



# Iran's Nuclear Program: Status

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## Summary

Iran's nuclear program began during the 1950s. The United States has expressed concern since the mid-1970s that Tehran might develop nuclear weapons. Iran's construction of gas centrifuge-based uranium enrichment facilities is currently the main source of proliferation concern. Gas centrifuges enrich uranium by spinning uranium hexafluoride gas at high speeds to increase the concentration of the uranium-235 isotope. Such centrifuges can produce both low-enriched uranium (LEU), which can be used in nuclear power reactors, and weapons-grade highly enriched uranium (HEU), which is one of the two types of fissile material used in nuclear weapons.

Obtaining fissile material is widely regarded as the most difficult task in building nuclear weapons. As of August 2012, Iran had produced an amount of LEU containing up to 5% uranium-235 which, if further enriched, could theoretically produce enough HEU for several nuclear weapons. Iran has also produced LEU containing up to 20% uranium-235, but, as of August 2012, this amount was not sufficient to yield a sufficient amount of weapons-grade HEU for a weapon.

Although Iran claims that its nuclear program is exclusively for peaceful purposes, the program has generated considerable concern that Tehran is pursuing a nuclear weapons program. Indeed, the U.N. Security Council has responded to Iran's refusal to suspend work on its uranium enrichment program by adopting several resolutions that imposed sanctions on Tehran. Despite evidence that sanctions and other forms of pressure have slowed the program, Iran continues to enrich uranium, install additional centrifuges, and conduct research on new types of centrifuges.

Tehran has also continued work on a heavy-water reactor, which is a proliferation concern because its spent fuel will contain plutonium—the other type of fissile material used in nuclear weapons. However, plutonium must be separated from spent fuel—a procedure called “reprocessing.” Iran has said that it will not engage in reprocessing.

The International Atomic Energy Agency (IAEA) monitors Iran's nuclear facilities and has been able to verify that Tehran's declared nuclear facilities and materials have not been diverted for military purposes. But the agency still has concerns about the program, particularly evidence that Iran may have conducted procurement activities and research directly applicable to nuclear weapons development. The United States has assessed that Tehran has the technical capability eventually to produce nuclear weapons, but has not yet mastered all of the necessary technologies for building such weapons. Whether Iran has a viable design for a nuclear weapon is unclear.

Whether Iran has a nuclear weapons program is also unclear. A National Intelligence Estimate made public in December 2007 assessed that Tehran “halted its nuclear weapons program” in 2003. The estimate, however, also assessed that Tehran is “keeping open the option to develop nuclear weapons” and that any decision to end a nuclear weapons program is “inherently reversible.” U.S. intelligence officials have reaffirmed this judgment on several occasions. For example, Director of National Intelligence James Clapper stated in January 2012 that Iran “is keeping open the option to develop” nuclear weapons.

Secretary of Defense Leon Panetta stated in January 2012 that Iran would probably need “about a year” to produce a nuclear weapon and “possibly another one to two years” to incorporate it into a delivery vehicle. However, Director Clapper indicated in February 2012 that it would likely take Iran longer than a year to produce a nuclear weapon after making a decision to do so. These estimates apparently assume that Iran would use its declared nuclear facilities to produce fissile

material for a weapon. However, Tehran would probably use covert facilities for this purpose; Iranian efforts to produce fissile material for nuclear weapons by using its known nuclear facilities would almost certainly be detected by the IAEA.

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## Background

Iran's nuclear program began during the 1950s. Construction of a U.S.-supplied research reactor located in Tehran began in 1960; the reactor went critical in 1967.<sup>1</sup> During the 1970s, Tehran pursued an ambitious nuclear power program; according to contemporaneous U.S. documents, Iran wanted to construct 10-20 nuclear power reactors and produce more than 20,000 megawatts of nuclear power by 1994.<sup>2</sup> Iran actually began constructing a light-water nuclear power reactor near the city of Bushehr and also considered obtaining uranium enrichment and reprocessing technology.

Iran also took steps to demonstrate that it was not pursuing nuclear weapons. For example, Tehran signed the nuclear Nonproliferation Treaty (NPT) in 1968 and ratified it in 1970. Iran also submitted a draft resolution to the U.N. General Assembly in 1974 that called for establishing a nuclear-weapons-free zone in the Middle East. Nevertheless, mid-1970s U.S. intelligence reports expressed concern that Iran might pursue a nuclear weapons program.<sup>3</sup> Although Iran cancelled its nuclear program after its 1979 revolution, a 1981 Department of State draft paper argued that Iran may develop a nuclear weapons program in response to a then-suspected Iraqi nuclear weapons program, although Iran was not one of several countries of "near to medium term proliferation concern" to which the paper referred.<sup>4</sup>

Tehran "reinstated" its nuclear program in 1982.<sup>5</sup> A 1985 National Intelligence Council report, which cited Iran as a potential "proliferation threat," stated that Tehran was "interested in developing facilities that ... could eventually produce fissile material that could be used in a [nuclear] weapon." The report, however, added that it "would take at least a decade" for Iran to do so.<sup>6</sup> A U.S. intelligence report published 10 years later stated that Iran was "aggressively

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<sup>1</sup> The United States and Iran signed a nuclear cooperation agreement in 1957; it entered into force in 1959. The two countries negotiated another such agreement during the 1970s, but it was never concluded. For a summary of these negotiations, see William Burr, "A Brief History of U.S.-Iranian Nuclear Negotiations," *Bulletin of the Atomic Scientists*, January/February 2009.

<sup>2</sup> For example, the United States was willing to supply Iran with reprocessing technology, according to 1975 and 1976 National Security Council documents. Tehran also had a 1976 contract for a pilot uranium-enrichment facility using lasers (see *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006) and 1747 (2007) in the Islamic Republic of Iran*, Report by the Director General, GOV 2007/58, November 15, 2007. Additionally, Iran had contemplated building its own enrichment facility, according to a 1976 State Department cable (U.S. Embassy Tehran Airgram A-76 to State Department, "The Atomic Energy Organization of Iran," April 15, 1976).

<sup>3</sup> *Prospects for Further Proliferation of Nuclear Weapons*, Special National Intelligence Estimate, August 23, 1974. A 1975 Department of State memorandum referred to the "uncertainty over" Iran's "long-term objectives despite its NPT status" ("Memorandum for the Assistant to the President for National Security Affairs: Department of State Response to NSSM 219 (Nuclear Cooperation with Iran)," April 18, 1975). A 1988 CIA report (*Middle East-South Asia: Nuclear Handbook*) indicated that Iran had conducted nuclear weapons "design work" before the 1979 revolution.

<sup>4</sup> "Request for Review of Draft Paper on the Security Dimension of Non-Proliferation," Special Assistant for Nuclear Proliferation Intelligence, National Foreign Assessment Center, Central Intelligence Agency, to Resource Management Staff, Office of Program Assessment et al, April 9, 1981. Iraq pursued nuclear, chemical, and biological weapons during the 1980s. The paper argued that Iraq's nuclear program was "intended to provide the option of developing nuclear explosives in the future."

<sup>5</sup> *Middle East-South Asia: Nuclear Handbook*, CIA, May 1988.

<sup>6</sup> *The Dynamics of Nuclear Proliferation: Balance of Power and Constraints*, National Intelligence Council, September 1985.

pursuing a nuclear weapons capability and, if significant foreign assistance were provided, could produce a weapon by the end of the decade.”<sup>7</sup>

The Iranian government says that it plans to expand its reliance on nuclear power in order to generate electricity. This program will, Tehran says, substitute for some of Iran's oil and gas consumption and allow the country to export additional fossil fuels—an argument that the previous Iranian regime had also made.<sup>8</sup> Currently, Iran is beginning to operate the Bushehr reactor and Iran says it intends to build additional reactors to generate 20,000 megawatts of power within the next 20 years.<sup>9</sup> Iranian officials say that Tehran has begun design work on its first indigenously produced light-water reactor, which is to be constructed at Darkhovin.<sup>10</sup> Iran told the International Atomic Energy Agency (IAEA) in 2009 that Tehran would begin building the reactor in 2011 and commission it in 2015.<sup>11</sup> However, then-head of Iran's Atomic Energy Organization Ali Akbar Salehi stated on October 4, 2009, that the “assembly of this plant will take ten years.”<sup>12</sup> According to a February 2011 report from IAEA Director-General Yukiya Amano, satellite imagery indicated that “construction activities” had not begun at the planned reactor site.<sup>13</sup> Fereyduun Abbasi-Davani, Head of Iran's Atomic Energy Organization of Iran, said in April 2012 that Iran would construct the plant without foreign assistance.<sup>14</sup>

Iranian officials have repeatedly asserted that the country's nuclear program is exclusively for peaceful purposes. For example, Supreme Leader Ayatollah Ali Khamene'i declared during a June 3, 2008, speech that Iran is opposed to nuclear weapons “based on religious and Islamic beliefs as well as based on logic and wisdom.” He added, “[n]uclear weapons have no benefit but high costs to manufacture and keep them. Nuclear weapons do not bring power to a nation because they are not applicable. Nuclear weapons cannot be used.” Similarly, Iranian Foreign Ministry spokesperson Hassan Qashqavi stated November 10, 2008, that “pursuance of nuclear weapons has no place in the country's defense doctrine.”<sup>15</sup> Iranian President Mahmoud Ahmadinejad asserted during an April 9, 2009, speech that “those who accumulate nuclear

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<sup>7</sup> *The Weapons Proliferation Threat*, Nonproliferation Center, March 1995.

<sup>8</sup> For example, according to a 1976 State Department cable, the head of the Atomic Energy Organization of Iran cited these arguments as reasons for starting an ambitious nuclear program (U.S. Embassy Tehran Airgram A-76 to State Department, “The Atomic Energy Organization of Iran,” April 15, 1976). Ambassador Ali Asghar Soltanieh, Iran's Permanent Representative to the International Atomic Energy Agency, has explained that nuclear power would only meet “perhaps a small portion” of the projected national electricity demand. “Interview with Iran's Ambassador to IAEA,” Campaign Against Sanctions and Military Intervention in Iran, June 29, 2008 (published July 2, 2008).

<sup>9</sup> “Iran to Follow Nuclear Timetable Regardless of IAEA Reports – Official,” *Islamic Republic of Iran News Network*, February 25, 2009.

<sup>10</sup> “Iran Nuclear Spokesman Interviewed on Situation,” *E'temad*, November 9, 2008. Iran has stated that construction on the 360 MW reactor is to start in 2013. The reactor is to be completed in 2016. See “Foreign Firms Interested to Build Darkhovin Nuclear Plant - Iran Official,” *Mehr News Agency*, October 19, 2008, and “Bushehr Plant To Be Inaugurated By Mid October 2008 - Iranian Official,” *Islamic Republic of Iran News Network*, January 30, 2008.

<sup>11</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006), 1747 (2007), 1803 (2008) and 1835 (2008) in the Islamic Republic of Iran*, Report by the Director General, GOV/2009/74, November 16, 2009

<sup>12</sup> “Iranian Nuclear Chief Salehi Describes Talks With IAEA Chief ElBaradei,” *Tehran Vision of the Islamic Republic of Iran Network 1*, October 4, 2009.

<sup>13</sup> *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/2011/7, February 25, 2011.

<sup>14</sup> “Iran Atomic Chief Says Country's Nuclear Facilities not Affected by Enemies,” *Fars News Agency*, April 10, 2012.

<sup>15</sup> “Weekly Briefing of the Foreign Ministry Spokesman,” November 10, 2008.

weapons are backwards in political terms.”<sup>16</sup> More recently, Khamene’i stated February 22, 2012, that

Ideologically and religiously speaking, we believe that it is not right [to have nuclear weapons]. We believe that this move [making nuclear weapons] and the use of such weapons are a great sin. We also believe that stockpiling such weapons is futile, expensive and harmful; and we would never seek this.<sup>17</sup>

Asked in January 2012 if Iran is trying to develop the capability to produce a nuclear weapon, Ambassador Mohammad Khazaei, Iran’s Permanent Representative to the United Nations, “[w]e are not going to develop the capacity to be able to make any weapon of mass destruction.”<sup>18</sup>

However, the United States and other governments have argued that Iran may be pursuing, at a minimum, the capability to produce nuclear weapons. Discerning a peaceful nuclear program from a nuclear weapons program can be difficult because much nuclear technology is dual-use. In addition, military nuclear programs may coexist with civilian programs, even without an explicit governmental decision to produce nuclear weapons. Jose Goldemberg, Brazil’s former secretary of state for science and technology, observed that a country developing the capability to produce nuclear fuel

does not have to make an explicit early [political] decision to acquire nuclear weapons. In some countries, such a path is supported equally by those who genuinely want to explore an energy alternative and by government officials who either want nuclear weapons or just want to keep the option open.<sup>19</sup>

Some analysts argue that several past nuclear programs, such as those of France, Sweden, and Switzerland, illustrate this approach.<sup>20</sup> Moreover, a 1975 U.S. intelligence assessment argued that countries might develop an “unweaponized” nuclear explosive device “to further their political, and even military, objectives.”<sup>21</sup>

The main source of proliferation concern is Tehran’s construction of gas-centrifuge-based uranium-enrichment facilities. Gas centrifuges enrich uranium by spinning uranium hexafluoride gas at high speeds to increase the concentration of the uranium-235 isotope. Such centrifuges can produce both low-enriched uranium (LEU), which can be used in nuclear power reactors, and highly enriched uranium (HEU), which is one of the two types of fissile material used in nuclear weapons. HEU can also be used as fuel in certain types of nuclear reactors.<sup>22</sup> Iran also has a

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<sup>16</sup> *Islamic Republic of Iran News Network*, April 9, 2009.

<sup>17</sup> “Leader Says West Knows Iran Not Seeking ‘Nuclear Weapons,’” *Vision of the Islamic Republic of Iran Network 1*, February 22, 2012.

<sup>18</sup> *The Charlie Rose Show*, January 18, 2012.

