn the international scrutiny and suspicion for a variety of reasons. First, enrichment is a sensitive technology that has a direct link to potential weapons acquisition. Second, the program was started in secret and aided by A. Q. Khan's illicit network. Third, it is unusual for countries to build enrichment facilities when they do not have any power reactors. (The one reactor that was due to come on line, Bushehr, would use Russian fuel.) Finally, Iran's refusal to grant the IAEA full access to its facilities, personnel, and records is a cause of ongoing doubt about Iran's intentions. The Agency contends that "Iran remains the only State with significant nuclear activities which has a comprehensive safeguards agreement in force that is not (fully) implementing" it.[17]

One of the facilities in question to which IAEA has requested and been denied access is a heavy water production plant. This raises concern because a reactor using heavy water, like the one being built in Arak, could be used to generate plutonium, which could then be reprocessed and used for weapons. Even building a heavy water reactor, as opposed to the standard light water reactor, raises eyebrows among nonproliferation specialists, and denial of access compounds

[17]– IAEA, "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran," Report by the Director General, GOV/2010/46 (6 September, 2010), p. 8.

those suspicions. It is also important to note, however, that IAEA has not observed any significant work at Iran's reprocessing-related laboratories.

Iranian officials have consistently denied that they are interested in nuclear weapons, citing both religious and strategic rationales.[18] They insist that past violations of their safeguards obligations were narrow or technical or have subsequently been addressed. Iran also points out the often forgotten fact that it voluntarily suspended its program for two years as a result of negotiations with the EU3. Iranian officials complain that despite that good faith step, pressure against Iran's nuclear program persisted.

The case of Iran, narrowly drawn, is certainly a challenge to the NPT and its implementing agency, the IAEA. In particular, Iran's backing away from it safeguards commitments and the limitations it

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[18] Iranian officials claim that a fatwa issued by the Supreme Leader forbids that production of nuclear weapons. *CNN,* "Iran Warns Over Nuclear Impasse," (11 August, 2005), accessed on the website of CNN.com at <www.cnn.com/2005/WORLD/europe/08/10/iran.iaea/index.html>. See also Karl Vick, "In Iran, Gray Area on Nuclear Weapons: Religious View Is Not Absolute," *The Washington Post* (21 June 2006), A15. During the Iran-Iraq War, Iranian religious officials were reported to have resisted the development of chemical weapons on religious grounds, despite their use by Iraq. See, for example, Javed Ali, "Chemical Weapons and the Iran-Iraq War: A Case Study in Noncompliance," *The Nonproliferation Review*, Vol. 8, No. 1 (Spring 2001), pp. 43－58; Gregory F. Giles, "Iranian Approaches to Chemical Warfare," Paper prepared for the U.S. Naval Postgraduate School Conference, *WMD Employment Concepts and Command and Control* (6－8 August, 1997); Joost R. Hiltermann, "Outsiders as Enablers: Consequences and Lessons from International Silence on Iraq's Use of Chemical Weapons during the Iran-Iraq War," Lawrence G. Potter and Gary Sick (eds.), *Iran, Iraq and the Legacies of War* (New York: Palgrave Macmillan, 2004), pp. 151－166. A scholarly treatment of these ideas can be found in Sohail H. Hashimi and Steven P. Lee (eds.), *Ethics and Weapons of Mass Destruction: Religious and Secular Perspectives* (Cambridge, U.K.: Cambridge University Press, 2006).

has imposed on the agency – even while being fully cooperative in other areas – is troubling. From a broader perspective, however, it is not clear that these problems with Iran have damaged the NPT or threaten the future of nonproliferation. The Iranian nuclear dispute is now entering its 9th year. Despite dire prognostications about the collapse of the nonproliferation regime and a new wave of proliferation in the Middle East, the situation has remained more or less the same, with the primary near-term concern being an Israeli attack on Iranian facilities. Other countries have expressed interest in restarting nuclear power programs and some have taken steps in that direction, but there has been no regional rush to the bomb, and the Treaty arguably had a more productive conference in 2010 than it had in a number of years.

None of this should be taken as reason to relax. The Iranian nuclear dispute has the potential to negatively effect both regional security and the cause of nonproliferation. But it has not done so yet, and there is no reason to think that it will inevitably do so.

