

The Verification of the Peaceful Nature of Iran's Nuclear Program

Olli Heinonen

Belfer Center for Science and International Affairs

J.F. Kennedy School of Government

Harvard University

Chapter for the forthcoming book

Nuclear Issues of North Korea and Iran: Technical Aspects

edited by Prof. S.H. Chang and Dr. Jungmin Kang,
Korea Advanced Institute of Science and Technology,

Background

It would soon be a decade since the international community has been faced with Iran's nuclear program. Since it became public in 2002-3 that Iran had violated its safeguards obligations and was building an enrichment plant in Natanz and a 40 MWt heavy-water reactor at Arak¹, the EU3² embarked on a diplomatic process to stop Iran from moving closer to a nuclear weapons capability. In November 2003, the EU3 and Iran agreed³ that the latter suspends its uranium enrichment and reprocessing programs, signs and implements provisionally the Additional Protocol, and provides the IAEA with a complete picture on its past nuclear program. In return for Iran's disclosures, transparency and co-operation with the IAEA, the EU3 agreed that Iran's case will not be reported to the UN Security Council.

In 2005, however, Iran declared the EU3 diplomatic efforts a failure and restarted its uranium enrichment activities. In early 2006, the IAEA's Board of Governors adopted a resolution and referred the matter to the UN Security Council⁴.

Since then the UN Security Council has adopted several resolutions asking Iran to suspend its enrichment and heavy water reactor programs and clarify issues related to the military dimension of its nuclear program⁵. Iran has, however, continued to a slow but

¹ Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran, 26 August 2003, IAEA, GOV/2003/63.

² France, Germany, and the United Kingdom

³ Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran, 10 November 2003, IAEA, GOV/2003/73.

⁴ Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran, IAEA Board of Governors, Resolution adopted on 4 February 2006, GOV/2006/14.

⁵The United Nations Security Council has adopted the following resolutions on Iran: 1696 (2006); 1737 (2006); 1747 (2007); 1803 (2008); 1835 (2008); and 1929 (2010).

steady process of furthering its enrichment program and working on other related nuclear sectors, including military aspects of the program. Simultaneously, Iran reduced its cooperation with the IAEA by suspending the provisional implementation of the Additional Protocol, and reverted back to the old Code 3.1. of the subsidiary arrangements without negotiating the provision with the IAEA⁶.

Since 2008, the IAEA has practically made no progress in clarifying issues related to the military dimension of Iran's nuclear program. Neither has the Agency been able to verify the correctness and completeness of Iran's declarations under its comprehensive safeguards agreement⁷.

As a result, the international community has come to know less about scope and actual content of Iran's nuclear program when Iran is, at the same time, building further its uranium enrichment capabilities.

The P5+1⁸ process to find a negotiated solution to prevent a nuclear Iran continues. Some see this process as more pertinent than ever in the face of Iran's continued enrichment to higher levels, growing stockpile of fissile material and continued unresolved military-related aspects of its nuclear program. Notwithstanding the search for a diplomatic path forward, a fundamental part of restoring international confidence on the peaceful scope and future of Iran's nuclear program – both in the immediate as well as long term - will be the verification of the completeness and correctness as well as removing the ambiguities of Iran's declarations that ensures that its nuclear program is and remains only peaceful. The following sections provide some ideas that the IAEA could explore in mapping out what sort of verification needs to be undertaken in Iran to that end.

Diversion of nuclear material

After ten years of efforts, the IAEA has not been able to verify that all nuclear materials and activities in Iran are subject to IAEA safeguards. While the IAEA has not observed any diversion of currently declared nuclear material, Iran had diverted in the 1990's substantial amounts of imported nuclear material and processed uranium ore without introducing them to safeguards. In addition, Iran used some of its declared nuclear

⁶ Code 3.1. refers to the provision of design information for the facilities. In 1992 the IAEA Board of Governors decided on safeguards strengthening measures. The new Code 3.1. , adopted in 1992, stipulates that first design information is to be provided as soon as a decision on the construction of a facility is made. Iran is the only country with a substantial nuclear program, which does not apply the new code.

⁷ Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran, 24 February 2012, IAEA, GOV/2012/9.

⁸ In 2005, United States, Russia, and China joined the EU3 efforts.

material through exemptions⁹ for clandestine purposes and processed them at facilities not declared to the IAEA¹⁰.

