

Ensuring the Peaceful Use of Iran's Uranium Enrichment Capability

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Background

Among technical experts it is widely recognized that the international safeguards of the International Atomic Energy Agency (IAEA) do not afford a high probability for timely detection of the diversion or theft of a Significant Quantity (SQ)¹ of nuclear materials from facilities that handle large quantities in bulk form. These are principally uranium enrichment, nuclear fuel reprocessing, and mixed-oxide fuel fabrication plants, and other facilities that store large quantities of such materials. Even small uncertainties in measuring the fissile materials contained in the large annual throughput of a nuclear bulk-handling facility will accumulate to a level at which state-sponsored diversion, or insider theft of an SQ can plausibly be hidden within the periodic inventory differences—“material unaccounted for” or MUF—that are usually attributed to measurement uncertainties. Other things being equal, the larger the plant, and/or the less frequent the inventory, the larger the potential diversion that can be hidden.

The “timely warning” problem arises because the “conversion time”—the time required to convert different types of direct use nuclear material to the metallic components of a nuclear explosive device—ranges from only about one to three weeks, while inventory differences in bulk handling facilities are tabulated and resolved—for example by shutting down and cleaning-out the process equipment—over a much longer time frame, usually measured in years. To provide timely warning, the timely detection goals that the IAEA uses to set inspection frequencies must be shorter than the conversion times. Even assuming the timely-warning requirement can be met, material-to-weapon conversion times in the 1-3 week range are also shorter than the time plausibly needed to bring international pressure to bear on the suspect non-nuclear weapon state, and thereby dissuade or prevent it from acquiring one or more nuclear weapons.

Thus, “timely warning” of an ongoing diversion or imminent conversion of “peaceful” nuclear materials to weapons use is not and cannot be reliably attained for bulk-handling facilities under the current IAEA safeguards system. This problem is compounded by the fact that the IAEA’s values for Significant Quantities of direct-use fissile materials, supposedly pegged to the least skillful proliferant, are technically in error, in some cases being too large by a factor of about eight.²

Containment and surveillance measures, if maintained and operated continuously by an independent international nuclear inspectorate, can significantly complicate the task of clandestine theft and diversion, but they do not entirely eliminate the risk. Moreover, such systems complicate the operation and routine maintenance of the plant, adding to its cost, and obviously must be bypassed during major maintenance and repair operations.

¹ A “Significant Quantity (SQ)” is the approximate amount of nuclear material for which the possibility of manufacturing a nuclear explosive device cannot be excluded. Significant quantities take into account unavoidable losses due to conversion and manufacturing processes and should not be confused with critical masses. IAEA, *IAEA Safeguards Glossary*, 2001 Edition, Paragraph 3.14.

² Thomas B. Cochran and Christopher E. Paine, “The Amount of Plutonium and Highly-Enriched Uranium Needed for Pure Fission Nuclear Weapons,” Natural Resources Defense Council, Revised 13 April 1995.

Hitherto the technical and strategic inadequacies of safeguards have been viewed as a serious problem only in non-weapon states, in line with the supposition that the primary proliferation threat is clandestine state-sponsored diversion of fissile materials within or between countries whose overt status under the Non-Proliferation Treaty (NPT) makes them ineligible to possess or acquire nuclear weapons. The threat of diversion from civil nuclear bulk-handling facilities in weapons states has attracted much less concern, on the supposition that these states already have established, dedicated pathways and/or large existing inventories of nuclear weapons materials. Therefore both their motivation to engage in diversion from the civil sector, and the strategic consequences for the security status quo, is believed to be minimal.

Both of these longstanding suppositions need to be re-examined in light of the historical events of the last decade. In both the political and strategic contexts, an exclusive focus on fuel-cycle facilities in NPT non-weapon states is no longer tenable. Such facilities located in countries outside the treaty, such as Pakistan and India, as well as in declared nuclear weapons states, also pose significant risks to international security in light of today's threats. The risk of insider nuclear theft and collusion with dissident subnational groups or international terrorist organizations is not confined to non-nuclear weapons states, and indeed may be higher in states like Pakistan, India, and Russia, which suffer from active violent insurgencies, than is now the case in Iran.