<sup>19</sup> Jose Goldemberg, “Looking Back: Lessons From the Denuclearization of Brazil and Argentina,” *Arms Control Today*, April 2006.

<sup>20</sup> See James Acton, “The Problem with Nuclear Mind Reading,” *Survival*, February-March 2009, pp. 119-42; Paul M. Cole, “Atomic Bombast: Nuclear Weapon Decisionmaking in Sweden 1945–1972,” The Henry L. Stimson Center, 1996; “Neutral States: Sweden and Switzerland,” in T.V. Paul, *Power Vs. Prudence: Why Nations Forgo Nuclear Weapons* (Montreal: McGill University Press), 2000, pp. 84-98; and Bruno Tertrais, “Has Iran Decided to Build the Bomb? Lessons from the French Experience,” January 30, 2007.

<sup>21</sup> Memorandum to Holders, Special National Intelligence Estimate, *Prospects for Further Proliferation of Nuclear Weapons*, SNIE 4-1-74, December 18, 1975. The assessment did not discuss whether Iran was pursuing such an option.

<sup>22</sup> Highly enriched uranium used in nuclear weapons typically contains about 90 percent uranium-235, whereas low- (continued...)

uranium-conversion facility, which converts uranium oxide into several compounds, including uranium hexafluoride.<sup>23</sup>

Iran claims that it wants to produce LEU fuel for its planned light-water nuclear power reactors, as well as its Tehran Research Reactor (TRR) and other planned future research reactors. The latter reactors will be used to produce isotopes for medical purposes, according to Tehran. Although Iranian officials have expressed interest in purchasing nuclear fuel from other countries, they assert that Tehran should have an indigenous enrichment capability as a hedge against possible fuel supply disruptions.<sup>24</sup> It is worth noting that an Iranian naval commander's June 12, 2012, announcement that Iran "has taken initial steps to design and build power and engine systems for nuclear submarines" may provide Tehran with a rationale for enriching uranium to levels suitable for use as fissile material in nuclear weapons, although the commander did not mention enrichment.<sup>25</sup> Notably, Abbasi stated the next month that, despite Iran's "capability to design nuclear fuel for ships and submarines," the country does not plan to produce enriched uranium containing more than 20% uranium-235.<sup>26</sup>

A heavy-water reactor, which Iran is constructing at Arak, has also been a source of concern. Although Tehran says that the reactor is intended for the production of radioisotopes for medical purposes, it is a proliferation concern because its spent fuel will contain plutonium well-suited for use in nuclear weapons. Spent nuclear fuel from nuclear reactors contains plutonium, the other type of fissile material used in nuclear weapons. In order to be used in nuclear weapons, however, plutonium must be separated from the spent fuel—a procedure called "reprocessing." Iran has said that it will not engage in reprocessing. This reactor is designed to use natural uranium fuel, which does not require enrichment.

In addition to the dual-use nature of the nuclear programs described above, Iran's inconsistent cooperation with the IAEA has contributed to suspicions that Tehran has a nuclear weapons program.<sup>27</sup> In the past, Iran has taken actions that interfered with the agency's investigation of its nuclear program, including concealing nuclear activities and providing misleading statements. Although the IAEA has a more complete picture of Iran's nuclear program since its investigation began in 2002, the agency still wants Tehran to provide more information. Then-IAEA Director-General Mohamed ElBaradei explained in a June 2008 interview that

they [the Iranians] have concealed things from us in the past, but that doesn't prove that they are building a bomb today. They continue to insist that they are interested solely in using nuclear power for civilian purposes. We have yet to find a smoking gun that would prove them wrong. But there are suspicious circumstances and unsettling questions. The Iranians'

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(...continued)

enriched uranium used in nuclear reactors typically contains less than 5% uranium-235.

<sup>23</sup> For a detailed description of the nuclear fuel cycle, see CRS Report RL34234, *Managing the Nuclear Fuel Cycle: Policy Implications of Expanding Global Access to Nuclear Power*, coordinated by Mary Beth Nikitin.

<sup>24</sup> "Soltaniyeh: Iran Has No Alternative But To Enrich Uranium," *Islamic Republic News Agency*, October 2, 2008; Paul Kerr, "U.S. Offers Iran Direct Talks," *Arms Control Today*, June 2006; "Interview with Iran's Ambassador to IAEA," 2008.

<sup>25</sup> "Iran to Make Engine Systems For Nuclear Submarines," *Fars News Agency*, June 12, 2012; "Iran Plans Nuclear-Powered Submarine: Report," *Reuters*, June 12, 2012. Some naval propulsion reactors use weapons-grade HEU.

<sup>26</sup> "Official Underscores Iran's Ability To Produce N. Fuel For Trade Vessels," *Fars News Agency*, July 23, 2012.

<sup>27</sup> For a detailed description of Iran's compliance with its international obligations, see CRS Report R40094, *Iran's Nuclear Program: Tehran's Compliance with International Obligations*, by Paul K. Kerr.



willingness to cooperate leaves a lot to be desired. Iran must do more to provide us with access to certain individuals and documents. It must make a stronger contribution to clarifying the last unanswered set of questions—those relating to a possible military dimension of the Iranian nuclear program.<sup>28</sup>

Consistent with ElBaradei's statement, IAEA Director-General Amano explained in a June 2012 interview that the IAEA has not claimed that "Iran [has] made a decision to obtain nuclear weapons."<sup>29</sup>

## Current Nuclear Controversy

The current public controversy over Iran's nuclear program began in August 2002, when the National Council of Resistance on Iran (NCRI), an Iranian exile group, revealed information during a press conference (some of which later proved to be accurate) that Iran had built nuclear-related facilities at Natanz and Arak that it had not revealed to the IAEA. The United States had been aware of at least some of these activities, according to knowledgeable former officials.<sup>30</sup> During the mid-1990s, Israel's intelligence services detected Iranian "efforts to develop a military nuclear industry," according to a 2004 Israeli Knesset committee report.<sup>31</sup>

States-parties to the nuclear Nonproliferation Treaty (NPT) are obligated to conclude a comprehensive safeguards agreement with the IAEA. In the case of non-nuclear-weapon states-parties to the treaty (of which Iran is one), such agreements allow the agency to monitor nuclear facilities and materials to ensure that they are not diverted for military purposes. As a practical matter, however, the IAEA's ability to inspect and monitor nuclear facilities, as well as obtain relevant information, pursuant to a comprehensive safeguards agreement is limited to facilities that have been declared by the government.<sup>32</sup> Additional Protocols to IAEA safeguards agreements augment the agency's ability to investigate clandestine nuclear facilities and activities by increasing the agency's authority to inspect certain facilities and demand additional information from states-parties.<sup>33</sup> The IAEA's statute requires the agency's Board of Governors to refer cases of non-compliance with safeguards agreements to the U.N. Security Council. Prior to the NCRI's revelations, the IAEA had expressed concerns that Iran had not been providing the agency with all relevant information about its nuclear programs, but had never found Iran in violation of its safeguards agreement.

In fall 2002, the IAEA began to investigate Iran's nuclear activities at Natanz and Arak; inspectors visited the sites the following February. The IAEA board adopted its first resolution, which called on Tehran to increase its cooperation with the agency's investigation and to suspend

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<sup>28</sup> "Interview With IAEA Boss Mohamed ElBaradei," *Der Spiegel*, June 11, 2008.

<sup>29</sup> Jay Solomon and David Crawford, "An Interview With IAEA's Yukiya Amano," *Wall Street Journal*, June 9, 2012.

<sup>30</sup> Gary Samore, Former Senior Director for Nonproliferation and Export Controls on the National Security Council, personal communication June 5, 2008; Director of Central Intelligence George J. Tenet, "DCI Remarks on Iraq's WMD Programs," February 5, 2004.

<sup>31</sup> *Report – Volume 1 (Unrestricted section)*, The Committee of Enquiry into the Intelligence System in Light of the War in Iraq, The Knesset Foreign Affairs and Defence Committee, March 2004.

<sup>32</sup> The IAEA does have other investigative tools, such as monitoring scientific publications from member-states.

<sup>33</sup> NPT states are not required to conclude Additional Protocols. However, applicable U.N. Security Council resolutions require Iran to conclude such a protocol.

its uranium enrichment activities, in September 2003. The next month, Iran concluded an agreement with France, Germany, and the United Kingdom, collectively known as the “E3,” to suspend its enrichment activities, sign and implement an Additional Protocol to its IAEA safeguards agreement, which Tehran concluded in 1974, and comply fully with the IAEA’s investigation.<sup>34</sup> As a result, the IAEA board decided to refrain from referring the matter to the U.N. Security Council.

The IAEA’s investigation, as well as information Tehran provided after the October 2003 agreement, ultimately revealed that Iran had engaged in a variety of clandestine nuclear-related activities, some of which violated Iran’s safeguards agreement. These included plutonium separation experiments, uranium enrichment and conversion experiments, and importing various uranium compounds.

After October 2003, Iran continued some of its enrichment-related activities, but Tehran and the E3 agreed in November 2004 to a more detailed suspension agreement. However, Iran resumed uranium conversion in August 2005 under the leadership of President Ahmadinejad, who had been elected two months earlier. Iran announced in January 2006 that it would resume research and development on its centrifuges at Natanz. In response, the IAEA board adopted a resolution on February 4, 2006, that referred the matter to the Security Council. Two days later, Tehran announced that it would stop implementing its Additional Protocol.

In June 2006, China, France, Germany, Russia, the United Kingdom, and the United States, collectively known as the “P5+1,” presented a proposal to Iran that offered a variety of incentives in return for Tehran taking several steps to assuage international concerns about its enrichment and heavy-water programs.<sup>35</sup> The proposal called on the government to address the IAEA’s “outstanding concerns ... through full cooperation” with the agency’s ongoing investigation of Tehran’s nuclear programs, “suspend all enrichment-related and reprocessing activities,” and resume implementing its Additional Protocol.

Then-European Union High Representative for Common Foreign and Security Policy Javier Solana presented a revised version of the 2006 offer to Iran in June 2008.<sup>36</sup> Representatives from the P5+1 discussed the new proposal with Iranian officials the next month. Iran provided a follow-up response in August 2008, but the six countries deemed it unsatisfactory.<sup>37</sup> Tehran has told the IAEA that it would implement its Additional Protocol “if the nuclear file is returned from the Security Council” to the agency.<sup>38</sup> It is, however, unclear how the council could meet this

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<sup>34</sup> The text of the agreement is available at [http://www.iaea.org/NewsCenter/Focus/IaeaIran/statement\\_iran21102003.shtml](http://www.iaea.org/NewsCenter/Focus/IaeaIran/statement_iran21102003.shtml). Iran signed its Additional Protocol in December 2003, but has not ratified it.

<sup>35</sup> The proposal text is available at [http://armscontrol.org/pdf/20060606\\_Iran\\_P5+1\\_Proposal.pdf](http://armscontrol.org/pdf/20060606_Iran_P5+1_Proposal.pdf). Prior to late May 2006, the United States refused to participate in direct talks with Iran about its nuclear program. In March 2005, Washington had offered some limited incentives for Iran to cooperate with the E3. (See Kerr, *Arms Control Today*, June 2006). For more information about the state of international diplomacy with Iran, see CRS Report RL32048, *Iran: U.S. Concerns and Policy Responses*, by Kenneth Katzman.

<sup>36</sup> The revised proposal text is available at <http://www.auswaertiges-amt.de/diplo/de/Aussenpolitik/Themen/Abruestung/IranNukes/Angebot-e33-080614.pdf>.

<sup>37</sup> Iran had also presented a proposal to the P5+1 in May 2008. See Peter Crail, “Proposals Offered on Iranian Nuclear Program,” *Arms Control Today*, May 2008. The proposal text is available at <http://www.iaea.org/Publications/Documents/Infceircs/2008/infceirc729.pdf>.

<sup>38</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006), 1747 (2007) and 1803 (2008) in the Islamic Republic of Iran*, Report by the Director General, GOV/2008/4, February 22, 2008.

condition. Iran's then-Minister for Foreign Affairs Manouchehr Mottaki told reporters October 7, 2009, that Iran is not discussing ratification of the protocol.<sup>39</sup> Asked in a June 2012 interview whether Tehran would ratify the protocol, Ambassador Ali Asghar Soltanieh, Iran's Permanent Representative to the IAEA, explained that "any possibility for re-adopting the Additional Protocol depends on the resolution of the [nuclear] issues with respect to the U.N. Security Council."<sup>40</sup>

The 2006 offer's requirements are also included in several U.N. Security Council resolutions, the most recent of which, Resolution 1929, was adopted June 9, 2010.<sup>41</sup> However, a May 2012 report from IAEA Director-General Amano to the Security Council and the IAEA board indicated that Tehran has continued to defy the council's demands by continuing work on both its uranium enrichment program and heavy-water reactor program.<sup>42</sup> An August 2012 report from Amano also indicated that Iran's behavior had not changed. Iranian officials maintain that Iran will not suspend its enrichment program.

Iran issued another proposal in early September 2009 which described a number of economic and security issues as potential topics for discussion but only obliquely mentioned nuclear issues and did not explicitly mention Iran's nuclear program.<sup>43</sup>

## **Tehran Research Reactor Discussions<sup>44</sup>**

After an October 1, 2009, meeting in Geneva with the P5+1 and High Representative Solana, Iranian officials repeatedly stated that Tehran would like future discussions about its September 2009 proposal. Nevertheless, during that meeting, Iranian officials agreed in principle to a proposal that would provide fuel enriched to about 20% uranium-235 for Iran's U.S.-supplied Tehran Research Reactor (TRR), which produces medical isotopes and operates under IAEA safeguards. Iran asked the IAEA in a June 2, 2009, letter to provide fresh fuel for its U.S.-supplied TRR. Initially fueled by U.S.-supplied HEU, the reactor was converted to use LEU fuel in 1994 after Argentina agreed to supply the reactor with such fuel in 1987.<sup>45</sup> The reactor is currently running on the Argentinean-supplied fuel, which contains about 20% uranium-235. Subsequent to Iran's June 2009 request, the United States and Russia presented a proposal to the IAEA (which the agency conveyed to Iran) for providing fuel for the reactor.

