Iran's Nuclear Program: Recent Developments

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Summary

International Atomic Energy Agency (IAEA) inspections since 2003 have revealed two decades' worth of undeclared nuclear activities in Iran, including uranium enrichment and plutonium separation efforts. Iran agreed in 2003 to suspend sensitive activities in negotiations with Germany, France, and the UK (EU-3), which 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 and reported Iran's case to the U.N. Security Council in February 2006. The Security Council called upon Iran to resuspend enrichment and reprocessing, reconsider construction of its heavy water reactor, ratify and implement the Additional Protocol, and implement transparency measures. Iran has continued its enrichment activities, failing to meet deadline after deadline. On December 23, 2006, the Security Council adopted limited sanctions under UNSCR 1737 and gave Iran another 60 days. However, the February 21, 2007, deadline has passed with little progress, and further sanctions may be under consideration. This report will be updated as needed.

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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 reserves.[2] Iran argues, as it did in the 1970s, that rising domestic energy consumption should be met by nuclear power, leaving oil and gas sales to generate foreign currency. Few observers believe that such an ambitious program is necessary or economic for Iran and many question Iran's motives in developing uranium enrichment before even a single power reactor is in operation.

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 government spokesman Gholam Hussein Elham said in July 2006 that the Islamic Republic will never produce weapons of mass destruction. At the same time, Supreme Leader Ali Khamanei said in November 2004 that Iran would not "give up" its enrichment "at any price" and former President Khatami stated in March 2005 that ending Iran's uranium enrichment program is "completely unacceptable." Uranium enrichment can be used for both peaceful (nuclear fuel) and military (nuclear weapons) uses. However, two decades of clandestine activities have raised questions about Iran's intentions, and many have called for Iran to rebuild world confidence by refraining from enrichment and reprocessing, perhaps indefinitely. Nonetheless, the further Iran proceeds down the path of enrichment, the more difficult it will become to foreswear it, if only for financial reasons.

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). Three years of intensive inspections by the IAEA 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

[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.

[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. (continued...)

IAEA Director General Mohamed ElBaradei, "Iran tried to cover up many of their activities, and they learned the hard way."[5]

Among other activities, 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). Iranian officials told the IAEA only in January 2005 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]

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 (PFEP) started up in June 2003 only to shut down after Iran suspended enrichment activities in December 2003. Since February 2006, when Iran resumed enrichment-related activities, Iran has tested small cascades (10, 20, then 164 machines) with uranium hexafluoride gas (UF6), all under IAEA safeguards.[8] The IAEA has reported that Iran has achieved a maximum enrichment of 4.2% at PFEP.[9] Construction on the commercial-scale plant (FEP) was also suspended in 2003. Although Iran announced plans in April 2006 to install 3,000 centrifuges in the commercial plant by the end of the year, it did not even meet a third of that goal. As of February 2007, Iran was operating two cascades under vacuum (without feedstock), and was in the process of installing another two cascades, which would bring the number of centrifuges up to 656. At the point when Iran introduces UF6 into the FEP, nuclear material accountancy must begin. The IAEA has also told Iran it must have remote monitoring equipment installed before 500 centrifuges are operating in FEP, which Iran has resisted.[10]

A few enrichment issues remain unresolved. The first is the source of highly enriched uranium (HEU) particles at sites in Iran. 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. 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.

Another unresolved issue is how far Iran has pursued more sophisticated centrifuge and laser enrichment technology. Iran admitted in October 2003 that it also pursued a laser enrichment program beginning in the 1970s, and admitted that it possessed more advanced centrifuge designs

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2004, vol. 60, no. 6.

[5] "Iran Was Offered Nuclear Parts," *Washington Post*, Feb. 27, 2005.

[6] *Iran,* Report by the Director General, GOV/2005/67, Sept. 2, 2005.

[7] "Iran 'Hands Over Nuclear Cookbook,'" Nov. 18, 2005, Aljazeera.net

[8] *Iran,* Report by the Director General, GOV/2006/15, Feb. 27, 2006.

[9] *Iran,* Report by the Director General, GOV/2006/64, Nov. 14, 2006

[10] *Iran,* Report by the Director General, GOV/2007/8, Feb. 22, 2007

(P-2) in January 2004. Such advanced designs could double Iran's enrichment capabilities, shortening the time, potentially, to a bomb. Iran insists that it received no centrifuge components after 1995, but admitted it received a limited number of magnets for P-2 centrifuges in 2003 and in April 2006, admitted to purchasing magnets suitable for the P-2 design. The IAEA continues to investigate this issue.

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 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.

Finally, 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 reported Iranian 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.[11] The heavy water production plant reportedly has been operational since 2004, and in August 2006, Iranian officials announced they would double its production.

Significance for a Nuclear Weapons Program

Iran is likely years away from producing weapons-grade plutonium or highly enriched uranium. Then-Director of National Intelligence John Negroponte told the Senate Select Committee on Intelligence on February 2, 2006, that, "We judge that Tehran probably does not yet have a nuclear weapon and probably has not yet produced or acquired the fissile material." According to one report, the 2005 National Intelligence Estimate on Iran assesses that it will be 10 years before Iran has a bomb.[12] 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. On January 18, 2007, then-DNI Negroponte told Members of Congress that, "Our assessment is that Tehran is determined to develop nuclear weapons. It is continuing to pursue uranium enrichment and has shown more interest in protracting negotiations than reaching an acceptable diplomatic solution."

[11] GOV/2006/15.