5. Syria, Iran, North Korea: Similarities, Differences and Lessons

So far, this analysis has examined the nuclear programs in Syria and Iran, as well as each country's relations with North Korea and other nuclear suppliers. Having described each, it is now possible to compare them. Not surprisingly, there are important similarities and important differences. We begin with the similarities.

Similarities

One could compare Syria, Iran, and North Korea across a variety of dimensions, but two areas of similarity seem especially relevant: ① their domestic politics and ② their relations with the IAEA.

Governance in all three countries runs from authoritarian to totalitarian, this despite the fact that each country offers a different ideology: theocratic, Baathist, and Communist. One could have argued that prior to the 2009 6·12 disputed election in Iran, that the Islamic Republic was the most democratic of the three. At least it had contested elections that could produce surprise winners, e.g., Mohammad Khatami in 1997. In Syria, Bashar al-Assad's succession was marked by a brief opening in Syrian politics ("The Damascus Spring"). Today, however, both Iran and Syria have moved in a more authoritarian direction. Syria, like North Korea, has had hereditary succession. North Korea has a communist system mixed with inherited familial rule and decidedly non-communist deistic elements, i.e., the rulers are said to have supernatural, even godly powers.

Perhaps the most important domestic political similarity worth highlighting is that two of the three are undergoing a major political transition. Kim Jong Il has selected his youngest son as a successor and named his brother-in-law as regent until the young Kim can assume his duties. Iran is in a post-6·12 election phase and confronts ① a sizeable fraction of the public that opposes the government, ② deep infighting between pro-Ahamdinejad and anti-Ahamdinejad hardliners, ③ an aging Supreme Leader, ④ a president who wants

to reshape the structure of governance towards a presidential system, and ⑤ an increasingly powerful and vocal Iranian Revolutionary Guard. With both Iran and North Korea, it is virtually possible to predict how the transition and competition for power will play out. Syria is arguably the most stable of the three, since it has already gone through its transition. Still, it is not obvious that the son has accumulated the power of the father or that the future will be uneventful.

The domestic political situation is of central importance to the future of the nuclear efforts in each country. Changes in leadership can lead to changes in policy, for good or for ill. Contested transitions and internally divided governments also make negotiations, for example negotiations on a country's nuclear program, very difficult. The expanding role of the military in each society may also have implications for the nuclear programs, if those militaries develop a taste for nuclear weapons, even if their leadership is willing to bargain them away.

Another similarity these three nations share is a poor relationship with the IAEA. Technically, the DPRK has almost no relationship with the agency after having pulled out of the NPT. IAEA relations with Syria are modest, as Damascus continues to stonewall Vienna about the surreptitious reactor that was bombed by Israel. Of the three, IAEA has the most interaction with Iran, but despite or more precisely because of their frequent interactions, relations between the two appear to be the worst of the group. Ironically, despite the bitterness of the IAEA-DPRK disputes in the early 1990s, North Korea may have had the best relationship with the agency. Once it

decided to open up, first with the Agreed Framework and then with the 2·13 Agreement, the North appeared to be more forthcoming in its cooperation than Iran or Syria have ever demonstrated.

Differences

Public commentators focus on the perceived similarities between Syria, Iran, and North Korea - that they are proliferators or nuclear threats, that they are dictatorships and rules violators, that they may have worked together, and that their leaders seem erratic. Still, a careful comparison would suggest that despite the veracity of some of these claims, their differences are at least as prominent, if not more prominent, than their similarities.

The chief and most important difference is that they are each at a very different stage of nuclear development. North Korea has built and tested a nuclear device. And while the North may not yet have traversed the technical distance between nuclear device and useable nuclear weapon, it has clearly crossed a threshold. Moreover, the DPRK openly acknowledges that they have done so and now seek either a buyout or "arms control."

If North Korea is at one end of the continuum, then Syria is at the other. It barely has a nuclear program, and its prospects for future progress in the field are anything but promising.

Iran, unlike North Korea, vigorously denies that it is seeking nuclear weapons. More importantly, most serious analysts have concluded that Iran has made a "capability decision," not a "bomb

decision." In other words, Iran seeks to have a capability to build a nuclear weapons should it decide to do so but has not, in fact, made the decision to build a bomb. In the popular imagination, this probably sounds like a distinction without a difference, but students of nonproliferation recognize that this is fundamental. The likelihood of becoming a nuclear weapons state is far greater when a country has made a bomb decision as compared to a capability decision. It must be said, however, that changes in Iran after the 6·12 election do not permit high confidence assessments about where Iran is headed.

