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Iran's Nuclear Program: Recent Developments

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Summary

International Atomic Energy Agency (IAEA) inspections since 2003 have revealed almost two decades' worth of undeclared nuclear activities in Iran, including uranium enrichment and plutonium separation efforts. Iran agreed in 2003 to suspend its enrichment and reprocessing activities in exchange for promises of assistance from Germany, France, and the UK (EU-3), but negotiations broke down in August 2005. On September 24, 2005, the IAEA Board of Governors found Iran to be in noncompliance with its Nuclear Nonproliferation Treaty (NPT) safeguards agreement (GOV/2005/77) and voted (GOV/2006/14) on February 4 to report Iran to the U.N. Security Council. The Security Council issued a presidential statement on March 29 that called upon Iran to reinstitute its voluntary suspension of enrichment and reprocessing and asked the IAEA to report on Iran's compliance by April 28. On April 11, Iranian officials announced that they had enriched some uranium to 3.5% enrichment (fuel-grade). This report will be updated as needed.

Background

Iran has had a nuclear program for close to 50 years, beginning with a research reactor purchased from the United States in 1959. The Shah's plan to build 23 nuclear power reactors by the 1990s was regarded as grandiose, but not necessarily viewed as a "back door" to a nuclear weapons program, possibly because Iran did not then seek the technologies to enrich or reprocess its own fuel.¹ There were a few suspicions of a nuclear weapons program, but these abated in the decade between the Iranian 1979 revolution and the end of the Iran-Iraq war, both of which brought a halt to nuclear activities. Iran's current plans — to construct seven nuclear power plants (1000 MW each) by 2025 — are still ambitious, particularly for a state with considerable oil and gas

¹ Reports in the 1970s indicated that Iran sought laser enrichment technology in the United States and conducted reprocessing-related experiments. Intelligence reports suggested that the Shah had a secret group to work on nuclear weapons. See Leonard S. Spector, *Nuclear Ambitions* (Colorado: Westview Press, 1990), p. 204.

reserves.² Iran argues, as it did in the 1970s, that nuclear power is necessary for rising domestic energy consumption, while oil and gas are needed to generate foreign currency. Few observers believe that such an ambitious program is necessary or economic for Iran.

Iran has asserted repeatedly that its nuclear program is strictly peaceful, stating in May 2003 that “we consider the acquiring, development and use of nuclear weapons inhuman, immoral, illegal and against our basic principles. They have no place in Iran’s defense doctrine.”³ Iranian officials have also insisted on their right to develop peaceful uses of nuclear technology. Former President Khatami stated in March 2005 that ending Iran’s uranium enrichment program is “completely unacceptable,” but that Iran would provide “objective guarantees” of the peaceful uses of enrichment. Uranium enrichment can be used for both peaceful (nuclear fuel) and military (nuclear weapons) uses. At the heart of the debate lie two issues: doubt about Iran’s intentions, magnified by revelations of almost two decades of clandestine activities, and whether the international community can adequately verify the absence of enrichment for nuclear weapons or should further restrict access to sensitive nuclear technologies.

What Inspections Revealed

In 2002, the National Council of Resistance of Iran (NCR) helped expose Iran’s undeclared nuclear activities by providing information about nuclear sites at Natanz (uranium enrichment) and Arak (heavy water production). In three years of intensive inspections, the IAEA has revealed significant undeclared Iranian efforts in uranium enrichment (including centrifuge, atomic vapor laser and molecular laser isotope separation techniques) and separation of plutonium, as well as undeclared imported material. Iranian officials have delayed inspections, changed explanations for discrepancies, cleaned up facilities and in one case, Lavizan-Shian, razed a site.⁴ According to IAEA Director General Mohamed ElBaradei, “Iran tried to cover up many of their activities, and they learned the hard way.”⁵ Only in January 2005 did Iranian officials share a copy of Pakistani scientist A.Q. Khan’s 1987 offer of a centrifuge enrichment “starter kit.”⁶ In November 2005, Iran finally admitted that the Khan network supplied it with information on casting and machining parts of nuclear weapons.⁷

Iran admitted in 2003 it conducted “bench scale” uranium conversion experiments in the 1990s (required to be reported to the IAEA) and later, admitted that it used for those experiments some safeguarded material that had been declared lost in other processes (a safeguards violation). In February 2004, the IAEA concluded that, “given the size and

² See statement by Iran’s former Foreign Minister Kamal Kharrazi at [http://www.pbs.org/newshour/bb/middle_east/july-dec04/iran_9-27.html].