According to the proposal, Iran would have transferred approximately 1,200 kilograms of its low-enriched uranium hexafluoride to Russia, which would have either enriched the uranium to about

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<sup>39</sup> "Iranian FM: No Discussions on Joining Additional Protocol," *Fars News Agency*, October 7, 2009.

<sup>40</sup> "Envoy: Robust Inspections Confirm Non-Diversion of Iran's N. Program," *FARS News Agency*, June 9, 2012.

<sup>41</sup> The resolution text is available at [http://www.iaea.org/newscenter/focus/iaeaairan/unsc\\_res1929-2010.pdf](http://www.iaea.org/newscenter/focus/iaeaairan/unsc_res1929-2010.pdf). The resolutions also require Iran to suspend work on its heavy water-related projects.

<sup>42</sup> GOV/2009/74.

<sup>43</sup> The proposal text may be found at <http://documents.propublica.org/iran-nuclear-program-proposal#p=1>.

<sup>44</sup> Unless otherwise noted, this section is based on an October 1, 2009, background briefing by senior U.S. officials; ElBaradei's remarks during an October 4, 2009, press conference; an October 13, 2009, French Foreign Ministry briefing; an analyst interview with a U.S. official; Mark Hibbs, "Six Nations Might Place Conditions on Reactor Fuel Supply to Iran," *Nuclear Fuel*, October 5, 2009; "Iran to Provide 20 % Fuel if Probable Deal with West Fails: AEOL," *Iranian Students News Agency*, October 10, 2009; and "Iran Foreign Ministry Spokesman's Weekly News Conference," *Iranian News Network Channel*, October 12, 2009.

<sup>45</sup> This information is contained in a February 18, 2010, letter from Iran to the IAEA (GOV/INF/2010/5).

20% uranium-235 or produced the LEU from Russian-origin uranium. Russia would then have transferred the low-enriched uranium hexafluoride to France for fabrication into fuel assemblies. Finally, France would have transferred the assemblies to Russia for shipment to Iran. France would have delivered the fuel within about one year.<sup>46</sup> Iran had, as of October 30, 2009, produced 1,763 kilograms of low-enriched uranium hexafluoride containing less than 5% uranium-235.<sup>47</sup>

Beginning October 19, 2009, Iranian officials met with officials from the IAEA, France, Russia, and the United States to discuss details of implementing the proposal, such as the fuel price, contract elements, and a timetable for shipping the fuel. Two days later, then-IAEA Director-General ElBaradei announced the conclusion of a “draft agreement,” which was drafted by the IAEA. Although Iran, France, Russia, and the United States held further discussions regarding the proposal’s implementation, they did not reach an agreement with Tehran. Iran resisted transferring all 1,200 kilograms of LEU out of the country before receiving the reactor fuel, arguing that the proposal needed more credible assurances that the fuel would actually be delivered. During the last few months of 2009, Iranian officials did suggest different compromises, such as shipping its LEU out of the country in phases or simultaneously exchanging its LEU for the TRR fuel on an Iranian island or in a third country, but these proposals were not accepted by the United States, France, and Russia.<sup>48</sup>

Further details about the French, Russian, and U.S. proposals later became public.<sup>49</sup> For example, the IAEA had agreed to take formal custody of any Iranian LEU transferred pursuant to a TRR agreement. Additionally, France, Russia, and the United States agreed to a “legally binding Project and Supply Agreement”; to “support technical assistance through the IAEA to ensure” that the TRR would operate safely; and expressed support for allowing Iran to transfer its LEU to a third country, which would hold the LEU in escrow until the TRR fuel was fabricated. The United States also offered “substantial political assurances that the agreement would be fulfilled.” An April 20, 2010, letter from President Obama to President Brazilian President Luis Inácio Lula da Silva stated that the United States had expressed its willingness to “potentially even play a more direct role in the fuel production process,” but did not elaborate.

Notably, the October 2009 IAEA draft did not include an explicit prohibition on Iranian production of uranium enriched to about 20% uranium-235. Instead, the agreement’s proponents thought that the supply of fuel for the TRR would obviate the need for Tehran to produce the fuel on its own.<sup>50</sup> The escrow proposal described in the previous paragraph was not contained in the October 2009 IAEA draft.<sup>51</sup> Whether the other provisions described above were explicitly contained in that draft is unclear because there is no public official copy of it.

Following a November 20, 2009, meeting, the P5+1 issued a joint statement expressing disappointment with Tehran’s failure to respond positively to the TRR proposal. “We have agreed

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<sup>46</sup> These details appeared in a June 2010 letter from France, Russia, and the United States to the IAEA. The text appears in “Text: Powers Dismiss Iran Fuel Offer Before U.N. Vote,” *Reuters*, June 9, 2010.

<sup>47</sup> GOV/2009/74.

<sup>48</sup> See, for example, “Iran Says It Would Swap Nuclear Material With West in Turkey,” *The Associated Press*, December 26, 2009; “Mottaki: Iran Ready for Simultaneous N. Fuel Swap,” *Fars News Agency*, December 26, 2009.

<sup>49</sup> These details are contained in an official February 12, 2010, letter from those three governments to IAEA Director-General Amano.

<sup>50</sup> *Ibid.*

<sup>51</sup> Analyst interview with knowledgeable U.S. official, June 16, 2010.

to remain in contact and expect a further meeting soon to complete our assessment of the situation and to decide on our next steps,” the statement said. Although some subsequent Iranian statements suggested that Iran was still open to some version of the IAEA proposal,<sup>52</sup> Tehran never officially accepted it. Iranian officials have stated that Iran is willing to purchase the fuel, but have also said that, absent an agreement with international suppliers, Tehran will produce its own TRR fuel.<sup>53</sup> Although, as discussed below, Iran has manufactured fuel for the reactor, whether Iran can produce sufficient amounts of fuel of acceptable quality is unclear.<sup>54</sup>

Following a May 17, 2010, meeting of Iranian President Ahmadinejad, Turkish Prime Minister Recep Tayyip Erdogan, and Brazilian President Lula, Iran did accept a proposal, known as the Tehran Declaration, for supplying the TRR with fuel.<sup>55</sup> Iran conveyed its acceptance of the declaration in a May 24, 2010, letter to the IAEA. The Tehran Declaration contained some of the same elements as the October 2009 IAEA draft proposal and other elements described in a February 12, 2010, letter to the IAEA. For example, the declaration stated that Iran would be willing to “deposit” 1,200 kilograms of LEU in Turkey. Iran would deposit the fuel, which would be subject to IAEA monitoring in Turkey, “not later than one month” after reaching an agreement regarding the details of the exchange with France, Russia, the United States, and the IAEA. However, unlike the IAEA draft proposal, the declaration did not mention an ultimate destination for the LEU to be deposited in Turkey. As noted, Tehran had resisted transferring all 1,200 kilograms of LEU out of the country before receiving fuel for the TRR.

IAEA Director-General Amano told the agency’s Board of Governors June 7, 2010, that he had “immediately conveyed Iran’s letter” to France, Russia, and the United States “and asked for their views.” Those three governments responded to the IAEA two days later with letters and a joint paper titled “Concerns about the Joint Declaration Conveyed by Iran to the IAEA.”<sup>56</sup> The paper conveyed several reservations about the Tehran Declaration, but did not reject it outright. For a discussion about the declaration and the French, Russian, and U.S. paper, see **Appendix A**.

Iran and the P5+1 met in December 2010 and January 2011, but the two meetings, held in Geneva and Istanbul, respectively, produced no results. In April 2012, the two sides resumed talks in Istanbul. Since then, Iran and the P5+1 have held two rounds of talks—a May meeting in Baghdad and a June meeting in Moscow. Additionally, the two sides held expert-level discussions in Istanbul on July 3 and Iranian Supreme National Security Council Undersecretary Ali Baqeri and Deputy Secretary General of the European External Action Service Helga Schmid met in Istanbul on July 24.

Following the April 2012 talks, the P5+1 stated that the process of inducing Iranian compliance with “all its international obligations” would be “guided by the principle of the step-by-step approach and reciprocity.”<sup>57</sup> The P5+1 presented their proposal the next month during the

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<sup>52</sup> See, for example, Iran’s February 18, 2010, letter to the IAEA.

<sup>53</sup> “Spokesman: Iran Waiting for 5+1 Response to N. Fuel Swap,” *Fars News Agency*, December 24, 2009.

<sup>54</sup> David Albright and Jacqueline Shire, *Iran’s Recent Statements about Production of Fuel for the Tehran Research Reactor: A Quick Review*, Institute for Science and International Security, February 8, 2010.

<sup>55</sup> The text is available at [http://www.brazil.gov.br/news/history/2010/05/17/joint-declaration-by-iran-turkey-and-brazil?set\\_language=en](http://www.brazil.gov.br/news/history/2010/05/17/joint-declaration-by-iran-turkey-and-brazil?set_language=en).

<sup>56</sup> The text appears in “Text: Powers Dismiss Iran Fuel Offer Before U.N. Vote,” *Reuters*, June 9, 2010.

<sup>57</sup> This paragraph is based on the following sources: Kelsey Davenport, “Iran, P5+1 Move to Technical Talks,” *Arms Control Today*, July/August 2012; Kelsey Davenport, “P5+1 and Iran Claim Progress in Talks,” *Arms Control Today*, June 2012; Kelsey Davenport, *History of Official Proposals on the Iranian Nuclear Issue*, Arms Control Association, (continued...)

Baghdad meeting. The six governments demanded that Tehran end its production of enriched uranium containing approximately 20% uranium-235; ship to a third country Iran's stockpile of uranium enriched to this level (this uranium would be under IAEA monitoring); halt enriching uranium, as well as installing centrifuges and centrifuge components, at the Fordow facility; and cooperate fully with the IAEA's investigation. Ashton stated on May 24, 2012, that the P5+1 "put ideas on the table on reciprocal steps we would be prepared to take." These included

- refraining from imposing new sanctions on Iran;
- facilitating Iranian access to spare aircraft parts, as well as safety and repair inspections;
- providing fuel for the TRR;
- supporting IAEA technical cooperation regarding the TRR's safety;
- providing medical isotopes to Tehran;
- potentially reviewing suspended IAEA technical cooperation projects with Iran;<sup>58</sup> and
- cooperating on Tehran's acquisition of a light-water reactor for producing radioisotopes.

## Iran's Cooperation with the IAEA

### Possible Military Dimensions

Iran and the IAEA agreed in August 2007 on a work plan to clarify the outstanding questions regarding Tehran's nuclear program.<sup>59</sup> Most of these issues,<sup>60</sup> which had contributed to suspicions that Iran had been pursuing a nuclear weapons program, have essentially been resolved, but then-IAEA Director-General ElBaradei told the IAEA Board of Governors June 2, 2008, that there is "one remaining major [unresolved] issue," which concerns questions regarding "possible military dimensions to Iran's nuclear programme."

Iran and the IAEA have had a series of discussions regarding these issues. The agency has provided Iran with documents or, in some cases, descriptions of documents which had been provided to the IAEA by several governments. The documents indicated that Iranian entities may

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(...continued)

August 2012; *The P5+1, Iran and the Perils of Nuclear Brinkmanship*, International Crisis Group Middle East Briefing, June 15, 2012; "Text of statement by EU's Ashton After Iran Talks," *Reuters*, May 24, 2012; Jay Solomon, "Iran, U.S. Agree Only to Resume Their Talks Next Month," *Wall Street Journal*, May 24, 2012; Paul Richter, "Iran, World Powers Clash At Latest Talks; Tehran Says The Six Nations Haven't Given It A 'Balanced' Offer On Its Nuclear Program," *Los Angeles Times*, May 24, 2012; "Full Text of Iran's Proposals to Six World Powers in Moscow Talks," *Fars News Agency*, July 7, 2012.

<sup>58</sup> These are apparently the same technical cooperation projects which the IAEA Board of Governors suspended in 2007.

<sup>59</sup> The text of the work plan is available at <http://www.iaea.org/Publications/Documents/Infocircs/2007/infocirc711.pdf>.

<sup>60</sup> These issues included plutonium experiments, research and procurement efforts associated with two types of centrifuges, operations of a uranium mine, and experiments with polonium-210, which (in conjunction with beryllium) is used as a neutron initiator in certain types of nuclear weapons.

have conducted studies related to nuclear weapons development. The subjects of these studies included uranium conversion, missile reentry vehicles for delivering nuclear warheads, and conventional explosives used in nuclear weapons. Iranian officials have claimed that the documents are not authentic,<sup>61</sup> but ElBaradei told the IAEA board on June 17, 2009, that “there is enough in these alleged studies to create concern in the minds of our professional inspectors.” Iranian officials have acknowledged that some of the information in the documents is accurate, but argued that the activities described were exclusively for non-nuclear purposes, ElBaradei reported in May 2008.<sup>62</sup> Tehran has provided some relevant information about these matters to the IAEA, but ElBaradei reported in August 2009 that the government should “provide more substantive responses” to the IAEA, as well as “the opportunity to have detailed discussions with a view to moving forward on these issues, including granting the agency access to persons, information and locations identified in the documents.”<sup>63</sup>

More recently, IAEA Director-General Amano issued a report to the IAEA board in November 2011 which stated that “Iran has not engaged with the agency in any substantive way” on the alleged studies since August 2008.<sup>64</sup> During a February 20-21, 2012, meeting between IAEA and Iranian officials, Iran provided “an initial declaration” regarding the possible nuclear weapons activities discussed in the November 2011 report. This declaration “dismissed the Agency’s concerns in relation to the aforementioned issues, largely on the grounds that Iran considered them to be based on unfounded allegations,” Amano reported.<sup>65</sup>

Amano’s November 2011 report provided the most detailed account to date of the IAEA’s evidence regarding Iran’s suspected nuclear weapons-related activities. According to the report, the agency has “credible” information that Iran has carried out activities “relevant to the development of a nuclear explosive device.” These include acquisition of “nuclear weapons development information and documentation,” work to develop “an indigenous design of a nuclear weapon including the testing of components,” efforts “to procure nuclear related and dual use equipment and materials by military related individuals and entities,” and work to “develop undeclared pathways for the production of nuclear material.” Although some of these activities have civilian applications, “others are specific to nuclear weapons,” the report notes. Most of

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<sup>61</sup> In a September 28, 2008, letter to the IAEA, Iran described some characteristics of the documents discussed above. The letter stated that some of the information from the United States was shown to Iranian officials as PowerPoint presentations. Additionally, some of the documents are “in contradiction with typical standard Iranian documentation” and lack “classification seals,” the letter said. See, Permanent Mission of the Islamic Republic of Iran, *Explanatory Comments by the Islamic Republic of Iran on the Report of the IAEA Director General to the September 2008 Board of Governors* (GOV/2008/38), September 28, 2008. INFCIRC/737. Iran has complained that the IAEA has not provided Tehran with original versions of some documentation related to the alleged “military dimensions” of Iran’s nuclear program. Several reports from ElBaradei have stated that the agency has not had permission to provide this documentation from the governments which provided it. In his November 2009 report, ElBaradei again called on such governments to authorize the IAEA to share additional information with Iran.