The same is true of the threat of terrorist attacks designed either to disperse the large inventories of radioactive materials held in such facilities, or to penetrate the facility in the hopes of seizing, or immediately assembling the fissile materials needed for an Improvised Nuclear Explosive Device or "dirty bomb." These threats are obviously not limited to bulk-handling facilities located in non-weapons states.

Finally, any truly credible international safeguard system for such facilities must somehow address two problems—the possible parallel development of clandestine facilities and the inherent threat to "break-out" of the NPT—which may be the most significant components of international concern regarding Iran's emerging national capacity for uranium enrichment. Once this capacity is fully developed, the critics reason, what is to prevent Iran from siphoning off small quantities of low-enriched uranium (LEU) product for further enrichment in a small clandestine parallel facility, or from suddenly leaving the NPT and reconfiguring the plant to produce highly-enriched uranium (HEU) from already enriched LEU feedstock. LEU typically represents 70-90 percent of the total separative work needed to enrich uranium to 80-90 percent U-235, thereby making it quite suitable for use in simple gun-type nuclear weapons.³

³ With an enrichment plant tails assay of 0.2% U-235, one kilogram (kg) of HEU product can be obtained by enriching 175.73 kg of natural uranium (0.711% U-235), with a separative work requirement of 227.34 kg SWU. Assuming the same tails assay, the 175.73 kg of natural uranium can be enriched to LEU, producing, for example, 20.88 kg of 4.5% U-235, and requiring 160.56 kg SWU. An additional 66.73 kg SWU are required to further enrich this 20.88 kg of LEU to obtain 1 kg of 90%-enriched HEU product. In this example, 70% of the separative work is used to produce the LEU and 30% to get from LEU to HEU. (footnote continues on the next page)

A credible nonproliferation regime must be structured in such a way that no nation can count on being able to change the status of a safeguarded peaceful-use nuclear facility without losing its right and ability to operate such a facility. Conceptually at least, this becomes easier to do when there is some degree of multinational ownership and control of the facility, and physical security is entrusted to an independent security force that answers to an international rather than national authority.

No doubt in recognition of all of these concerns, IAEA Director General Dr. Mohamed El Baradei has called for a moratorium on the construction of new enrichment and fuel reprocessing plants. The governments of the United States, France and Germany also recognize the problems, but instead of taking steps to adopt a global solution, they have called upon Iran alone to halt its uranium enrichment activities, while remaining silent regarding the construction of a uranium enrichment plant in Brazil, a commercial reprocessing plant in Japan, a breeder reactor for weapons material production in India, and two new private commercial centrifuge enrichment plants, one plutonium mixed-oxide fuel plant, and one prototype transuranics separation plant in the United States.

A Dangerous Impasse

The U.S. government, and in particular the administration of President George W. Bush, allege, and probably actually believe, that Iran is seeking nuclear weapons. While the Bush Administration prefers a diplomatic solution to the nuclear impasse with Iran, it is seeking international support for the application of economic sanctions against Iran. In addition, independent U.S. media report that the U.S. military and intelligence services have increased clandestine activities inside Iran and moved from developing military contingency plans to the development of operational plans for air strikes to destroy Iran's nuclear facilities.⁴

For its part, the IAEA has concluded that Iran has violated its safeguards agreement with the agency. As a consequence Iran has also violated Article III of the NPT, which stipulates that IAEA safeguards "*shall be followed.*" The IAEA safeguards violations have been interpreted by some, notably Iran, as merely "technical breaches" of its NPT commitment that can be explained by the need to protect Iran's peaceful nuclear program from preemptive destruction by hostile military powers in the region.