³ Statement by H.E. Mr. G. Ali Khoshroo, Deputy Foreign Minister for Legal and International Affairs, Second Session of the Prepcom for the 2005 NPT Review Conference, Apr. 29, 2003.

⁴ David Albright and Corey Hinderstein, “Iran: Countdown to Showdown,” *Bulletin of Atomic Scientists*, Nov./Dec. 2004, vol. 60, no. 6.

⁵ “Iran Was Offered Nuclear Parts,” *Washington Post*, Feb. 27, 2005.

⁶ *Ibid.*

⁷ “Iran ‘Hands Over Nuclear Cookbook,’” November 18, 2005, Aljazeera.net

capacity of the equipment used, the possibility cannot be excluded that larger quantities of nuclear material could have been involved than those declared.”⁸ The IAEA has deemed credible Iran’s explanation that it needed to convert uranium into metal for its laser uranium enrichment program (revealed only in October 2003). Conversion of uranium into metal is a step in producing nuclear weapons.

Enrichment Activities. Inspections revealed two enrichment plants at Natanz — a pilot-scale facility (planned to have 1000 centrifuges) and a commercial-scale plant under construction (planned to have 50,000 centrifuges). The pilot-scale plant started up in June 2003 only to shut down after Iran suspended enrichment activities in December 2003. Iran’s resumption of enrichment-related activities in February 2006 has included testing a 10-centrifuge cascade with uranium hexafluoride gas (UF₆). This has been conducted under IAEA safeguards, but constitutes small-scale enrichment of uranium (See GOV/2006/15).⁹ On April 11, Iranian officials announced they had enriched uranium to 3.5% U-235 in a cascade of 164 centrifuge machines.¹⁰

Construction on the commercial-scale plant was also suspended in 2003. Its construction partly underground raises concerns about Iran’s intentions. IAEA concerns focused on whether Iran introduced UF₆ into the pilot-scale plant for two reasons: if not declared, such an activity would have constituted unsafeguarded enrichment, and there were doubts about Iran’s ability to advance to a production stage of centrifuge enrichment without such testing.¹¹

Another key concern arose from environmental sampling by the IAEA that detected highly enriched uranium (HEU) particles. Iranian officials asserted that HEU particles found at the Natanz pilot plant in 2003 were contaminants from foreign centrifuge assemblies, a first clue revealing the Pakistani A.Q. Khan network. Iran admitted to enriching uranium to just 1.2%, while the particles sampled ranged from 36% to 70% U-235 enrichment. In October 2003, Iranian officials admitted they tested centrifuges at the Kalaye Electric Company using UF₆ between 1998 and 2002. IAEA report GOV/2006/15 reveals that components also came from another country besides Pakistan.

A third concern arose from Iran’s reluctance to provide information about its pursuit of more sophisticated centrifuge and laser enrichment technology. Iran did not admit until October 2003 that it also pursued a laser enrichment program beginning in the 1970s, and did not admit that it possessed more advanced centrifuge designs (P-2) until asked by the IAEA in January 2004. Iran insists that it received no P-1 or P-2 components after 1995, and that it did not receive any large shipments of magnets for P-2 centrifuges in 2003. Nonetheless, the IAEA is still awaiting clarification and more documentation.

Plutonium-Related Activities. In October 2003 Iran revealed that it had conducted plutonium reprocessing experiments in a hot cell at the Tehran Nuclear Research Center and estimated the amount separated as 200 micrograms. The IAEA

⁸ *Iran*, Report by the Director General, GOV/2004/11, Feb. 24, 2004.

⁹ *Iran*, Report by the Director General, GOV/2006/15, Feb. 27, 2006.

¹⁰ “Nuclear Energy Facilitates Sustainable Development: Aqazadeh,” IRNA, Apr. 11, 2006.

¹¹ *Iran*, Report by the Director General, GOV/2003/40, June 6, 2003.

calculated that more plutonium would have been produced (about 100g) and Iran admitted in May 2004 that it understated the amount. Inspections also revealed that Iran experimented between 1989 and 1993 on irradiating bismuth, which can be used to produce Polonium-210 for civilian purposes (for nuclear batteries) or in conjunction with beryllium to create a neutron initiator for a nuclear weapon. However, polonium, according to many observers, is not ideal for nuclear weapons purposes.