<sup>62</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006), 1747 (2007) and 1803 (2008) in the Islamic Republic of Iran*, Report by the Director General, GOV/2008/15, May 26, 2008.

<sup>63</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006), 1747 (2007), 1803 (2008) and 1835 (2008) in the Islamic Republic of Iran*, Report by the Director General, GOV/2009/55, August 28, 2009.

<sup>64</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran*, GOV/2011/65, November 8, 2011.

<sup>65</sup> *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/2012/9, February 24, 2012.

these activities were conducted before the end of 2003, though some may have continued. (See **Appendix B** and “Nuclear Weapon Development Capabilities”) for more details.

The IAEA Board of Governors adopted a resolution November 18, 2011, stating that “it is essential” for Iran and the IAEA “to intensify their dialogue aiming at the urgent resolution of all outstanding substantive issues.” Since then, the agency has not made any substantive progress on these matters. However, beginning in January 2012, IAEA and Iranian officials have held five meetings, one of which included Director-General Amano, to devise a procedure for resolving these issues. The two sides have discussed what the IAEA has termed a “structured approach to the clarification of all outstanding issues related to Iran’s nuclear programme.”<sup>66</sup> According to the agency, this approach includes “issues to be addressed, initial actions and modalities” and is designed to ensure that Iran will provide “access for the Agency to all relevant information, documentation, sites, material and personnel.”<sup>67</sup> The approach is also designed to address “Iran’s security concerns”;<sup>68</sup> Tehran has previously expressed concern to the IAEA that resolving some of the outstanding issues would require agency inspectors to have “access to sensitive information related to its conventional military and missile related activities.”<sup>69</sup> IAEA and Iranian officials discussed the “structured approach” on August 24, 2012, but the two sides did not reach an agreement.

### ***Parchin***

Parchin is an Iranian military site. As part of its investigation into “possible military dimensions” of Iran’s nuclear program, the IAEA wants Tehran to respond to information which the agency obtained from unnamed governments indicating that in 2000 “Iran constructed a large explosives containment vessel” at Parchin in which to conduct experiments related to the development of nuclear weapons, according to Amano’s November 2011 report.<sup>70</sup> The report does not say whether Iran actually built the vessel or conducted these experiments at Parchin. Iran, according to a May 2012 report from Amano, has argued that granting IAEA inspectors access to Parchin “would not be possible before agreement had been reached” on the investigative approach described above. IAEA inspectors visited the site twice in 2005, but did not visit the location “now believed to contain the building which houses the explosives chamber.”<sup>71</sup> Amano told reporters on August 22, 2012, that apparent Iranian efforts to remove evidence of past nuclear-related activities could “hamper our verification activities.”<sup>72</sup> These activities have included “moving soil, demolishing buildings, using water, removing fences, [and] doing landscape activities,” he said. For more information about the Parchin site, see **Appendix B**.

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<sup>66</sup> *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/2012/23, May 25, 2012.

<sup>67</sup> *Ibid.*

<sup>68</sup> *Ibid.*

<sup>69</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006), 1747 (2007) and 1803 (2008) in the Islamic Republic of Iran*, GOV/2008/38, September 15, 2008.

<sup>70</sup> GOV/2011/65.

<sup>71</sup> *Ibid.*

<sup>72</sup> “IAEA Head ‘Not Optimistic’ on Access to Iran Military Site,” *Reuters*, August 22, 2012.



## Other Issues

Despite the apparent stalemate over the issues described in the previous section, Iran has cooperated with the IAEA in other respects, albeit with varying consistency. The IAEA has been able to verify that Iran's declared nuclear facilities and materials have not been diverted for military purposes.<sup>73</sup> Moreover, Tehran has provided the agency with "information similar to that which Iran had previously provided pursuant to the Additional Protocol," ElBaradei reported to the IAEA board in February 2008, adding that this information clarified the agency's "knowledge about Iran's current declared nuclear programme."<sup>74</sup> Iran, however, provided this information "on an ad hoc basis and not in a consistent and complete manner," the report said. Indeed, the IAEA requested in April 2008 that Iran provide "as a transparency measure, access to additional locations related ... to the manufacturing of centrifuges, R&D on uranium enrichment, and uranium mining."<sup>75</sup> Tehran has never agreed to do so, however.

ElBaradei's February 2008 report underscored the importance of full Iranian cooperation with the IAEA investigation, as well as Tehran's implementation of its Additional Protocol:

Confidence in the exclusively peaceful nature of Iran's nuclear programme requires that the Agency be able to provide assurances not only regarding declared nuclear material, but, equally importantly, regarding the absence of undeclared nuclear material and activities in Iran.... Although Iran has provided some additional detailed information about its current activities on an ad hoc basis, the Agency will not be in a position to make progress towards providing credible assurances about the absence of undeclared nuclear material and activities in Iran before reaching some clarity about the nature of the alleged studies, and without implementation of the Additional Protocol.<sup>76</sup>

The IAEA has also asked Iran to "reconsider" its March 2007 decision to stop complying with a portion of the subsidiary arrangements for its IAEA safeguards agreement.<sup>77</sup> That provision, to which Iran agreed in February 2003, requires Tehran to provide design information for new nuclear facilities "as soon as the decision to construct, or to authorize construction, of such a facility has been taken, whichever is earlier." Previously, Iran was required to provide design information for a new facility 180 days before introducing nuclear material into it.<sup>78</sup> If Tehran does not alter this decision, the agency will receive considerably later notice about the construction of future Iranian nuclear facilities. Indeed, invoking its March 2007 decision, Iran withheld from the IAEA until September 2009 "preliminary design information" for the planned Darkhovin reactor; the agency first requested the information in December 2007. Tehran has also refused to provide updated design information for the Arak reactor—a decision which, according to Amano's May 2012 report, "is now having an adverse impact on the Agency's ability to effectively verify the design of the facility."

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<sup>73</sup> GOV/2012/23.

<sup>74</sup> GOV/2008/4.

<sup>75</sup> GOV/2008/15.

<sup>76</sup> GOV/2008/4.

<sup>77</sup> According to the 2001 IAEA Safeguards Glossary, subsidiary arrangements describe the "technical and administrative procedures for specifying how the provisions laid down in a safeguards agreement are to be applied."

<sup>78</sup> For more detail about Iran's safeguards obligations and reporting requirements, see CRS Report R40094, *Iran's Nuclear Program: Tehran's Compliance with International Obligations*.

Iran had also refused to allow IAEA officials to conduct an inspection of the Arak reactor in order to verify design information that Tehran provided to the agency. ElBaradei argued in a June 2009 report to the IAEA board that this continued refusal “could adversely impact the Agency’s ability to carry out effective safeguards at that facility,” adding that satellite imagery is insufficient because Iran has completed the “containment structure over the reactor building, and the roofing for the other buildings on the site.” However, IAEA inspectors visited the reactor facility in August 2009 to verify design information, according to ElBaradei’s report issued the same month; IAEA inspectors had last visited the reactor in August 2008. Inspectors have visited the facility several more times, according to reports from Amano.

In addition, Iran failed to notify the IAEA until September 2009 that it was constructing a uranium enrichment facility, called the Fordow Fuel Enrichment Plant, near the city of Qom. Iran revealed in September 2009 that it had been constructing the facility and provided some details about it to the IAEA in a September 21, 2009, letter. Four days after the IAEA received the letter, British, French, and U.S. officials revealed that they had previously developed intelligence on the facility. The three governments provided a detailed intelligence briefing to the IAEA after the agency received Iran’s letter. U.S. officials have said that, despite its letter to the agency, Iran intended for the facility to be kept secret. Tehran placed the facility under IAEA safeguards after its September 2009 letter. (For more details about the facility, see the “Fordow Enrichment Facility” section below).

In a letter published on October 1, 2009, the IAEA asked Iran to provide additional information about the facility, including “further information with respect to the name and location of the pilot enrichment facility, the current status of its construction and plans for the introduction of nuclear material into the facility.” The letter also requested that Tehran provide IAEA inspectors with access to the facility “as soon as possible.” IAEA officials inspected the facility and met with Iranian officials in late October 2009. According to a November 2009 report from ElBaradei to the IAEA board, Tehran “provided access to all areas of the facility,” which “corresponded with the design information provided by Iran” a week before the visit. IAEA officials have since conducted regular inspections of the facility. Although Iran provided additional design information about the facility to the IAEA, the agency still had questions about the facility’s “purpose and chronology” and wished to interview other Iranian officials and review additional documentation, according to ElBaradei’s report. Amano reported in May 2012 that Iran has provided the IAEA with some requested information regarding the Fordow construction decision, but the agency still wants more information from Tehran. ElBaradei told the IAEA board November 26, 2009, that “Iran’s late declaration of the new facility reduces confidence in the absence of other nuclear facilities under construction in Iran which have not been declared to the Agency.”

The IAEA has also requested additional information about Iran’s production of heavy water. As noted, Iran is constructing a heavy-water nuclear reactor. ElBaradei’s November 2009 report states that, during an inspection of Iran’s uranium conversion facility the previous month, IAEA inspectors “observed 600 50-litre drums said by Iran to contain heavy water.”<sup>79</sup> The inspectors visited the facility in order to verify updated design information submitted by Iran in August 2009 and observed the drums after gaining access to an area of the facility which agency inspectors had not previously visited.<sup>80</sup> Tehran has told the IAEA that the water originated in Iran and has

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<sup>79</sup> GOV/2009/74.

<sup>80</sup> CRS analyst interview with a U.S. official, December 17, 2009.

permitted agency inspectors to count the number of drums and to weigh a “small number of randomly selected drums.”<sup>81</sup> But Tehran has not permitted the agency to take samples of the heavy water.<sup>82</sup> Moreover, the government has not granted repeated IAEA requests for “further access” to Iran’s heavy- water production plant—a facility which agency inspectors have not visited since August 2011.<sup>83</sup>

The IAEA is also attempting to resolve a discrepancy discovered during an August 2011 inspection of an Iranian research laboratory that had been used to conduct uranium conversion experiments. IAEA measurements revealed that Iran had overstated the amount of material in the facility, described in Amano’s November 2011 report as “natural uranium metal and process waste,” by almost 20 kilograms.<sup>84</sup> Iran and the IAEA are working to resolve the discrepancy, according to Amano’s August 2012 report.

## **Status of Iran’s Nuclear Facilities**

Some non-governmental experts and former U.S. officials have argued that, rather than producing fissile material for nuclear weapons indigenously, Iran could obtain such material from foreign sources.<sup>85</sup> A November 2007 National Intelligence Estimate (NIE) states that the intelligence community “cannot rule out that Iran has acquired from abroad—or will acquire in the future—a nuclear weapon or enough fissile material for a weapon.”<sup>86</sup> Similarly, during a press briefing that same day, a senior intelligence official characterized such acquisition as “an inherent option” for Iran.<sup>87</sup> However, Tehran’s potential ability to produce its own fissile material highly is a greater cause of concern; the official explained that “getting bits and pieces of fissile material from overseas is not going to be sufficient” to produce a nuclear arsenal.<sup>88</sup> As noted, uranium enrichment facilities can produce highly-enriched uranium (HEU), which is one of the two types of fissile material used in nuclear weapons. The other type is plutonium, which is separated from spent nuclear reactor fuel.

## **Uranium Enrichment Facilities**

Iran is enriching uranium in three centrifuge facilities: a pilot centrifuge facility and a larger commercial facility, both located at Natanz, and a centrifuge facility located near the city of Qom. Iran also has a variety of facilities and workshops involved in the production of centrifuges and

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<sup>81</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006), 1747 (2007), 1803 (2008) and 1835 (2008) in the Islamic Republic of Iran*, Report by the Director General, GOV/2010/10, February 18, 2010.

<sup>82</sup> GOV/2012/23.

<sup>83</sup> *Ibid.*

<sup>84</sup> GOV/2011/65.

<sup>85</sup> See, for example, then-Undersecretary of State for U.S. Arms Control And International Security Robert Joseph’s testimony before the Senate Committee on Foreign Relations, February 9, 2006, and then-Director of Research Institute for National Strategic Studies National Defense University Stephen Cambone’s testimony before the Senate Committee on Governmental Affairs, September 21, 2000.

<sup>86</sup> *Iran: Nuclear Intentions and Capabilities*, National Intelligence Estimate, November 2007.

<sup>87</sup> “Unclassified Key Judgments of the National Intelligence Estimate: Iran: Nuclear Intentions and Capabilities,” Background Briefing with Senior Intelligence Officials, December 3, 2007.