These programs also differ in terms of the kinds of threats they might pose. Syria poses no nuclear threat. North Korea, the only one with nuclear weapons, has no intention of using them, and their possession of these weapons has not set off a wave of proliferation in East Asia. The real dangers with North Korea are collapse of the regime and the possibility of misperception, miscalculation, and crisis escalation as a desperate, secretive regime undergoes a difficult political transition.

Like Syria, Iran has no bomb, but some analysts fear an Iranian capability will set off a proliferation chain in the Middle East. Past predictions of this kind have fared poorly, but it is not impossible that Iran could have some effect on others in the region. More likely is scenario that Israel or the U.S. use military force against Iran's program. Here the dangers are the political and security con- sequences of such an action rather that the nuclear capability itself. This is not to suggest that a nuclear weapons capability in Iran should be welcomed. It is simply to point out that the most serious near-term consequences are

likely to come from efforts to forcibly attrit Iran's capability.

In sum, these programs are at wildly varying points of development, are located in fundamentally different regional contexts, and pose very, very different kinds of dangers. These differences would suggest that analysts should be especially careful about distinguishing these cases when considering how to respond to them.

Lessons

Despite their differences, it is possible to look at the three as a set and draw some preliminary conclusions or lessons. First, a policy of isolating countries will have the effect of increasing the incentives for them to cooperate with each other. North Korea's alleged cooperation with Burma and its documented cooperation with Syria may have taken place because ① sanctions had the effect of reducing alternative sources of income, thus giving greater importance to illicit or illegal activities, and ② isolation reduced the possibilities for transactions to those countries that also suffer international opprobrium. It short, the effect may have been to push international violators into each other's arms and to encourage them to engage in the worst forms of trade.

Second, military-to-military ties between countries in one area (missiles) may provide opportunities for cooperation in other areas (nuclear). This will be even more likely in cases where countries have a strong or politically autonomous military. Finally, there is little automaticity to be found in any of this. It was not inevitable that the North tested a nuclear device, thought they eventually did so.

It was not inevitable that Japan or other countries in East Asia would rush to the bomb because of the DPRK. (They did not.) It is not inevitable that Iran will get the bomb, that others will follow suit, or that the death of the nonproliferation regime is upon us. Of course, all these continue to be possibilities, but the record to date does not suggest that they are fixed futures, despite the widespread belief to the contrary.

6. Going Forward

The purpose of this chapter has been to examine more rigorously the nuclear programs and challenges posed by three countries that are typically thought to be members of the same class. In the course of the analysis, both similarities and differences have been uncovered. The similarities, for example that two of the three are undergoing political transition, suggest that there may be areas where non-proliferation policies aimed at each country should also be similar. The similarities also suggest possible lessons that might be applied to future cases, e.g., that military-to-military ties in one area may provide the basis for cooperation on nuclear or other areas.

Still, while the similarities are worth noting, it is the differences that are most striking. There differing levels of nuclear development, their regional contexts, and the different threats their nuclear ambitions pose suggest that scholars and policymakers should be cautious about using policy tools that may be appropriate for one

country and applying them willy nilly to another country, even if it is politically inviting to do so.

The record of these three cases also suggests that an unflinching pessimism about proliferation is unwarranted. Syria's program is going nowhere. North Korea still talks about giving up its program for the right price – something that is never heard from the other nuclear weapons states. And Iran, it appears, has yet to make the most consequential of all nuclear decisions – the bomb decision. Yes, there is much cause for concern, but the record suggests are good reasons to believe that these problems can be managed and that the nonproliferation regime will continue to grow stronger over time.

References

1. Books

Campbell, Kurt M., Robert J. Einhorn and Mitchell B. Reiss (eds.). *The Nuclear Tipping Point.* Washington D.C.: Brookings Institution Press, 2004.

Cohen, Avner. *Israel and the Bomb*. New York: Columbia University Press, 1998.

_____. *The Worst Kept Secret: Israel's Bargain with the Bomb*. New York: Columbia University Press, 2010.

Fitzpatrick, Mark (ed.). *Nuclear Programmes in the Middle East: in the Shadow of Iran*. London: International Institute for Strategic Studies(IISS), 2008.