While Iran's fear of preemptive attack is no doubt genuine and justified by historical precedent in the region, it does not remove the fact that Iran has committed violations of its safeguards agreement. Nor can it be disputed that the sudden involuntary disclosure of

If 262.66 kg of natural uranium feed is enriched to 31.2 kg of 4.5%-enriched LEU, the separative work requirement is 239.94 kg SWU, assuming a tails assay of 0.2% U-235. If this 31.2 kg of LEU were further enriched to obtain 1 kg of 80% U-235 HEU using a higher tails assay of 2% U-235, then only 26.92 kg SWU is required. In this example, 90% of the SWUs are expended in getting from natural uranium feed to LEU, and only 10 percent in further enriching the LEU to HEU.+

⁴ Seymour M. Hersh, "The Iran Plans," *The New Yorker*, April 17, 2006, pp. 30-37.

a long-standing secret Iranian program for uranium enrichment has led other nations justifiably to perceive an Iranian effort to develop nuclear weapons.

In its latest report the IAEA has “deemed it necessary for Iran to:

- re-establish full and sustained suspension of all enrichment related and reprocessing activities, including research and development, to be verified by the Agency;
- reconsider the construction of a research reactor moderated by heavy water;
- ratify promptly and implement in full the Additional Protocol;
- pending ratification, continue to act in accordance with the provisions of the Additional Protocol which Iran signed on 18 December 2003;
- implement transparency measures, as requested by the Director General, including in GOV/2005/67, which extend beyond the formal requirements of the Safeguards Agreement and Additional Protocol, and include such access to individuals, documentation relating to procurement, dual use equipment, certain military-owned workshops and research and development as the Agency may require in support of its ongoing investigations.”⁵

Iran has chosen not to comply fully with these IAEA requirements, which are designed to restore international confidence in Iran’s observance of its NPT obligation.

Israel claims that since the 1979 Iranian Revolution, the Islamist regime in Tehran has continually declared its aspiration to annihilate the State of Israel. The new President of Iran has also unwisely left that impression through recent intemperate remarks made to both domestic and international audiences. Last year President Ahmedinejad said Israel should be “wiped off the map, and less than two weeks ago he claimed, “The Zionist regime is a rotten, dried tree that will be eliminated by one storm.”⁶ His public questioning of the historical veracity of the Holocaust which befell European Jews at the hands of the Nazi regime in World War II has left even those sympathetic to the merits of Iran’s case shaking their heads. Surely, some responsible authorities in Iran must recognize the terrible damage such statements have done to Iran’s international reputation.

In a recent speech, Lt. Gen. (ret.) Moshe Yaalon, former Israel Defense Forces (IDF) Chief of Staff, identified eight areas of concern regarding Iran.⁷

⁵ IAEA, Board of Governors, Report by the Director General, GOV/2006/15, 27 February, 2006.

⁶ Remarks of President Mahmoud Ahmadinejad at a conference in Tehran supporting the Palestinians, as reported in The Wall Street Journal Online,” April 14, 2006, 1:10 PM.

⁷ Lt. Gen. (ret.) Moshe Yaalon, “Confronting Iran,” Speech at Hudson Institute, Washington, D. C., March 7, 2006. According to General Yaalon:

“1) Iran has exported the revolution to the Shiite sector in Lebanon. In this vein, it has built, financed, equipped, and trained Hizballah, empowering it as a political party, armed militia, and terror organization. Indeed, Hizballah is the long arm Iran has long used to threaten Israel.

2) Iran has continued to support Palestinian terror organizations. This support has come in multiple forms, including financing, training, and equipping Palestinian terrorist

Israel believes that Iran is financing and equipping organizations such as Hezbollah, Palestinian Islamic Jihad, Fatah, and Hamas that employ terror attacks against Israeli civilian targets, and that Iran's Intelligence Ministry has been responsible for attacks on Jewish and Israeli targets abroad. Israel claims that Iran must be isolated politically and economically, and that while the military option should not be excluded, it should be used only when these methods have been exhausted.⁸

Without in the least concurring in Israel's continuing occupation and settlement of the West Bank, we do concur in the judgment that Iran's overt and covert support for organizations that carry out terror attacks on civilian targets in Israel and elsewhere is a serious violation of international humanitarian law. In a just world, where the mantle of state policy would not confer impunity for criminal acts—many would put the U.S. invasion of Iraq in this category—the Iranian officials responsible for formulating and carrying out Iran's support for acts of terrorism would likewise be detained, bound over to the custody of the International Criminal Court, and put on trial for their crimes. Moreover, the rest of the world can be forgiven for believing that governments that

groups in need of sponsorship. I wish here to point to three major areas of Iranian funding of Palestinian terrorists:

- a) First, Palestinian Islamic Jihad (PIJ) is financed and directed by the Iranian Revolutionary Guard unit, al-Quds, and dependent on Iran.
 - b) Second, Fatah terrorists are financed and directed by Hizbollah special apparatus from Beirut. This relationship began with the *Karine-A* affair, in which Fatah, under Yasser Arafat, bought weapons and ammunition from Iran, loaded a ship in the Persian Gulf, and attempted to smuggle its contents into the Gaza strip. Since the implementation of the Disengagement Plan, Hizbollah, via Fatah, has established front headquarters in Gaza.
 - c) The third area of Iranian funding of Palestinian terror groups is Hamas. Although Hamas initially refused funds from Iran because of its status as an international pariah, over the past three years, Hamas has received financial support, terrorist mentorship, and weapons. Hamas leader Khalid Mashal's recent meetings with President Ahmadinejad—before and after elections—demonstrates Hamas' strategic decision to cooperate with Iran. Indeed, the two are united in their common interests regarding Israel.
- 3) Returning to my list of major areas of concern regarding Iran, Iran is involved in influencing the political and security situation in Iraq.
 - 4) Iran grants safe haven, protection, and assistance to al-Qaeda elements on its soil and granted support to Ansar al-Islam.
 - 5) The Iranian Intelligence Ministry is responsible for terror attacks in Germany (Mykonos Cafe) and Argentina (the Israeli Embassy and AMIA, the Jewish Community Center). These attacks reflect Iranian modus operandi and tactics.
 - 6) Iran operates behind the scene to blackmail regimes, such as Saudi Arabia, or to undermine regimes linked to the West, including Egypt and Jordan.
 - 7) The Iranian regime consistently acts to prevent political agreements or settlements between Israel and its Arab neighbors.
 - 8) Finally, The Iranian regime challenges the legitimacy of Western culture and values, as well as the legitimacy of the State of Israel's existence.

⁸ The historical record shows, however, that at other times Israel has cooperated with the Islamic government of Iran, shipping it significant quantities of weapons and spare parts during its protracted conflict with Saddam Hussein's regime in Iraq.

tolerate such criminal acts by its senior officials should not be entrusted with the inherent technical capacity to manufacture nuclear weapons-usable materials. This political fact-of-life seems obvious to almost everyone except Iran

Ignoring the serious geopolitical consequences of its support for acts of terrorism, Iran claims that regardless of its differences with other nations in the region, it has every right to develop nuclear technologies for peaceful purposes.

These hardened positions of the parties, coupled with the ongoing conflicts in Iraq and Palestine, carry a high risk of interacting in a way, wittingly or unwittingly, that could lead to a major war.

Proposed Solution to the Impasse

Iran should openly declare what its own experts and nuclear scientists around the world already know—namely, that the current international safeguards system, to which it is a party, is actually incapable of adequately safeguarding uranium enrichment and other bulk handling facilities that operate under exclusively national ownership and control. Nor can the current system ensure that such facilities remain impervious to terrorist penetration or attack, a task now assigned with varying degrees of competence to national governments and private security organizations. Under such circumstances, further construction of such facilities anywhere in the world multiplies both the reality and the perception of an increased threat to international security.

Iran is right in insisting that the current U.S. and EU policy of singling out Iran, while turning a blind eye to construction of sensitive nuclear fuel cycle facilities in other countries, is symptomatic of a double standard that is unfair and unsustainable. But recognizing this bias in Western policy does not mean that Iran is correct when it insists that it has a clearly established and unlimited “right” under the NPT to deploy a complete nuclear fuel cycle, in defiance of the views of the other Parties to the treaty and the IAEA.

Under Articles I and II of the NPT, the nuclear weapon State Parties are obligated “not in any way to assist, encourage, or induce any non-nuclear-weapon state to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices...” and the non-nuclear weapon State Parties are obligated “not to seek or receive any assistance in the manufacture or nuclear weapons or other explosive devices.”