<sup>88</sup> *Ibid.*

related components. (See **Appendix C** and CRS Report R42443, *Israel: Possible Military Strike Against Iran's Nuclear Facilities*, coordinated by Jim Zanotti.)

## Natanz Commercial Facility

The commercial facility is eventually to hold more than 47,000 centrifuges.<sup>89</sup> Former Vice President Gholamreza Aghazadeh, who also headed Iran's Atomic Energy Organization until July 2009, explained in February of that year that Iran's goal is to install all of the centrifuges by 2015.<sup>90</sup> Iran began enriching uranium in the facility after mid-April 2007; as of August 6, 2012, Tehran had produced an estimated total of 6,876 kilograms of low-enriched uranium hexafluoride containing up to 5% uranium-235. This quantity of LEU, if further enriched, could theoretically produce enough HEU for at least five nuclear weapons.<sup>91</sup><sup>92</sup> However, an Iranian attempt to enrich this LEU would likely be detected by the IAEA.

Individual centrifuges are linked together in cascades; each cascade in the commercial facility contains either 164 or 174 centrifuges. According to IAEA Director-General Amano's August 2012 report, Iran was, as of August 21, 2012, feeding uranium hexafluoride into 54 cascades (9,156 centrifuges)<sup>93</sup> of first generation (IR-1) centrifuges and had installed another cascade. Tehran is also installing additional IR-1 centrifuges in the facility.<sup>94</sup>

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<sup>89</sup> GOV/2008/15. According to this report, Iran is planning to install 16 cascade units, each containing 18 164-centrifuge cascades. Tehran has also told the agency that it intends to install over 50,000 centrifuges; see *Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran*, Report by the Director-General, GOV/2004/83. Gholamreza Aghazadeh, who headed Iran's Atomic Energy Organization, also said in February 2009 that Iran would install 50,000 centrifuges ("Iran to Follow Nuclear Timetable Regardless of IAEA Reports – Official," *Islamic Republic of Iran News Network*, February 25, 2009).

<sup>90</sup> *Islamic Republic of Iran News Network*, February 25, 2009.

<sup>91</sup> David Albright, Christina Walrond, Andrea Stricker, and Robert Avagyan, *ISIS Analysis of IAEA Iran Safeguards Report: Iran's Refusal for Access to Parchin Hindering Effective Verification; Little Hope for Structured Agreement to Resolve Issues on Iran's Past and Possibly On-Going Military Activities; Rate of 20% LEU Production Increases but the Number of Cascades Producing the Material Remains Constant; Number of Installed Centrifuges at Fordow Doubles; Production of 3.5% Enriched Uranium Increases Slightly; Advanced Centrifuge Program Still Troubled and Makes No Visible Progress*, Institute for Science and International Security, August 30, 2012. Based on David Albright, Andrea Stricker, and Christina Walrond, *ISIS Analysis of IAEA Iran Safeguards Report: Production of 3.5% Enriched Uranium Increases Significantly; Iran Continues to Increase its Stock of 19.75% LEU; Rapid Installation of Large Numbers of IR-1 Centrifuge Outer Casings Not a Prelude to Dramatically Increased Centrifuge Deployment at Natanz or Fordow; Advanced Centrifuge Program Still Troubled But Makes Some Progress*, Institute for Science and International Security, May 25, 2012, and calculations from *Iran's Nuclear, Chemical, and Biological Capabilities: A Net Assessment*, International Institute for Strategic Studies, 2011, p.72. The latter report points out that Iran would likely need to produce more uranium-235 in order to produce its first nuclear weapon because "the fabrication of an initial bomb would involve an amount of unavoidable wastage" (p.69).

<sup>92</sup> The IAEA term for this amount of uranium is "significant quantity," defined as the "approximate amount of nuclear material for which the possibility of manufacturing a nuclear explosive device cannot be excluded." That amount is 25 kilograms of uranium-235 (approximately 27.8 kilograms of uranium containing 90 percent uranium-235). Some types of weapons could be developed using less uranium-235.

<sup>93</sup> Some of the cascades that were being fed with feedstock may not have been working, according to Amano's August 2012 report.

<sup>94</sup> GOV/2012/23.

## **Natanz Pilot Facility**

Iran began enriching uranium up to 20% uranium-235 in the Natanz pilot facility in February 2010 and, as of August 21, 2012, had produced approximately 124.1 kilograms of the material. Tehran has stated that this enriched uranium is to serve as fuel in Iran's Tehran Research Reactor (TRR), as well as future such research reactors.<sup>95</sup> Fereyduun Abbasi-Davani, Head of Iran's Atomic Energy Organization of Iran, stated in an April 2012 interview that, once Iran has "enough" uranium enriched to this level, the country will use its enrichment facilities to produce enriched uranium containing 3.5% uranium-235.<sup>96</sup>

Additionally, Iran is testing two types of more-advanced centrifuges in the pilot facility; these centrifuges could increase the other enrichment facilities' capacity.<sup>97</sup> But the development of new centrifuges has apparently been less successful than Tehran's development of its IR-1 centrifuge;<sup>98</sup> past estimates from Iranian officials regarding the deployment of more-advanced centrifuges have been excessively optimistic.<sup>99</sup> According to a 2012 report from a U.N. Panel of Experts, the advanced centrifuge program's lack of success "may be the result of sanctions limiting" Tehran's "ability to procure items necessary for its centrifuge programme," as well as "[o]ther variables, including design and manufacturing limitations, or a shortage of other necessary materials."<sup>100</sup>

## **Fordow Enrichment Facility<sup>101</sup>**

Iran began enriching uranium in the Fordow Fuel Enrichment Plant in December 2011, according to IAEA reports. Iran had, as of August 12, 2012, enriched approximately 65 kilograms of uranium enriched up to 20% uranium-235 in the facility<sup>102</sup> and was feeding uranium hexafluoride into four cascades (696 centrifuges) of IR-1 centrifuges. Iran had installed a total of 2,140 IR-1 centrifuges in the facility. Tehran plans to install a total of 16 cascades containing approximately 3,000 centrifuges in the plant. Although Iran has only produced uranium enriched to

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<sup>95</sup> *Ibid.* Iran will need to provide fuel for "at least 4 other research reactors," according to the text of a June Iranian proposal to the P5+1 ("Full Text of Iran's Proposals to Six World Powers in Moscow Talks," *Fars News Agency*, July 7, 2012). Abbasi stated in an April 2012 interview that Iran plans to design and build another 10 megawatt "strong pool reactor" reactor. He indicated that the reactor would also use fuel enriched to the level of the TRR fuel, but provided no additional details ("Nuclear Chief: Iran Sees No Reason For Suspending Fordo Activities," *Iranian Students News Agency*, April 8, 2012).

<sup>96</sup> *Iranian Students News Agency*, April 8, 2012.

<sup>97</sup> GOV/2012/23. Iran has experimented with a variety of advanced centrifuges. A June 2009 report from ElBaradei stated that Iran was testing four other more-advanced centrifuges; Iran informed the IAEA in February 2012, according to a report from Amano issued that month.

<sup>98</sup> Analyst interview with U.S. official, June 25, 2009; "Iran May Be 'Struggling' with New Nuclear Machines," *Reuters*, February 28, 2012.

<sup>99</sup> For example, then-Atomic Energy Organization head Aghazadeh indicated in February 2009 that at least one new type of centrifuge would be installed in the "near future" (*Islamic Republic of Iran News Network*, February 25, 2009). Then-Atomic Energy Organization head Salehi stated in a December 2009 interview that Iran hopes to have the new types of centrifuges operational by early 2011. ("Iran to Produce New Generation of Centrifuges - Nuclear Chief," *Fars News Agency*, December 18, 2009.)

<sup>100</sup> *Final Report of the Panel of Experts Established Pursuant to Resolution 1929 (2010)*, S/2012/395, June 12, 2012.

<sup>101</sup> Unless otherwise noted, this section is based on a September 21, 2009, letter from Iran to the IAEA and September 25, 2009, background briefings from U.S. officials, along with associated Obama Administration talking points.

<sup>102</sup> GOV/2012/23.

approximately 20% uranium-235, Tehran has told the IAEA that the facility will be configured to produce both uranium enriched to 5% uranium-235 and 20% uranium-235. Iran has installed only IR-1 centrifuges in the facility, but has told the IAEA that “the facility could be reconfigured to contain centrifuges of more advanced types should Iran take a decision to use such centrifuges in the future.”<sup>103</sup>

As noted, Iran revealed in September 2009 that it had been constructing the facility; Tehran provided some details that month about the facility to the IAEA. The United States had been “observing and analyzing the facility for several years,” according to September 25, 2009, Obama Administration talking points, which added that “there was an accumulation of evidence” earlier in 2009 that the facility was intended for enriching uranium. Some of this evidence apparently indicated that “Iran was installing the infrastructure required for centrifuges earlier” in 2009. U.S. officials have not said exactly when Iran began work on the facility, which is “located in an underground tunnel complex on the grounds of an Islamic Revolutionary Guard Corps” base near the Iranian city of Qom. Nevertheless, the Atomic Energy Organization of Iran, rather than the Iranian military, is responsible for the development and management of the facility, according to September 2009 U.S. government talking points.

According to a November 2009 report from former IAEA Director-General ElBaradei, Iran informed the IAEA that construction on the site began in the second half of 2007.<sup>104</sup> However, the agency has information that appears to contradict Tehran’s claim and has asked Iran to provide more information about the facility’s chronology.<sup>105</sup>

U.S. officials have suggested that the facility may have been part of a nuclear weapons program. President Obama stated on September 25, 2009, that “the size and configuration of this facility is inconsistent with a peaceful program.” But the Administration’s talking points were somewhat more vague, stating that the facility “is too small to be viable for production of fuel for a nuclear power reactor,” although it “could be used” for centrifuge research and development or “configured to produce weapons-grade uranium.” The facility “would be capable of producing approximately one weapon’s worth” of HEU per year, according to the talking points.<sup>106</sup>

Iran’s failure to inform the IAEA of the Fordow plant’s existence until well after Tehran had begun constructing it has raised concerns that the country may have other covert nuclear facilities. A November 2009 IAEA Board of Governors resolution stated that Iran’s declaration of the Fordow facility “reduces the level of confidence in the absence of other nuclear facilities and gives rise to questions about whether there are any other [undeclared] nuclear facilities under construction in Iran.” More recently, UK Foreign Office Minister Alistair Burt told Parliament in February 2012 that the Fordow facility “which Iran initially kept secret from the IAEA, also

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<sup>103</sup> GOV/2009/74.

<sup>104</sup> *Ibid.*

<sup>105</sup> Majlis speaker Ali Larijani, who was formerly Iran’s lead nuclear negotiator, indicated September 27, 2009, that Iran had been constructing the facility for approximately three years. (“Iran Speaker Says Country has Fully Mastered Nuclear Technology,” *Islamic Republic News Agency*, September 27, 2009).

<sup>106</sup> Such estimates depend on several variables, including the number and type of centrifuges used, as well as the degree to which the uranium hexafluoride feedstock is enriched. This particular estimate appears to assume the use of 3,000 IR-1 centrifuges; the other assumed parameters are unclear. For more information on the facility’s potential weapons-grade HEU production capability, see *Iran’s Nuclear, Chemical and Biological Capabilities: A Net Assessment*, February 2011, p.67.

raises our concerns that there may also be other, undeclared sites in Iran that could be engaged in work” related to nuclear weapons.<sup>107</sup>

Tehran’s shifting explanations regarding the facility’s purpose have also raised concerns that Iran may use it in the future to produce fissile material for nuclear weapons. Iran’s 2009 letter to the IAEA described the Fordow facility as a “new pilot fuel enrichment plant” that would produce uranium enriched to no higher than 5% uranium-235. Tehran has since changed the plant’s stated purpose several times. As noted, Tehran has most recently told the IAEA that the facility will be configured to produce both uranium enriched to 5% uranium-235 and 20% uranium-235. Apparently suggesting that Iran might later produce uranium containing higher levels of uranium-235, a U.S. official told the IAEA Board of Governors March 8, 2012, that “[w]e cannot help but wonder ... whether Iran has finally informed us of the ultimate purpose of this facility.”<sup>108</sup>

For its part, Iran has asserted that the facility is for peaceful purposes and that the government has acted in accordance with its international obligations. As noted, Tehran argues that it is producing enriched uranium containing up to 20% uranium-235 for use as fuel in research reactors, which will be used to produce isotopes for medical purposes. Regarding the facility’s secret nature, Iranian officials have argued that Tehran was not previously obligated to disclose it to the IAEA.<sup>109</sup> Furthermore, Iranian officials have stated on several occasions that the facility was concealed in order to protect it from military attacks.<sup>110</sup> Moreover, Iran told the IAEA in 2009 that the Fordow facility is to serve as a “contingency enrichment plant, so that the enrichment activities shall not be suspended in the case of any military attack.”<sup>111</sup> The Natanz commercial facility “was among the targets threatened with military attacks,” Iran explained. Moreover, Iranian officials stated during a June 2012 meeting with the P5+1 that the Fordow facility is “not a military base” and is “not located on a military base.”<sup>112</sup>

### **Enriched Uranium Containing Up To 20 Percent Uranium-235**

As noted, Iran argues that it is producing uranium enriched up to 20% uranium-235 for use in research reactors; as of mid-May 2012, Tehran had used the Natanz commercial facility and the Fordow facility to produce a total of 189.4 kilograms of the material, approximately 96 kilograms of which has been converted for use as fuel in the Tehran Research Reactor or is being prepared for that purpose. However, the production of uranium enriched to this level is potentially significant because relatively little additional effort would be required to use this uranium to produce weapons-grade enriched uranium (which contains about 90% uranium-235). Nevertheless, Director of National Intelligence James Clapper suggested during a February 16, 2012, Senate Armed Services Committee hearing that “a number of factors” could impede Tehran’s ability to produce weapons-grade HEU from uranium enriched to 20% uranium-235.

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<sup>107</sup> “Written Answers to Questions,” *Daily Hansard*, February 7, 2012.