The heavy water program also has raised questions about Iran's intentions. Iran first told the IAEA that it planned to export heavy water, then suggested that the heavy water would be used as a coolant and moderator for a planned IR-40 reactor for research and development, radioisotope production, and training. However, Iran's design information for the facility, which omitted necessary hot cell equipment for producing radioisotopes, conflicted with reports of Iran's efforts to import hot cell equipment. Construction of the IR-40 reactor has continued, despite the Board's continued calls for a halt, although Iranian officials predict that the reactor will not be operational until 2011.¹² The heavy water production plant may soon produce heavy water.¹³

Significance for a Nuclear Weapons Program

Iran is likely years away from producing weapons-grade plutonium or highly enriched uranium. Vice Admiral Jacoby, director of the Defense Intelligence Agency, told the Senate Armed Services Committee in March 2005 that Iran is expected to be able to produce a weapon early next decade. According to one report, the 2005 National Intelligence Estimate on Iran assesses that it will be 10 years before Iran has a bomb.¹⁴ That said, Iran has pursued three different methods of enriching uranium and has experimented with separating plutonium, suggesting a steady accrual of expertise in weapons-relevant areas, according to some observers. If Iran received the same nuclear weapon design that A.Q. Khan gave Libya, the remaining technical hurdle (albeit the most difficult) would be fissile material production. Covert production of fissile material could be very difficult to detect, particularly if conducted at an undeclared facility. In other states, such as North Korea, U.S. intelligence capabilities have found it difficult to determine where clandestine centrifuge facilities are located. Although the interim application of the Additional Protocol in Iran was probably useful in improving the IAEA's capabilities to verify the absence of undeclared materials or facilities, its suspension is similarly unhelpful. A solution endorsed by many is a complete ban of Iran's enrichment and reprocessing to build confidence and facilitate the task of verification. A collateral benefit of that approach is to demonstrate that noncompliance carries a price. Iran, so far, is resisting this approach.

Iran's 3.5% enrichment of uranium in a 164-centrifuge cascade demonstrates, at the least, Iran's continued defiance of world opinion, and at most, a further step towards acquiring a capability to make nuclear weapons. However, this laboratory-scale capability should not be equated with an industrial scale capability, which requires the sustained operation of centrifuges aligned in cascades containing many thousands of machines.

¹² GOV/2006/15.

¹³ For analysis, see [<http://www.isis-online.org/publications/iran/arakconstruction.html>].

¹⁴ "Iran is Judged 10 Years From Nuclear Bomb," *Washington Post*, August 2, 2005.

NPT Compliance Issues

NPT compliance is, fundamentally, compliance with a safeguards agreement, which is the legal document between the IAEA and a member state. Assessing compliance is rarely black and white; there are myriad opportunities for technical discrepancies that mostly do not rise to the level of noncompliance. Often, a state's willingness to take corrective action weighs heavily in its favor.¹⁵ In the case of Iran, there have been many technical violations, but Iran corrected lapses in reporting and made significant concessions, such as signing the Additional Protocol, and agreeing to a voluntary suspension of enrichment and reprocessing-related activities.

Two developments appear to have guided events since late 2003. First, a second negotiating track was opened through the European Union foreign ministers (known as the EU-3) of Germany, the UK, and France. Second, the IAEA did not declare Iran in noncompliance but could not conclude that there were no undeclared nuclear material or activities in Iran (see GOV/2005/67 and GOV/2006/15). To some, the opening of a second negotiating track through the three European foreign ministers signaled a failure by the IAEA and the Board of Governors to take decisive action against a clear pattern of deception. Those observers would argue that the second track of negotiations left Iran free to set the terms of engagement, since its concessions were voluntary and political. While it is true that the EU-3 have been unable to obtain Iran's agreement to a permanent halt to uranium enrichment activities — their key objective — such an objective could not have been pursued by the IAEA because that is not in its mandate. To some observers, two years of negotiation and a temporary shutdown have bought the world community two years of time to change Iran's mind about nuclear weapon aspirations.