Limitations of transparency visits

In early 1990's, allegations on clandestine nuclear activities in Iran started to emerge^{11 12 13 14}. The IAEA tried to clarify claims by conducting "transparency visits"¹⁵. However, the transparency visits to Iran in the 1990s provided a false sense of security, both internally within the IAEA as well as externally to the larger international community. The IAEA provided assurances through press statements following the visits made to Iran without inspectors taking samples or more technical details. For instance the statements issued stated that "... activities ... at ... facilities and sites were found to be consistent with the peaceful application of nuclear energy and ionizing radiation."¹⁶

The limitations of transparency visits were moreover not well understood by the Board and the general public. As such, it was not obvious that assurances made by the IAEA through press statements etc. that no evidence were found on undeclared nuclear activities in Iran were not derived as a result of rigorous safeguards verification carried out.

Current status of enrichment

Iran continues to defy the UN Security Council and the IAEA Board of Governors resolutions, which have, inter alia, requested Iran to suspend uranium enrichment activities.

⁹ Under the provisions of a safeguards agreement, a State can request exemption of nuclear material up to certain limits. However, if the material is stored or mixed with safeguarded material, or processed further, safeguards needs to be re-applied to the material.

¹⁰ Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran, 26 August 2003, IAEA, GOV/2003/63.

¹¹ H. Sokolski, Middle Eastern Quarterly June 1994.

¹² A. H. Cordesman, "Iran and Nuclear Weapons: A Working Draft," Center for Strategic and International Studies, 7 February 2000.

¹³ K. R. Timmerman, "Tehran's A-bomb programme shows startling progress", *The Washington Times*, 8 May 1995.

¹⁴ Iran's Nuclear Ambitions, *Jane's Intelligence Review*, Special Report, No.6, 1 June 1995.

¹⁵ In early 1990's, during the IAEA Board discussions on strengthening of the IAEA safeguards, then Director General Hans Blix advocated voluntary 'transparency visits' to clarify questions and ambiguities that were raised by the international community.

¹⁶ Press Release 92/11, 14 February 1992, IAEA.

According to the latest IAEA report¹⁷, Iran has installed over 9000 IR-1 centrifuges in Natanz. Since February 2010, Iran has been producing 20 % enriched uranium, which it justifies with the needs of its Tehran Research Reactor (TRR) to produce medical isotopes for civilian purposes. Iran has incidentally a stockpile of uranium that far exceeds the needs of its TRR for next 5-10 years.

Iran has also tripled the production of 20 % enriched uranium, and commissioned additional cascades at Fordow. The result would be a stock of enriched uranium of likely more than 250 kg 20 % enriched UF₆ by end-2012¹⁸. By re-feeding such amount to current centrifuges at Fordow, Iran would be able to turn the stock to highly enriched uranium components of a nuclear weapon in a couple of months time.

The role of Fordow in Iran's enrichment program has also raised concerns about the completeness and correctness of Iran's statements. Iran constructed the installation in secrecy until September 2009, when it was revealed. Iran has since then repeatedly changed the purpose of the said facility. It was originally stated to be a facility for LEU production, then it became a facility for the R&D, and more recently also for the production of 20 % enriched uranium. The latest statements of Mr. F. Abbasi Davani, President, Atomic Energy Organization of Iran (AEOI), say that Iran will continue to produce 20 % enriched uranium for exports when the requirements of TRR have been met¹⁹. His statement is in odds with those of President Ahmadinejad from September 2011 when he said that the production of 20 % enriched uranium in Iran is not economically attractive.

Military dimension

The Annex of the IAEA report issued in November 2011 laid out the evidence that, despite denials, Iran has carried out a structured program relevant to the development of a nuclear explosive device until the end of 2003. It appears from the report that at least

¹⁷ Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions in the Islamic Republic of Iran, 24 February 2012, IAEA, GOV/2012/9.

¹⁸ In 2009 Iran requested the IAEA assistance to have 20 % enriched fuel for the TRR. Russia, US, and France negotiated an agreement in Iran would have exported most of its stockpile of 3.5% LEU (800 kg) as feed to produce 120 kg of 20-percent enriched uranium for TRR fuel. This would have been sufficient to run the TRR for more than a decade. However, Iran did not signal its final agreement to the deal. Finally, in May 2010, Turkey and Brazil persuaded Iran to agree to a new version of the deal under which Iran's LEU would be held in Turkey until the TRR fuel was delivered. This deal was, however, too little and too late. Meanwhile, the stocks of 3.5 % enriched uranium had substantially increased. Additionally, as the deal was agreed to on the eve of a new sanctions vote by the UN Security Council, the US rejected the agreement as a tactical move by Iran to derail the sanctions vote.