<sup>108</sup> “U.S. Statement to the Board of Governors on Iran,” March 8, 2012.

<sup>109</sup> For more information, see CRS Report R40094, *Iran’s Nuclear Program: Tehran’s Compliance with International Obligations*, by Paul K. Kerr.

<sup>110</sup> See, for example, “Iranian Nuclear Negotiator Says 5+1 Talks ‘Positive,’” *Islamic Republic of Iran News Network*, October 1, 2009.

<sup>111</sup> GOV/2009/74.

<sup>112</sup> “Full Text of Iran’s Proposals to Six World Powers in Moscow Talks,” *Fars News Agency*, July 7, 2012.

Only approximately 91 kilograms of this enriched uranium is available to be further enriched, at least in the near term.<sup>113</sup> Iran would need approximately 215 kilograms of uranium hexafluoride containing 20% uranium-235 in order to produce approximately 27.8 kilograms of uranium containing 90% uranium-235, which the IAEA considers to be the minimum sufficient amount of weapons-grade HEU for a nuclear weapon. This is a conservative estimate; the specific characteristics of Iran's enrichment facilities may necessitate more such material.

### **Possible Future Enrichment Facilities**

In addition to the Fordow facility, Iranian officials have indicated that Tehran intends to construct 10 additional centrifuge plants—a goal that many analysts argue is virtually unachievable. Then-head of Iran's Atomic Energy Organization Ali Akbar Salehi stated in December 2009 that Iran is investigating locations for the sites.<sup>114</sup> Current Atomic Energy Organization Head Abbasi argued in February 2012 that “mastering” centrifuge enrichment technology would enable Iran to “develop [centrifuge] sites in various locations to avoid any threat by foreign enemies.” Iranian officials have denied that they have other undisclosed enrichment-related facilities<sup>115</sup> and no British, French, or U.S. officials have disclosed evidence of such Iranian facilities since Iran acknowledged the Fordow facility. Furthermore, according to Colin Kahl, Deputy Assistant Secretary of Defense for the Middle East until January 2012, there is no evidence that Iran has clandestine enrichment facilities.<sup>116</sup>

### **Sustainable Progress?**

A senior U.S. intelligence official said on December 3, 2007, that a country needs to be able to “operate large numbers of centrifuges for long periods of time with very small failure rates” in order to be able to “make industrial quantities of enriched uranium.”<sup>117</sup> The NIE stated that Iran still “faces significant technical problems operating” its centrifuges. Nevertheless, a 2008 report to Congress submitted by the Deputy Director for National Intelligence described the amount of LEU that Iran produced in 2008 as a “significant improvement” over the amount it had produced in 2007.<sup>118</sup> Moreover, data from IAEA Director-General Amano's reports published during the second half of 2011 and the first half of 2012 indicate that Iran's daily production of LEU at its commercial enrichment facility increased since mid-August 2011. However, according to data from reports by the Institute for Science and International Security (ISIS) published during the first half of 2012, the average per-centrifuge performance at that facility has fluctuated<sup>119</sup>

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<sup>113</sup> In addition to the 43 kilograms of this material which is being prepared for use as fuel, Iran has altered another 1.6 kilograms of the material, which now contains less than 5% uranium-235.

<sup>114</sup> *Fars News Agency*, December 18, 2009.

<sup>115</sup> See, for example, Press Conference with Manouchehr Mottaki, Minister for Foreign Affairs of The Islamic Republic of Iran, *Federal News Service*, October 1, 2009.

<sup>116</sup> Kahl, *Foreign Affairs*, January 17, 2012.

<sup>117</sup> Background Briefing with Senior Intelligence Officials, December 3, 2007.

<sup>118</sup> *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, Covering 1 January to 31 December 2008*.

<sup>119</sup> David Albright, Paul Brannan, and Christina Walrond, *ISIS Analysis of IAEA Iran Safeguards Report: Production of 20% Enriched Uranium Triples; Iran Increases Number of Enriching Centrifuges at Natanz FEP by Nearly 50% and Signals an Intention to Greatly Expand the Number of Centrifuges at Both Natanz and Fordow; Advanced Centrifuge Program Appears Troubled*, Institute for Science and International Security, February 24, 2012; David Albright, Paul (continued...)



and a May 2012 ISIS report stated that Iran's "IR-1 centrifuge performance is improving, although still below par." The report attributed the increased LEU production to a greater number of operating centrifuges. It is important to note that calculating the average performance of Iran's centrifuges is more difficult without information about the Natanz commercial facility's average product enrichment level, which has not been reported by Amano since November 2010 - about the time when Iran began operating 174-centrifuge cascades.

The extent to which Iran's progress is sustainable is open to question. Former Pakistani nuclear official Abdul Qadeer Khan described Pakistan's first-generation centrifuges as "unsuccessful" in a 1998 interview.<sup>120</sup> Furthermore, Mark Fitzpatrick of the International Institute for Strategic Studies observed that "[i]t can be years before it is clear whether an enrichment programme is working well," observing that centrifuges at a Japanese enrichment facility "started to crash seven years after installation."<sup>121</sup> And, as noted, Iran has had difficulty in developing and deploying more-advanced centrifuges. Nevertheless, historical experience indicates that sustained operation of gas centrifuges appears to be a manageable task for governments with even modest technical capabilities. According to a U.S. Nuclear Regulatory Commission document, some centrifuges of simple design "have operated 30 years with a failure rate of less than one percent."<sup>122</sup> (Also see "Effects of Sanctions and Sabotage on Iran's Enrichment Program").

## Uranium Conversion

As noted, uranium conversion is a process whereby uranium oxide is converted into several compounds, including uranium hexafluoride—the feedstock for Iran's centrifuges. In addition to its centrifuge work, Iran produced approximately 541 metric tons of uranium hexafluoride between March 2004 and August 10, 2009.<sup>123</sup> Iran has not produced any uranium hexafluoride since August 2009, according to IAEA reports. Although Tehran informed the IAEA in July 2011 that it would restart the production of uranium hexafluoride using domestically produced uranium oxide,<sup>124</sup> Iran has not yet done so. Tehran has transferred domestically produced uranium oxide to the uranium conversion facility, but the government has told the IAEA that the material will be

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(...continued)

Brannan, Andrea Stricker, Christina Walrond, and Houston Wood, *Preventing Iran From Getting Nuclear Weapons: Constraining Its Future Nuclear Options*, Institute for Science and International Security, March 5, 2012; David Albright, Andrea Stricker, and Christina Walrond, *ISIS Analysis of IAEA Iran Safeguards Report: Production of 3.5% Enriched Uranium Increases Significantly; Iran Continues to Increase its Stock of 19.75% LEU; Rapid Installation of Large Numbers of IR-1 Centrifuge Outer Casings Not a Prelude to Dramatically Increased Centrifuge Deployment at Natanz or Fordow; Advanced Centrifuge Program Still Troubled But Makes Some Progress*, Institute for Science and International Security, May 25, 2012

<sup>120</sup> "A Talk with A.Q. Khan: Pakistan's Top Nuclear Scientist Talks About Nuclear Weapons," *Jane's Foreign Report*, July 24, 1998.

<sup>121</sup> Mark Fitzpatrick, *The Iranian Nuclear Crisis: Avoiding Worst-Case Outcomes*, Adelphi Paper 398, International Institute for Strategic Studies, May 2008, p. 50.

<sup>122</sup> USNRC Technical Training Center: Uranium Enrichment Processes, Module 4.0 of the Uranium Enrichment Processes Directed Self-Study Course 9/08 (Rev 3), Directed Self Study. The document appears to have been published in 2008.

<sup>123</sup> Based on data from GOV/2009/74.

<sup>124</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran*, GOV/2011/29, May 24, 2011.

used to produce uranium dioxide. Iran may be storing unenriched uranium hexafluoride in tunnels at Esfahan.<sup>125</sup>

The 2012 report from the U.N. Panel of Experts concluded that, based on data from Amano's February 2012 report, Iran "has an ample supply of uranium hexafluoride to maintain current levels of enrichment for the foreseeable future."<sup>126</sup> However, Iran's supply of imported uranium oxide is dwindling; according to a report from the Director of National Intelligence to Congress covering 2011, "Iran has almost exhausted" this supply.<sup>127</sup> According to the 2012 U.N. Panel report, "a number" of governments believe that Tehran is "seeking new sources of uranium ore to supply its enrichment efforts," adding that "the Panel is not aware of any confirmed cases of actual transfers." Prior to 2009, Tehran apparently improved its ability to produce centrifuge feedstock of sufficient purity for light-water reactor fuel; a May 2010 IAEA report indicates that Iran is purifying its centrifuge feedstock.<sup>128</sup> <sup>129</sup> Whether Iran is currently able to produce feedstock pure enough for weapons-grade HEU is unclear, however.

## Plutonium

Iran acknowledged to the IAEA in 2003 that it had conducted plutonium-separation experiments—an admission which aroused suspicions that Iran could have a program to produce plutonium for nuclear weapons. The IAEA, however, continued to investigate the matter, and ElBaradei reported in August 2007 that the agency has resolved its questions about Iran's plutonium activities.<sup>130</sup> The 2007 NIE stated that "Iran will not be technically capable of producing and reprocessing enough plutonium for a weapon before about 2015." But, as noted above, Iran says that it does not plan to engage in reprocessing, and numerous IAEA reports have noted that the agency has found no evidence that Iran is engaging in any such activities. IAEA Director-General Amano's November 2011 report described an "absence of any indicators that Iran is currently considering reprocessing irradiated nuclear fuel to extract plutonium."<sup>131</sup>

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<sup>125</sup> CRS analyst interview with knowledgeable former U.S. official, March 7, 2012. According to a March 2005 statement from then- IAEA Deputy Director-General Pierre Goldschmidt, Iran told the IAEA in December 2004 that it was constructing a tunnel for storing nuclear material in a more secure fashion. (Mr. Pierre Goldschmidt, *Statement to the IAEA Board of Governors*, March 1, 2005).

<sup>126</sup> *Panel of Experts*, 2012.

<sup>127</sup> *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, Covering 1 January to 31 December 2011*.

<sup>128</sup> IISS Strategic Comments, "Nuclear Iran: How Close Is It?," September 2007; Paul Kerr, "Iran Continues Security Council Defiance," *Arms Control Today*, June 2007; analyst interview with State Department official October 28, 2008.

<sup>129</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006), 1747 (2007), 1803 (2008) and 1835 (2008) in the Islamic Republic of Iran*, Report by the Director General, GOV/2010/28, May 31, 2010. A footnote in the report states that some enriched uranium hexafluoride "was present in the feed purification cylinder."

<sup>130</sup> *Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran*, Report by the Director General, GOV/2007/48, August 30, 2007.

<sup>131</sup> GOV/2011/65.

## Arak Reactor

Iran says that its heavy-water reactor, which is being constructed at Arak, is intended for the production of medical isotopes. According to a May 5, 2008, presentation by Ambassador Soltanieh, the reactor is to substitute for the “outdated” Tehran Research Reactor (TRR), which has been in operation since 1967.<sup>132</sup> As noted, Iran has since decided to re-fuel the TRR.

However, the Arak reactor is a proliferation concern because its spent fuel will contain plutonium better suited for nuclear weapons than the plutonium produced by light-water moderated reactors, such as the TRR and Bushehr reactor. In addition, Iran will be able to operate the reactor with natural uranium, which means that it will not be dependent on supplies of enriched uranium. Iran has told the IAEA that the reactor is scheduled to begin operating in 2013.<sup>133</sup> An Iranian heavy-water production plant located near Arak “appears to be in operation,” according to Amano’s May 2012 report.<sup>134</sup>

## Bushehr Reactor

Iran is also beginning to operate a 1,000-megawatt nuclear power reactor located near the city of Bushehr moderated by light water. The original German contractor, which began constructing the reactor in 1975, abandoned the project following Iran’s 1979 revolution. Russia agreed in 1995 to complete the reactor, but the project has since encountered repeated delays; both Russian and Iranian officials have attributed the project delays to technical issues. In February 2005, Moscow and Tehran concluded an agreement stating that Russia would supply fuel for the reactor for 10 years. Atomstroyexport sent the first shipment of LEU fuel to Iran on December 16, 2007, and the reactor received the last shipment near the end of January 2008. The fuel, which is under IAEA seal, will contain no more than 3.62% uranium-235, according to an Atomstroyexport spokesperson.<sup>135</sup> The fuel has since been loaded into the reactor and, as of late July 2012, the reactor was “operating at 75 percent of its nominal power,” according to Amano’s August 2012 report.

The United States had previously urged Moscow to end the project, citing concerns that it could aid an Iranian nuclear weapons program by providing the country with access to nuclear technology and expertise.<sup>136</sup> However, U.S. officials said in 2002 that Washington would drop these public objections if Russia took steps to mitigate the project’s proliferation risks; the 2005

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<sup>132</sup> “Iran’s Exclusively Peaceful Nuclear Programs and Activities,” Briefing for NGOs, May 5, 2008.

<sup>133</sup> GOV/2012/23.

<sup>134</sup> *Ibid.*

<sup>135</sup> “Atomstroyexport Completes Latest Shipment of Fuel to Bushehr Nuclear Plant,” *Interfax*, December 28, 2007.