All Parties are obligated under Article IV of the treaty to interpret their “inalienable right” to the peaceful uses of nuclear energy “*in conformity with Articles I and II of this treaty.*” In other words, the “right” to exploit nuclear energy for peaceful purposes is not unlimited, but rather constrained by the nonproliferation obligations undertaken by the Parties in Articles I and II. It is a well-settled principle of legal interpretation that no statute or treaty should be construed in such a way as to nullify its basic intended purpose.

These articles clearly bar transfer to, and receipt by Iran of *any form* of assistance in the manufacture or acquisition of nuclear weapons. To the extent that the international community sincerely views Iran's long-concealed program to acquire a large-scale enrichment capability as *undermining or circumventing the basic purpose of these articles*, then the international community is clearly within *its rights* in insisting that Iran cease its enrichment efforts until some mutually acceptable arrangement can be worked out, i.e., *until a majority of the Parties come to believe that large-scale enrichment by Iran no longer threatens to circumvent the prohibitions in Articles I and II of the Treaty*. This is unavoidably both a technical and a political judgment, and both dimensions of the problem must be addressed.

To break the current impasse, Iran could state that it is prepared, provided other countries do the same, to suspend further deployment of its commercial scale gas-centrifuge uranium enrichment plant for a fixed period, in the range of 3-5 years, during which time it pledges to work with the IAEA, and all states engaged in the construction or operation of similar sensitive nuclear fuel cycle facilities, to develop a *credible* international control regime. In barest outlines, this regime would:

- (a) indefinitely defer further deployment of sensitive nuclear fuel cycle facilities under exclusively national ownership and control, applicable equally to all states currently building or contemplating such national facilities, irrespective of where they are located;
- (b) develop a scheme for multi-national participation in the ownership, control and licensing of such facilities, subject to the application of technically credible safeguards and security arrangements administered by the International Atomic Energy Agency, or by a new UN Nuclear Inspectorate specifically created for this purpose, which would enjoy extra-territorial status in overseeing the operations and ensuring the security of such facilities; and
- (c) seek to develop and apply rational and technically defensible economic, environmental, safety, security, and safeguards criteria to the international licensing of such facilities, thereby ensuring that sensitive nuclear technology is not pursued merely for its own sake, i.e., for its military-strategic implications, but rather for its potential net economic benefit as a low-carbon energy source, one among many potential energy sources, each with its own unique set of risks and benefits that must be weighed and compared. In other words, *international nuclear cooperation, while essential for international security, must not become a pathway or excuse for massive misallocation of the world's scarce capital resources*.

Whatever multi-national arrangement is ultimately agreed to, Iran would be entitled, for the duration of the 3-5 year moratorium on large-scale deployment of enrichment capability, to receive an internationally guaranteed supply of fuel for its Bushehr reactor(s), including spent-fuel "take-back" services as part of the contract. For the duration of the moratorium on full-scale deployment, Iran would pledge to observe:

- (a) an IAEA verified cap on its enrichment capability, consisting of an enrichment limit of 5% U-235;
- (b) a cap on its enrichment capacity at 350 kg SWU/yr;
- (c) agreed caps on the stockpiling of fresh UF₆ for future enrichment and on low-enriched UF₆ product awaiting conversion to UO₂ reactor fuel; and
- (d) a continued moratorium on all nuclear fuel reprocessing activities.

Iran would pledge to accept the same strengthened international control arrangements, on the same time table, as those deemed acceptable by the Board of Governors of the IAEA and a majority of states with sensitive nuclear fuel cycle facilities. If at end of the 3-5 year period, an international consensus has not emerged on a more robust regime of safeguards and multi-national control, Iran would be free to resume its quest for a national enrichment capability, subject to the prevailing level of safeguards and inspections then being applied to comparable facilities in other non-weapon states, such as Japan and Brazil.