[12] "Iran is Judged 10 Years From Nuclear Bomb," *Washington Post*, Aug. 2, 2005.

Calculations of nuclear weapons production are generally based on estimates of fissile material production. One calculation is that a cascade of 1000 P-1 centrifuges could produce one bomb's worth of HEU (25 kg) in 2.2 to 2.7 years; and that a cascade of 3000 P-1 centrifuges could produce the same amount in 271-330 days.[13] Such an estimate assumes that Iran has the necessary amount and quality of uranium hexafluoride to feed the enrichment plant, the components for building 1000 or 3000 centrifuges, and the engineering skills to keep such cascades operating with few mishaps. In short, Iran's limited experience in enrichment so far should not be equated yet with an ability to operate an industrial-scale enrichment plant for peaceful or weapons purposes.

Negotiating with Iran

Since 2003, negotiations with Iran on its nuclear program have proceeded on two levels—with IAEA inspectors and at the IAEA Board of Governors in Vienna, and with the European Union foreign ministers (known as the EU-3) of Germany, the UK, and France. In 2006, the EU-3 were joined by Russia, China and the United States after Iran's noncompliance was reported to the UN Security Council.

Some observers may view the second negotiating track as necessary because the IAEA and Board of Governors failed to take decisive action against a clear pattern of deception early on; others may view it as necessary because of the potential danger of Iran pulling out of the NPT. Iran's voluntary measures negotiated with the EU-3 may have allowed IAEA inspectors greater access than would otherwise be granted under Iran's comprehensive safeguards agreement, but also may have left Iran free to set the terms of engagement, since Iran's 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.

Within a few months of Iran's voluntary moratorium, there were signs of continued activities that called into question Iran's commitment. Although the November 2004 Paris agreement clarified the terms of the moratorium, by 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.[14] 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. Specifically, the Board found that "Iran's many failures and breaches of its obligations to comply with its NPT Safeguards Agreement, as detailed in GOV/2003/75, constitute noncompliance in the context of Article XII.C of the Agency's Statute."

For several months thereafter, Iran provided limited details on outstanding issues and discussed, with Russia, 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,

[13] International Institute for Strategic Studies, *Iran's Strategic Weapons Programmes: A Net Assessment*, (UK: Routledge, 2005), p. 54.

[14] 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.

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.[15] Iran asserts that the Khan network provided the document on its own initiative. 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, without consensus) to report Iran to the Security Council.

The U.N. Security Council issued a presidential statement on March 29, 2006 calling upon Iran to reinstate its suspension of enrichment and reprocessing, reconsider construction of its heavy water reactor, ratify and implement the Additional Protocol and implement transparency measures.[16] Iran continued its enrichment activities, while claiming it was cooperating with the IAEA.[17] The IAEA reported to the U.N. Security Council (GOV/2006/27) on April 28 that it was "unable to make progress in its efforts to provide assurance about the absence of undeclared nuclear material and activities in Iran." Its June 8 report (GOV/2006/38) reported even less progress, given a lack of new information.

On June 6, 2006, the EU-3, Russia, China, and the United States (P-5 + 1) offered Iran a new negotiating proposal, which included incentives such as affirming Iran's inalienable right to peaceful nuclear energy, assistance in building state-of-the-art light water reactors for Iran, fuel supply guarantees, dismissing U.N. Security Council consideration of Iran's NPT noncompliance, WTO membership, and an end to certain U.S. sanctions to allow Iran to purchase agriculture appliances and Boeing aircraft parts.[18] In return, Iran would suspend enrichment- and reprocessing-related activities, resume implementation of the Additional Protocol and fully cooperate with the IAEA. Iran's moratorium could be reviewed once several conditions had been met, including resolving all issues and restoring international confidence in the peaceful nature of Iran's nuclear program. The proposal also outlined several measures targeted at Iran's nuclear program should Iran not agree to cooperate: a ban on nuclear-related exports, freeze of assets, travel/visa bans, suspension of technical cooperation with the IAEA, a ban on investment in related entities, and on Iranians studying abroad in nuclear and missile-related areas. Broader measures could include an arms embargo, no support for WTO membership, and a general freeze on assets of Iranian financial institutions.

Since June 2006, the Security Council has demanded Iranian compliance and transparency, and Iran has failed to respond. The P-5 discussed sanctions through the fall, and the Security Council ultimately adopted UNSCR 1737 on December 23, 2006, which requires states to prevent the supply, sale or transfer of equipment and technology that could contribute to enrichment-, reprocessing-, heavy-water-related activities, or missile delivery systems in Iran and to freeze the funds of persons and entities involved in the nuclear and ballistic missile programs.[19] UNSCR 1737 gave Iran another 60 days to comply, which expired on February 21, 2007. On February 22, 2007, the IAEA reported its inability to make further progress and hence its inability to verify the absence of undeclared nuclear material and activities in Iran (GOV/2007/8). The Security Council

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

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

[17] "EU says Iran Nuclear Announcement 'Regrettable,'" *Reuters*, Apr. 12, 2006.

[18] Text available at http://www.diplomatie.gouv.fr/en/country-files_156/iran_301/the-iranian-nuclear-question_2724/elements-of-revised-proposal-to-iran_5314.html.

[19] See http://www.un.org/News/Press/docs//2006/sc8928.doc.htm.

continues to discuss further sanctions on Iran. (See CRS Report RL32048, *Iran: U.S. Concerns and Policy Responses*, by (name redacted), for more on sanctions.)

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