<sup>136</sup> For example, then- Deputy Assistant Secretary of Defense Marshall Billingslea testified before the Senate July 29, 2002, that the United States was “concerned that the Bushehr nuclear power project is, in reality, a pretext for the creation of an infrastructure designed to help Tehran acquire atomic weapons.” Similar concerns are expressed in a 2005 State Department report (Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments, U.S. Department of State, August 2005, p.77.) Then-Undersecretary of State for International Security and Arms Control John Bolton told the House International Relations Committee in June 2003 that Iran could build “over 80 nuclear weapons” if it had access to sufficient fuel, operated the reactor for five to six years, and chose to withdraw from the NPT. During a June 12, 2008, House Foreign Affairs Committee hearing, then-Acting Undersecretary of State for Arms Control and International Security John Rood agreed with a Department of Energy assessment that the reactor’s spent fuel would contain enough plutonium for between 50 and 60 nuclear weapons. These estimates assume that Iran possesses a reprocessing facility, but the country does not have such a facility.

deal requires Iran to return the spent nuclear fuel to Russia.<sup>137</sup> This measure is designed to ensure that Tehran will not separate plutonium from the spent fuel. Moscow also argues that the reactor will not pose a proliferation risk because it will operate under IAEA safeguards. It is worth noting that light-water reactors are generally regarded as more proliferation-resistant than other types of reactors. Although the U.N. Security Council resolutions restrict the supply of nuclear-related goods to Iran, they do permit the export of nuclear equipment and fuel related to light-water reactors.

## Fuel Manufacturing Plant

Iran is continuing work on a fuel manufacturing plant that, when complete, is to produce fuel for the Arak and Darkhovin reactors.<sup>138</sup> The plant has produced fuel for the Tehran Research Reactor and has started the process of producing fuel for the Arak reactor.<sup>139</sup>

## Uranium Mines

Iran has a uranium mill and an open-pit uranium mine located at a site called Bandar Abbas, which is also sometimes referred to as Gchine. The IAEA assesses that these facilities are currently operating, according to the most recent reports from Amano. Iran has also told the IAEA that it is developing a uranium mine at a site called Saghand, as well as constructing an associated uranium mill called the Ardakan Yellowcake Production Plant. Iranian officials acknowledge that the country's uranium deposits are insufficient for its planned nuclear power program.<sup>140</sup> These reserves are sufficient, however, to produce 250-300 nuclear weapons, according to a past U.S. estimate.<sup>141</sup>

## Effects of Sanctions and Sabotage on Iran's Enrichment Program

Sanctions and apparent sabotage are two methods the international community has employed to impede Iran's nuclear program.

## Sanctions

According to various sources, international sanctions have made it difficult for Iran to obtain components and materials for its centrifuge program. For example, the 2012 U.N. Panel of Experts report observed that "[s]anctions are slowing the procurement by the Islamic Republic of

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<sup>137</sup> Estimates for the length of time the spent fuel must stay in Iran to cool range from two to five years. See Paul Kerr, "Iran, Russia Reach Nuclear Agreement," *Arms Control Today*, April 2005.

<sup>138</sup> "Aqazadeh: Iran Heralds Peaceful Nuclear Program," *Islamic Republic News Agency*, April 8, 2008.

<sup>139</sup> GOV/2012/23

<sup>140</sup> Installation of centrifuges continues in Natanz - Iran nuclear official," *Iranian Students News Agency*, April 17, 2007; Thomas W. Wood, Matthew D. Milazzo, Barbara A. Reichmuth, and Jeffrey Bedell, "The Economics Of Energy Independence For Iran," *Nonproliferation Review*, Vol. 14, No. 1, March 2007.

<sup>141</sup> Paul Kerr, "Iran Nuclear Abilities Limited," *Arms Control Today*, September 2005.

Iran of some critical items required for its prohibited nuclear programme.”<sup>142</sup> Similarly, the Panel’s 2011 report stated that “sanctions are constraining Iran’s procurement of items related to prohibited nuclear and ballistic missile activity and thus slowing development of these programmes.”<sup>143</sup> In addition, Paul Arkwright, then-Head of the UK Foreign and Commonwealth Office’s Counter Proliferation Department, stated in February 2009 that “there is some evidence that” sanctions “have been able to slow down” Iran’s nuclear program.<sup>144</sup> U.S. officials have also argued that the sanctions are impeding Iran’s ability to acquire technology for its nuclear programs. State Department Special Advisor for Nonproliferation and Arms Control Robert Einhorn told a Washington audience in March 2011 that “[w]e believe Iran has had difficulty in acquiring some key technologies and we judge this has had an effect of slowing some of its programs.”<sup>145</sup> Similarly, National Security Adviser Tom Donilon argued in November 2011 that “[s]anctions and export control efforts have made it more difficult and costly for Iran to acquire key materials and equipment for its enrichment program, including items that Iran can’t produce itself.”<sup>146</sup>

However, the extent to which sanctions have slowed Tehran’s program is unclear. Donilon also cited “mistakes and difficulties in Iran,” as obstacles to the progress of Iran’s nuclear program. Indeed, former IAEA Deputy Director General Olli Heinonen stated that “[w]e do not know” whether Iran’s delays in deploying advanced centrifuges are attributable to “lack of raw materials or design problems,” according to a February 2012 press report.<sup>147</sup> Furthermore, reports from the Office of the Director of National Intelligence covering 2009, 2010, and 2011 stated that “some obstacles slowed” the progress of Iran’s nuclear program during those years, but the report did not name those obstacles.<sup>148</sup>

Iran has, in recent years, tried to improve its capabilities to produce materials and components for its centrifuge program, according to Heinonen.<sup>149</sup> However, Iranian officials have suggested that Tehran is not yet-self-sufficient in manufacturing all of the necessary centrifuge components. Iran’s Atomic Energy Organization head Abbasi stated during a February 15, 2012, television broadcast that “Iran could not claim that it did not need other countries” for its enrichment program, adding that “domestic production of all items was not economically viable.”<sup>150</sup> Indeed,

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<sup>142</sup> *Panel of Experts*, 2012.

<sup>143</sup> *Panel of Experts Established Pursuant to Resolution 1929 (2010): Final Report*, June 2011.

<sup>144</sup> House of Commons Foreign Affairs Committee, *Global Security: Non-Proliferation Fourth Report of Session 2008–09*, June 14, 2009.

<sup>145</sup> Robert J. Einhorn, “Solving the Iranian Nuclear Puzzle” Briefing Series, Arms Control Association, March 9, 2011.

<sup>146</sup> Tom Donilon, “Iran And International Pressure: An Assessment Of Multilateral Effort To Impede Iran’s Nuclear Program,” The Brookings Institution, November 22, 2011.

<sup>147</sup> “Iran May Be ‘Struggling’ with New Nuclear Machines,” *Reuters*, February 28, 2012.

<sup>148</sup> *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, Covering 1 January to 31 December 2009; Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, Covering 1 January to 31 December 2010; Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, Covering 1 January to 31 December 2011.*

<sup>149</sup> Analyst interview January 18, 2012.

<sup>150</sup> “Nuclear Chief Says West Aware of Significance of Iran Achievements,” *Vision of the Islamic Republic of Iran Network* 2, February 15, 2012. Iran’s Ambassador to the IAEA appeared to suggest in a March 2012 statement to the Agency’s Board of Governors that Iran cannot produce all of the necessary centrifuge components. (Statement by H.E. Ambassador Soltanieh, Resident Representative of the Islamic Republic of Iran to the IAEA, before the IAEA Board of Governors, March 8, 2012).

Iran has apparently continued its attempts to obtain items for its nuclear program from foreign suppliers, according to a November 2011 State Department fact sheet<sup>151</sup> and the 2012 Panel of Experts report<sup>152</sup> (see **Appendix D**).

## Sabotage

There have been allegations of efforts by the United States and other governments, including Israel, to sabotage Iran's centrifuge program, but the extent to which any of these efforts have affected Tehran's nuclear program is unclear. The *New York Times* reported in January 2009 that such efforts have included "undermin[ing] electrical systems, computer systems and other networks on which Iran relies," according to unnamed senior U.S. and foreign government officials.<sup>153</sup> One effort involved foreign intelligence services sabotaging "individual power units that Iran bought in Turkey" for Tehran's centrifuge program. "A number of centrifuges blew up," according to the *Times*.<sup>154</sup> Western governments have reportedly made other efforts to sabotage centrifuge components destined for Iran, according to some non-governmental experts.<sup>155</sup> Additionally, *New York Times* reporter James Risen wrote in 2006 that, according to unnamed U.S. officials, the United States engaged in a covert operation to provide Iran with flawed blueprints for a device designed to trigger a nuclear explosion.<sup>156</sup> There have also been reports that the United States and Israel have executed cyber attacks on Iran's nuclear facilities. Perhaps the best known of these utilized the Stuxnet computer worm, which was discovered in 2010 and probably developed by a government to attack Iran's enrichment facilities.<sup>157</sup> Moreover, some governments have reportedly assassinated Iranians associated with Iran's nuclear program.<sup>158</sup> Furthermore, the United States may have obtained information from Iranian officials who defected as part of a CIA program to induce them to do so.<sup>159</sup>

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<sup>151</sup> *Executive Order 13382 Designations on Iran Fact Sheet*, November 21, 2011. The fact sheet states that "Iran uses a wide network of procurement agents to procure items, equipment, and technology in support of this illicit nuclear program."

<sup>152</sup> The report has a list of such items on pages 15 and 16.

<sup>153</sup> David E. Sanger, "U.S. Rejected Aid for Israeli Raid on Nuclear Site," *New York Times*, January 11, 2009.

<sup>154</sup> David E. Sanger and William J. Broad, "U.S. Sees an Opportunity to Press Iran on Nuclear Fuel," *New York Times*, January 3, 2010. Iranian officials alluded to this incident, according to a January 2007 Iranian press report (*Ayande-ye Now*, January 6, 2007).

<sup>155</sup> James Blitz, Roula Khalaf, and Daniel Dombey, "Suggestions of Iran Nuclear Sabotage," *Financial Times*, July 22, 2010.

<sup>156</sup> James Risen, *State of War: The Secret History of the CIA and the Bush Administration* (New York: Free Press), 2006.

<sup>157</sup> David Albright, Paul Brannan, Andrea Stricker, Christina Walrond, and Houston Wood, *Preventing Iran From Getting Nuclear Weapons: Constraining Its Future Nuclear Options*, Institute for Science and International Security, March 5, 2012; R Scott Kemp, "Worm Holes - Virus Attacks Iran's Enrichment Operation," *Jane's Intelligence Review*, September 15, 2011; David E. Sanger, "Obama Order Sped Up Wave of Cyberattacks Against Iran," *New York Times*, June 1, 2012; Ellen Nakashima, Greg Miller, Julie Tate, "U.S. and Israel Created 'Flame'," *Washington Post*, June 20, 2012. For more information about Stuxnet, see CRS Report R41524, *The Stuxnet Computer Worm: Harbinger of an Emerging Warfare Capability*, by Paul K. Kerr, John Rollins, and Catherine A. Theohary.

<sup>158</sup> See, for example, Ulrike Putz, "Sabotaging Iran's Nuclear Program," *Der Spiegel*, August 2, 2011; Artin Afkhami, "Tehran Abuzz as Book Says Israel Killed 5 Scientists," *New York Times*, July 11, 2012.

<sup>159</sup> Greg Miller, "CIA Has Recruited Iranians to Defect; The Secret Effort Aims to Undermine Tehran's Nuclear Program," *Los Angeles Times*, December 9, 2007.

## Nuclear Weapon Development Capabilities

Statements from the U.S. intelligence community indicate that Iran has the technical capability to produce nuclear weapons. For example, a 2007 National Intelligence Estimate (NIE) assessed that “Iran has the scientific, technical and industrial capacity eventually to produce nuclear weapons if it decides to do so.”<sup>160</sup> More recently, Director of National Intelligence Clapper stated during a January 31, 2012, Senate Select Intelligence Committee hearing that Iran has the “capacity to eventually produce nuclear weapons” and “is keeping open the option to develop” such weapons.

Obtaining fissile material is widely regarded as the most difficult task in building nuclear weapons. As noted, Iran is enriching uranium, but whether and to what extent Tehran has taken the other steps necessary for producing a nuclear weapon is unclear. A November 2008 report from former IAEA Director-General ElBaradei points out that the IAEA, with the exception of a document related to uranium metal, has “no information ... on the actual design or manufacture by Iran” of components, nuclear or otherwise, for nuclear weapons.<sup>161</sup> However, according to IAEA Director-General Amano’s November 2011 report, the IAEA has “credible” information that Iran has carried out activities “relevant to the development of a nuclear explosive device.”<sup>162</sup> These include acquisition of “nuclear weapons development information and documentation” and work to develop “an indigenous design of a nuclear weapon including the testing of components.” Although some of these activities have civilian applications, “others are specific to nuclear weapons,” the report notes.<sup>163</sup> Most of the report provides additional details about Iranian activities applicable to nuclear weapons development that were described in previous IAEA reports, although it did contain some previously unreported material.<sup>164</sup> An April 2012 Department of Defense report described Amano’s report as containing “extensive evidence of past and possibly ongoing Iranian nuclear weapons-related research and development work.”<sup>165</sup> (See **Appendix B** for more details about the IAEA’s information regarding suspected military aspects of Iran’s nuclear program.)

Amano’s November 2011 report states that, according to information available to the IAEA, Iranian activities related to building a nuclear explosive device “took place under a structured programme” prior to the end of 2003. That program, however, “was stopped rather abruptly pursuant to a ‘halt order’ instruction issued in late 2003 by senior Iranian officials,” the report says. Nevertheless, “[t]here are also indications that some activities relevant to the development of a nuclear explosive device continued after 2003, and that some may still be ongoing,” according to the report.

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<sup>160</sup> *Iran: Nuclear Intentions and Capabilities*, November 2007.

<sup>161</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006), 1747 (2007), 1803 (2008) and 1835 (2008) in the Islamic Republic of Iran*, Report by the Director General, GOV/2008/59, November 19, 2008.

<sup>162</sup> GOV/2011/65.

<sup>163</sup> An annex to the report details these activities and provides a detailed explanation of the suspected weapons program’s organizational structure.

<sup>164</sup> For example, the IAEA had previously reported documentation of an undisclosed Iranian uranium conversion project and an undisclosed missile re-entry vehicle program. However, the November report describes documents obtained by the IAEA after May 2008 which “established a connection” between the two programs. Similarly, the annex also describes information provided by an unnamed government which contains additional details about Iranian experiments with high explosives.

<sup>165</sup> Department of Defense, *Annual Report on Military Power of Iran*, April 2012.