Hashimi, Sohail H. and Steven P. Lee (eds.). *Ethics and Weapons of Mass Destruction: Religious and Secular Perspectives*. Cambridge, U.K.: Cambridge University Press, 2006.

Reiss, Mitchell. *Bridled Ambition*. Washington D.C.: Woodrow Wilson Center Press, 1995.

Solingen, Etel. *Nuclear Logics*: Contrasting Paths in East As*ia & the Middle East.* Princeton, N. J.: Princeton University Press, 2007.

United Nations. *Report to the Security Council from the Panel of Experts established Pursuant to Resolution 1874(2009)*. New York: United Nations, 2010.

U.S. Department of State. *Foreign Relations of the United States, 1958*

—*1960. Near East Region; Iraq; Iran; Arabian Peninsula.* Vol. 12. Washington D.C.: U.S. Government Printing Office, 1993.

Wilson, P. D. (ed.). *The Nuclear Fuel Cycle: from Ore to Wastes*. Oxford: Oxford University Press, 1996.

2. Articles

Ali, Javed. "Chemical Weapons and the Iran-Iraq War: A Case Study in Noncompliance." *The Nonproliferation Review*. Vol. 8, No. 1, Spring 2001.

Giles, Gregory F. "Iranian Approaches to Chemical Warfare." Paper prepared for the U.S. Naval Postgraduate School Conference "WMD Employment Concepts and Command and Control." 6—8 August, 1997.

Hiltermann, Joost R. "Outsiders as Enablers: Consequences and Lessons from International Silence on Iraq's Use of Chemical Weapons during the Iran-Iraq War." Lawrence G. Potter and Gary Sick (eds.). *Iran, Iraq and the Legacies of War*. New York: Palgrave Macmillan, 2004.

Park, John. "An Examination of the IAEA's Special Inspections in North Korea, 1992—1994." Ph. D. dissertation, Cambridge University 2001.

Spector, Leonard and Deborah Berman. "The Syrian Nuclear Puzzle." William Potter and Gaukhar Mukhatzhanova (eds.). *Forecasting Nuclear Proliferation in the 21st Century: A Comparative Perspective*. Palo Alto, CA: Stanford University Press, 2010.

Squassoni, Sharon. "Iran's Nuclear Program: Recent Developments." *CRS Report for Congress*. 22 February, 2007.

Tertrais, Bruno. "Kahn's Nuclear Exports: Was There a State Strategy?" Henry D. Sokolski (ed.). Pakistan's Nuclear Future: *Worries Beyond War*. Carlisle, PA: Strategic Studies Institute, United States Army War College, 2008.

Walsh, Jim. "Bombs Unbuilt: Power, Ideas and Institutions in International Politics." Ph. D. dissertation, Massachusetts Institute of Technology, 2000.

_____. "Learning from Past Success: The NPT and the Future of Nonproliferation." *WMDC Paper* No. 41, Oslo: Weapons of Mass Destruction Commission, 2006.

3. News Articles, Electronic Materials, etc.

Blair, Dennis C. "Annual Threat Assessment of the U.S. Intelli- gence Community for the Senate Select Committee on Intelligence." Washington D.C.: Director of National Intelli- gence, 2 February, 2010.

CNN. "Iran Warns Over Nuclear Impasse." 11 August, 2005. <www.cnn.com/2005/WORLD/europe/08/10/iran.iaea/index.html>.

IAEA. "Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran." Report by the Director General. GOV/2010/46, 6 September, 2010.

_____. "Implementation of the NPT Safeguards Agreement in the Syrian Arab Republic." Report by the Director General. 6 September, 2010.

Nuclear Threat Initiative (NTI). <www.nti.org/e_research/profiles/Syria/Nuclear/index.html>.

Pinkston, Daniel A. *The North Korea Ballistic Missile Program.* Carlisle, PA: Strategic Studies Institute, United States Army War College, February 2008. <www.dtic.mil/cgi-bin/GetTRDoc?Location =U2&doc=GetTRDoc.pdf&AD=ADA477526>.

Vick, Karl. "In Iran, Gray Area on Nuclear Weapons: Religious View Is Not Absolute." *The Washington Post.* 21 June 2006.

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