¹⁹ Interview of Mr. Abbasi Davani, AL-Alam News Network, 19 February 2012.

some of that work likely persisted into the present. For the first time, the IAEA has published organizational details of the program. The organization of the program is complex: some activities were confined to the original program, while others shifted to different bodies. The report concludes that some of the Iran's military-related nuclear activities probably continue today.

The report describes Iran's activities in three technical areas -- the "green salt" project (an intermediate step in producing feed material for uranium enrichment), high explosives development, and re-engineering the Shahab-3 missile's reentry vehicle -- were consolidated under the so-called AMAD Plan from the late 1990s to early 2000s. Although the IAEA reported a halt in these activities in late 2003 and early 2004, it also noted that personnel involved in these efforts were deployed to other military-related entities, where some activities were subsequently resumed. For instance, work involving neutron initiators, triggering systems, mathematical modeling, and implosion experiments continued. The report further implies that Iran has knowledge of a fairly advanced nuclear weapon design and has tested some of its components, though it has not used actual nuclear material in those experiments.

The IAEA has not seen evidence of Iran using nuclear material in these experiments. But this is a clear case where what Iran is doing goes against the spirit of Article III of the NPT.

Transparency, Openness and Co-operation

Throughout the discussions on the scope and content of its nuclear program, Iran has repeatedly offered 'transparency' to build international confidence on its nuclear program.

Larrimore et al²⁰ have defined the transparency in international safeguards and non-proliferation as: "the condition in which a state's nuclear programs, activities, facilities, capabilities, and intentions are known to other members of the international community, through explicit policies and actions of the state, by reason of its general climate and culture of openness, and by independent information available on the state."

In this context it is important to note that *transparency* and *open* availability of *information* on a state that allows other states to see more clearly what the state's activities and capabilities are. The openness by a state provides the Agency access to information, which in broader terms means access to people, equipment, documents and sites.

²⁰ J. Larrimore, M. Kratzer, J. Carlson, and B. Moran, Transparency and Openness: Roles and Limitations in the Nuclear Nonproliferation Verification System, Journal of Nuclear Materials Management, Fall 2006, Volume XXXV, No. 1, pages 36-51.

Confidence-building measures

Confidence-building measures are of vital importance when the confidence has been shaken. Confidence-building measures are actions by a state that go beyond the obligations of safeguards and nonproliferation agreements, such as capping or refraining from particular sensitive nuclear fuel cycle activities to build confidence on the part of other states in the peaceful nature of a state's nuclear program.

But care must be taken with confidence-building measures, first that calling for them does not lead to confusion between what is obligatory and what is voluntary. Actions that a state is already obligated to take under its safeguards and non-proliferation agreements, such as providing access that has been denied, should not be viewed as confidence-building measures. In addition, while confidence-building measures can contribute to confidence as to the absence of additional, undeclared activities, they cannot provide assurance on their absence.

Looking back to the recent visits and offers made by Iran to the IAEA, would Iran's actions qualify as being transparent? It is questionable whether transparency is the appropriate term to use when the inspectors have the right within their mandate (including from Board and UNSC resolutions) to visit the barred sites. The inspections process is a rigorous and often laborious affair. Even in the name of 'transparency,' where Iran decides to 'show' a place previously off limits (imposed by Iran), such inspection visits can have meaning only if substantially new information and discussions take place, and explanations are provided on the scope and content of the nuclear program.

Verification and Monitoring Measures

In tandem with the continued search for a negotiated political solution between the P5+1 and Iran, the IAEA should continue to press for commitments that would provide the best assurances on that Iran's nuclear program is peaceful. This means that the verification process will have to be comprehensive and expansive. What this also means is that the current stage of unsatisfactory cooperation and approach by Iran to the IAEA needs to change. Given the past experiences, if Iran takes the opportunity of widening those with the following measures, the IAEA will be in a position to provide assurances about the scope of Iran's nuclear program.