By definition, if international security is to be enhanced, any state hosting or participating in multinational nuclear fuel-cycle facilities must be a responsible state. Lending official overt or clandestine support for acts of terrorism against unarmed civilian targets anywhere, for any purpose, is the working definition of an irresponsible government. In its proposal to the international community, Iran would acknowledge that any government's sponsorship of acts of terrorism against unarmed civilians is a gross violation of international humanitarian law, and that such sponsorship, if proven, would be seen in the future as sufficient justification for depriving the sponsoring state of continued international access to nuclear fuel cycle facilities and technology.

If Iran were to adopt such a policy it would be much harder to argue that its nuclear aspirations were other than peaceful. It would "reframe" the issue in a way that more clearly delineates the responsibilities of all states—not just Iran—for ensuring development and deployment of a technically and politically credible nuclear safeguards regime, one that amounts to more than a superficial band-aid covering deep-seated fears of the inherent security threats posed by nominally "peaceful" nuclear fuel cycle facilities.

The burden of resolving this inherent duality cannot be placed on Iran's shoulders alone. Attempting to force Iran into unilaterally and permanently abandoning what it claims is a "peaceful" enrichment program, even as it is surrounded on all sides by the forces of no less than five nuclear-armed states, is neither politically credible nor morally just. The responsibility for repairing the international safeguards regime and making it credible, such that it *actually provides the level of assurance needed to under gird non-proliferation*, belongs to all NPT members states, and particularly to those that have long operated and are even now promoting the construction of sensitive nuclear fuel cycle facilities as the panacea for the world's energy needs

Thirty years ago Henry Kissinger, Donald Rumsfeld, and Dick Cheney were among the senior U.S. officials in the Ford Administration who signed-off on a huge secret nuclear

deal with the then Shah of Iran, Mohammad Reza Pahlavi, including the proposed sale of a complete turnkey spent-fuel reprocessing plant for separating plutonium. These gentlemen had no qualms then about Iran's acquisition of a sensitive nuclear fuel cycle facility, perhaps because they believed the Shah would be on the Peacock throne indefinitely.⁹

That feckless and opportunistic policy made no sense, and could have culminated during the Iran-Iraq war in the catastrophe of an Iranian plutonium bomb landing on Baghdad, rather than the atrocity of Iraqi chemical arms landing on Halabja, a war crime that could have been prevented had American officials not deliberately chosen to ignore Saddam's recurring use of chemical weapons in the Iran-Iraq war. In fact, in the late 1970s the United States received intelligence data indicating that the Shah had established a clandestine nuclear weapons development program, which caused the Carter Administration to stop supplying Iran with highly-enriched uranium.

Now some of the same U.S. officials who sought to supply a civil plutonium separation plant to the Shah seek to make Iran the sole scapegoat for the inherent weaknesses of the global safeguards regime, even as they hypocritically hand India the nuclear equivalent of free pass to international legitimacy for its steadfast refusal to sign the Nuclear Nonproliferation Treaty or even cap its fissile material stockpile for weapons. "The United States is unapologetically pursuing a 'double standard' as it seeks a civil nuclear trade agreement with India, while pressuring Iran and North Korea to abandon their alleged nuclear weapons programs, the top negotiator on the agreement [Undersecretary of State for Political Affairs Nicholas Burns] said last week."¹⁰ This is an equally feckless—not to say dangerous and unstable—basis for a sustainable security policy in the region.

By the same token, Iran must recognize that its nuclear fuel cycle activities, like those of other nations in the world and within the Near East/South Asia region, raise legitimate security concerns that must be addressed by the NPT State parties in an equitable, systematic and technically credible way.

The risk of war, already high, will only increase if Iran continues to call for the destruction of Israel, pursues its uranium enrichment activities without restraint, and refuses to cooperate fully with the IAEA.

By taking the high road, avoiding needlessly provocative actions and statements, and refusing to submit to Washington's nonproliferation "double standard," Iran can simultaneously defend its national interest in peaceful nuclear technology while focusing the world's attention on the real problem—the urgent need for a technically and strategically credible nuclear control regime that can provide the levels of assurance needed for nations—even rival nations—to forego secret programs that provide an option for eventual deployment of nuclear weapons.

⁹ Dafna Linzer, *The Washington Post*, March 27, 2005, p. A17.

¹⁰ Global Security Newswire, April 12, 2006.