The course of negotiations between Iran and the EU-3 has not been easy. In 2004, Iran continued certain activities that called into question its October 2003 suspension, leading to the November 2004 Paris agreement. In March 2005, Iran proposed running its pilot-scale enrichment facility, which EU-3 negotiators rejected. In April 2005, Iran said that unless negotiations progressed, it would start up its uranium conversion plant, which it did in August 2005.¹⁶ Following Iranian President Ahmadinejad's inflammatory remarks at the September 2005 U.N. Summit, the IAEA Board voted on resolution GOV/2005/77, which found Iran in noncompliance with its safeguards agreement.

The September 24, 2005, Board resolution is notable for at least two reasons: it did not enjoy a consensus (which is the usual outcome) and it did not immediately refer the issue to the Security Council.¹⁷ The IAEA Statute requires that once the Board has made a finding of noncompliance, it must report it to the Security Council. The resolution

¹⁵ See CRS Report RS22125, *NPT Compliance Issues*, by Sharon Squassoni.

¹⁶ INFCIRC/648, *Communication dated 1 August 2005 received from the Permanent Mission of the Islamic Republic of Iran to the Agency*. Available at [<http://www.iaea.org>].

¹⁷ Voting For: the U.S., Australia, Britain, France, Germany, Canada, Argentina, Belgium, Ghana, Ecuador, Hungary, Italy, the Netherlands, Poland, Portugal, Sweden, Slovakia, Japan, Peru, Singapore, South Korea, and India; Voting Against: Venezuela. Abstaining: Pakistan, Algeria, Yemen, Brazil, China, Mexico, Nigeria, Russia, South Africa, Sri Lanka, Tunisia, and Vietnam "International Consensus Against Iran Fails," *Tehran Times*, Sept. 25, 2005.

noted that the Board would address “the timing and content of the report required under Article XII.C [of the Statute].”

For several months, Iran provided limited details on outstanding issues and negotiated an offer to conduct uranium enrichment on Russian soil as an alternative to indigenous production. In January 2006, Iran abandoned its voluntary suspension of enrichment-related activities negotiations, as well as the interim application of the Additional Protocol, prompting an emergency Board meeting. An IAEA report prepared for the meeting linked, for the first time, a Khan network document in Iran’s possession on uranium casting and machining to the fabrication of nuclear weapons components.¹⁸ Iran has stated that the Khan network provided the document on its own initiative. Reportedly, key information on dimensions and other specifications for components was missing. Nonetheless, Article II of the NPT obligates Iran not to receive any assistance in the manufacture of nuclear explosives, so the question of whose initiative prompted transfer of the document is moot. The February Board passed a resolution (GOV/2006/14, upon a vote with no consensus) to report Iran to the Security Council.

IAEA investigation of allegations that Iran is pursuing a “Green Salt Project” (to convert uranium dioxide into UF₄, the precursor for UF₆ that is used in an enrichment plant), as well as high explosives and missile reentry vehicle designs, has yielded little information thus far from Iranian officials, who say the allegations are baseless.

Next Steps

The U.N. Security Council issued a presidential statement on March 29 that called for Iran’s compliance with its voluntary suspension and interim application of the Additional Protocol, as well as for Iran to resolve outstanding issues.¹⁹ On April 11, Iran declared it had enriched uranium at the Natanz plant, which some observers termed “regrettable.”²⁰ Reportedly, the United States, Russia, China, France, Britain, and Germany will meet to discuss a response to Iran’s latest action in the coming week.²¹ Some states have supported sanctions, while others, like Russia and China, have not. Potential sanctions could include bans on Iranian oil, trade, or international investment in Iran’s energy sector; a ban on arms sales to Iran; limiting travel by certain Iranian officials; and/or limiting international lending.²² There are several resolutions and bills in Congress that urge imposition of sanctions, including H.Con.Res. 341 and S.Res. 351.

¹⁸ See [<http://www.iaea.org/NewsCenter/Statements/DDGs/2006/heinonen31012006.pdf>]

¹⁹ See [<http://www.un.org/News/Press/docs/2006/sc8679.doc.htm>] for full text.

²⁰ “EU says Iran Nuclear Announcement ‘Regrettable,’ *Reuters*, April 12, 2006.

²¹ “Rice Urges U.N. to Take ‘Strong Steps’ on Iran,” *Washington Post* online, April 12, 2006.

²² See CRS Report RL32048, *Iran: U.S. Concerns and Policy Responses*, by Kenneth Katzman.