The following outlines could be envisaged to start the process:

1. The first step is to have a clear decision and commitment by the competent authorities within Iran to good faith transparency, openness and co-operation with the IAEA²¹.

²¹ Recently Mr. F. Abbasi Davani, the Head of the AEOI offered of 5 years of transparency measures to the IAEA, which included the Additional Protocol, Code 3.1, and other measures in exchange for the UNSC Sanctions being removed.

2. Consistent with the obligations of all members of the NPT, Iran will implement fully its obligations under the IAEA Statutes, Iran's Safeguards Agreement with the IAEA [INFCIRC/214]
 3. Iran returns to the provisional implementation of the Additional Protocol and works for an early ratification of the Protocol.
 4. Iran implements fully the verification and clarification requirements of the resolutions of the IAEA Board of Governors and the UN Security Council.
 5. Iran will provide an expanded declaration on all aspects of its past and current nuclear program.
 6. The IAEA will be permitted to verify the production or import of key centrifuge components and materials in addition to access provisions of the Additional Protocol. During the period of confidence-building until the IAEA has reached the conclusion that all nuclear material in Iran is in peaceful use, Iran will declare at agreed intervals the numbers and locations of centrifuges and key components and materials that it has produced. The IAEA will have the right to short-notice visits to centrifuge component and key material production sites to verify the number of centrifuges and major components and materials produced and that they are being shipped only to declared sites.
 7. Iran will decommission, dismantle or convert to non-nuclear or peaceful use in a verifiable and irreversible manner nuclear related equipment, materials, facilities and sites, which contradict the provisions of the safeguards agreement or the spirit of Article III of the NPT. Such installations will be subject to a long-term monitoring by the IAEA.
 8. Iran will, during a mutually agreed upon interim period, not increase its enrichment capacity and production beyond the requirements of its domestic reactors whose fuel is not contracted to be provided by foreign suppliers and to export any enriched uranium in excess of its immediate domestic requirements in exchange for nuclear fuel.
 9. During this period of confidence-building, if, by mutual agreement, other parties provide the 19.75% enriched uranium fuel that Iran requires to operate its research reactors, Iran will not enrich uranium to greater than 5%.
 10. Consistent with the foregoing, Iran will during the same interim period, limit its enrichment activities to Natanz and its centrifuge-production activities to a declared sites.
-

11. During the period of confidence building, Iran will report to the IAEA its import of uranium ores and R&D related to recovery of uranium from imported and domestic ores. Iran will also provide the IAEA with information about actual production of source materials at R&D, mining and milling facilities. Iran will permit sampling by the IAEA of uranium ores and materials not yet reached the composition and purity suitable for fuel application or being isotopically enriched.
12. Iran will agree not to reprocess the spent fuel from its research or power reactors for a period of confidence-building²². Instead, Iran will place spent fuel from its research and power reactors to storage facilities abroad.
13. The Arak reactor, if fueled by natural uranium, will produce relatively low neutron fluxes for research or isotope production because most of the neutrons it produced would be absorbed in the fuel to make plutonium. Iran will agree to build, with foreign assistance if needed, instead of a heavy-water reactor, a modern light-water research and isotope-production reactor fueled by uranium enriched to 5- 19.75%.
14. Iran will provide the IAEA with unconditional and unrestricted access to any and all areas, facilities, equipment, records, people, which are deemed necessary by the IAEA to fulfill its requirements under the safeguards agreement, and to verify Iran's declarations made under items above.
15. The purpose the measures above would be to re-establish Iran's non-proliferation records, and not to lay the basis for further punitive measures.
16. Iran will adopt legislation strengthening export control mechanisms for nuclear material and technology.
17. As a further confidence-building measure, Iran will place its nuclear fuel-cycle activities under a multinational ownership, control and management and invites other countries to join a consortium.
18. Iran will support proactively the initiative to establish a Middle Eastern Zone that is free of Weapons of Mass Destruction.

²² Reprocessing and plutonium recycle are not currently economic.

Conclusion

Iran can continue to defy the requests of the international community and reap the return of an unnecessary painful high price and deeper isolation. However, there is an alternative path: the policy of openness and cooperation, which will bring about the transparency that is required about the scope and content of Iran's nuclear program. By selecting this path, Iran can demonstrate that it follows the spirit of the NPT, fulfills its legal obligations, and can without ambiguities enjoy its legitimate rights under the Treaty.