According to some non-governmental organization reports, the IAEA has assessed that Iran “has sufficient information to be able to design and produce a workable implosion nuclear device based upon HEU as the fission fuel.”<sup>166</sup> However, these reports cite information from an internal 2009 IAEA document which ElBaradei has described as

a rolling text compiled by the Agency’s Department of Safeguards that included all the various pieces of information that had come in from different intelligence organizations, most of which IAEA inspectors had been unable to verify or authenticate ... by definition, it was a series of best guesses.<sup>167</sup>

The IAEA Deputy Director General for Safeguards at the time had neither “assessed” nor “signed off on” the document, ElBaradei added.

For its part, the U.S. government assesses that Iran has not mastered “all the necessary technologies” for building a nuclear weapon, a senior Administration official stated during a November 8, 2011, briefing about Amano’s November 2011 report.<sup>168</sup> During the same briefing, a senior Administration official explained that “the fact that some activities have apparently continued after the full-scale program was shut down in 2003 suggests that there’s been some advancement” in Iran’s ability to develop nuclear weapons, but “since it appears to be relatively uncoordinated and sporadic activity ... the advancement probably hasn’t been that dramatic.” Perhaps reinforcing this point, Director Clapper stated during the February 2012 Senate Armed Services Committee hearing that “there are certain things” that Iran has not yet done to develop a nuclear weapon, but he did not elaborate.

Amano’s November 2011 report states that, according to a member of a “clandestine nuclear supply network” run by former Pakistani nuclear official Abdul Qadeer Khan, Iran “had been provided with nuclear explosive design information.” However, this information may not be sufficient to produce a nuclear weapon. Although Khan’s network supplied Libya with “documents related to the design and fabrication of a nuclear explosive device,” according to the IAEA,<sup>169</sup> these documents lacked “important parts” for making a nuclear weapon, according to ElBaradei.<sup>170</sup> In addition to the documents supplied to Tripoli, members of the Khan network also had computer files containing “drawings for the components of two smaller, more advanced

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<sup>166</sup> *Excerpts from Internal IAEA Document on Alleged Iranian Nuclear Weaponization*, Institute for Science and International Security, October 2, 2009. Colin H. Kahl, Melissa G. Dalton, and Matthew Irvine, *Risk and Rivalry Iran, Israel and the Bomb*, Center for a New American Security, June 2012.

<sup>167</sup> Mohamed ElBaradei, *The Age of Deception: Nuclear Diplomacy in Treacherous Times*, (New York, Metropolitan Books, Henry Holt and Company), 2011, pp. 290.

<sup>168</sup> “Press Briefing by Senior Administration Officials on IAEA Report on Iran’s Nuclear Activities,” November 8, 2011.

<sup>169</sup> *Implementation of the NPT Safeguards Agreement in the Socialist People’s Libyan Arab Jamahiriya*, GOV/2008/39, September 12, 2008.

<sup>170</sup> Mohamed ElBaradei, *The Age of Deception*, p.155. The International Institute for Strategic Studies described the design as “95% complete” (*Nuclear Black Markets: Pakistan, A.Q. Khan and the Rise of Proliferation Networks*, (London: The International Institute for Strategic Studies), 2007, p. 79). Khan told a former member of his network that the plans that he had provided to Libya were “for a non-working nuclear device” (Extract from the Statement of Sayed Abu Tahir Bin Bukhary, June 7, 2006, *Annexure L in Plea and Sentence Agreement, State vs. Geiges, Wisser, and Krusch Engineering*, September 2007). A report from Pakistan’s Inter-Services Intelligence organization published in September 2011 argued that neither the technical assistance nor centrifuge components provided by the Khan network were sufficient “for the establishment of a small pilot [centrifuge] plant or to produce nuclear weapons.” (“The A.Q. Khan Report by Pakistan ISI,” September 15, 2011).



nuclear weapons”<sup>171</sup> However, according to former IAEA Deputy Director-General Olli Heinonen, these “detailed designs” were not “complete sets” of weapons design information. Other members of the network could have possessed more complete nuclear weapons designs, he said.<sup>172</sup>

## Timelines

A senior intelligence official explained during a December 2007 press briefing that the “acquisition of fissile material ... remains the governing element in any timelines” regarding Iran’s production of a “nuclear device.”<sup>173</sup> According to the 2007 NIE, “centrifuge enrichment is how Iran probably could first produce enough fissile material for a weapon.” Secretary of Defense Leon Panetta told *60 Minutes* January 29, 2012, that, if Iran decided to build a nuclear weapon, “it would probably take them about a year to be able to produce a bomb and then possibly another one to two years in order to put it on a deliverable vehicle of some sort in order to deliver that weapon.”<sup>174</sup> However, Director of National Intelligence Clapper indicated during the February 2012 Senate Armed Services Committee hearing that it would more likely take Iran longer than a year to produce a nuclear weapon after making a decision to do so.<sup>175</sup> Although, as noted, the United States estimates that Iran’s Fordow enrichment facility “would be capable of producing approximately one weapon’s worth” of HEU per year, whether and how that assessment factors into the U.S. timelines for Iranian nuclear weapons development is unclear.<sup>176</sup>

The 2007 NIE added that “the earliest possible date Iran would be technically capable of producing enough HEU for a weapon is late 2009.”<sup>177</sup> This date, however, “is very unlikely,” the estimate says, adding that “Iran probably would be technically capable of producing enough HEU for a weapon sometime during the 2010-2015 time frame.” But the State Department Bureau for Intelligence and Research, the estimate says, judged that Tehran “is unlikely to achieve this capability before 2013”<sup>178</sup> and all intelligence agencies recognized “the possibility that this capability may not be attained until *after* 2015.”<sup>179</sup>

Some independent experts have published estimates for the amount of time necessary for the Natanz facility to produce enough HEU for a weapon—a process that would require Iran to reconfigure the cascades, and further enrich the uranium.<sup>180</sup> As noted, Tehran had, as of August 6,

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<sup>171</sup> David Albright, *Peddling Peril: How the Secret Nuclear Trade Arms America’s Enemies*, The Institute for Science and International Security, 2010. p.151.

<sup>172</sup> Interview with CRS analyst, August 4, 2011.

<sup>173</sup> “Unclassified Key Judgments of the National Intelligence Estimate: Iran: Nuclear Intentions and Capabilities,” Background Briefing with Senior Intelligence Officials, December 3, 2007.

<sup>174</sup> Transcript of remarks by Secretary Panetta from CBS’s *60 Minutes* interview, January 29, 2012.

<sup>175</sup> These estimates probably assume that Iran would use its declared centrifuge facilities to produce fissile material; the other assumptions behind them are not clear. For a detailed discussion of the variables such estimates must take into account, see International Institute for Strategic Studies, February 2011, pp.69-70.

<sup>176</sup> See “Fordow Enrichment Facility” section.

<sup>177</sup> This time frame describes the point at which Iran could have enough HEU for a weapon, rather than when Iran could start producing HEU.

<sup>178</sup> In responses to Questions for the Record from the Senate Select Committee on Intelligence, which were made public in August 2009, the Director for National Intelligence stated that the Bureau continues to stand by this estimate.

<sup>179</sup> The time frame described in the 2007 NIE is the same as one described in a 2005 NIE.

<sup>180</sup> See, for example, R. Scott Kemp and Alexander Glaser, “Statement on Iran’s Ability to Make a Nuclear Weapon (continued...)”

2012, produced an amount of enriched uranium hexafluoride containing up to 5% uranium-235 which, if further enriched, could theoretically produce enough HEU for at least five nuclear weapons.<sup>181</sup> Iran did not, as of August 21, 2012, yet possess sufficient uranium hexafluoride containing about 20% uranium-235 to yield a sufficient amount of weapons-grade HEU for a weapon. Although the IAEA considers approximately 27.8 kilograms of uranium containing 90% uranium-235 to be the minimum sufficient amount of weapons-grade HEU for a nuclear weapon, Tehran would likely need to produce more uranium-235 in order to produce its first nuclear weapon; according to a 2011 International Institute for Strategic Studies report, “the fabrication of an initial bomb would involve an amount of unavoidable wastage.”<sup>182</sup> Then-Deputy Assistant Secretary of Defense Colin Kahl explained during a November 15, 2011, hearing that “the time to actually complete a testable [Iranian nuclear] device could shrink over time.”<sup>183</sup> Asked why, despite the estimates described above, Iran has not developed a nuclear weapon, Kahl noted that such estimates assume an Iranian decision to produce a nuclear weapon. “There’s no evidence” that Tehran has made such a decision, he added.

The U.S. estimates described above apparently assume that Iran would use its declared nuclear facilities to produce fissile material for a weapon. However, the 2007 NIE states that Iran “probably would use covert facilities—rather than its declared nuclear sites—for the production of highly enriched uranium for a weapon.” Similarly, a CIA report covering 2004 concluded that “inspections and safeguards will most likely prevent Tehran from using facilities declared to the IAEA directly for its weapons program as long as Iran remains a party to the NPT.”<sup>184</sup>

Iran would probably prefer to avoid using its safeguarded facilities partly because the IAEA would likely detect an Iranian attempt to use them for producing weapons-grade HEU. According to former Deputy Assistant Secretary Kahl, Tehran “is unlikely to dash for a bomb in the near future because IAEA inspectors would probably detect Iranian efforts to divert low-enriched uranium and enrich it to weapons-grade level at declared facilities.”<sup>185</sup> Similarly, Deputy Assistant Secretary of Defense for Media Operations John Kirby told reporters December 21, 2011, that, were Iran to begin producing a nuclear weapon, IAEA inspectors would likely give sufficient warning for the United States to take action. Former IAEA Deputy Director-General Olli

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and the Significance of the 19 February 2009 IAEA Report on Iran’s Uranium-Enrichment Program,” March 2, 2009 (available at <http://www.princeton.edu/~rskemp/can-iran-make-a-bomb.pdf>); R. Scott Kemp, “Update On Iran’s Ability to Make a Nuclear Weapon and the Significance of the 5 June 2009 IAEA Report on Iran’s Uranium-Enrichment Program,” June 17, 2009; Albright and Shire, June 5, 2009; and David Albright, Paul Brannan, and Jacqueline Shire, *Nuclear Weapon Breakout Scenarios: Correcting the Record*, March 18, 2009 (available at [http://www.isisnucleariran.org/assets/pdf/Correcting\\_the\\_Record.pdf](http://www.isisnucleariran.org/assets/pdf/Correcting_the_Record.pdf)). Shutting off some valves in Iran’s centrifuge facilities may also be a viable option.

<sup>181</sup> The U.S. statement to the June 2012 IAEA Board of Governors meeting described this quantity as “enough for several nuclear weapons if further enriched to higher levels” (Robert Wood, Chargé d’Affaires, U.S. Mission to the IAEA, *Implementation of the NPT Safeguards Agreement and Relevant Provisions of United Nations Security Council Resolutions in the Islamic Republic of Iran, IAEA Board of Governors Meeting*, June 4-8, 2012).

<sup>182</sup> *Iran’s Nuclear, Chemical, and Biological Capabilities: A Net Assessment*, 2011.

<sup>183</sup> *Panel II of a Hearing of the National Security, Homeland Defense and Foreign Operations Subcommittee of the House Oversight and Government Reform Committee Subject: Progress of the Obama Administration’s Policy Toward Iran*. November 15, 2011

<sup>184</sup> *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions*, January 1-December 31, 2004.

<sup>185</sup> Colin Kahl, “Before Attacking Iran, Israel Should Learn From Its 1981 Strike On Iraq,” *The Washington Post*, March 2, 2012.

Heinonen observed in November 2010 that Iran would probably be caught if it attempted to divert more than “small quantities” of nuclear material from its safeguarded nuclear facilities.<sup>186</sup> Moreover, it would be extremely difficult to reconfigure the cascades in the Natanz facility without detection<sup>187</sup> and, in any case, IAEA inspectors measure the isotopic content of enriched uranium and would thereby detect Iranian production of weapons-grade HEU.

Although Iran could decide to eject IAEA inspectors and/or withdraw from the NPT, such a move would be “an incredibly provocative action and very risky for Iran to undertake,” Department of State Special Advisor Einhorn argued in March 2011, adding that Iran is unlikely to take such a risk because its operating first-generation centrifuges are inefficient.<sup>188</sup> Such an action would also be virtually unprecedented.<sup>189</sup>

A senior intelligence official explained in December 2007<sup>190</sup> that Iran could use knowledge gained from its Natanz facilities at covert enrichment facilities; according to the NIE, a “growing amount of intelligence indicates Iran was engaged in covert uranium conversion and uranium enrichment activity,” but Tehran probably stopped those efforts in 2003. “There is no evidence that Iran has built additional covert enrichment plants,” according to Kahl, who added that the time needed for Iran to develop nuclear weapons in this manner “could be years off.”<sup>191</sup>

## Does Iran Have a Nuclear Weapons Program?

In addition to the possible nuclear weapons-related activities discussed above, Iran has continued to develop ballistic missiles, which could potentially be used to deliver nuclear weapons. It is worth noting, however, that Director of National Intelligence Dennis Blair indicated during a March 10, 2009, Senate Armed Services Committee hearing that Iran’s missile developments do not necessarily indicate that the government is also pursuing nuclear weapons, explaining that “I don’t think those missile developments ... prejudice the nuclear weapons decision one way or another. I believe those are separate decisions.” Iran is developing missiles and space launch vehicles “for multiple purposes,” he added.

In any case, Tehran’s nuclear program has also raised concerns for various other reasons. First, Iran has been secretive about the program. For example, Tehran hindered the IAEA investigation by failing to disclose numerous nuclear activities, destroying evidence, and making false

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<sup>186</sup> Heinonen described “small quantities” as “one gram or a hundred grams”—far less than the amount necessary for a nuclear weapon. Arms Control Association, “The Status of Iran’s Nuclear and Missile Programs,” Transcript, November 22, 2010. The Verification Research, Training, and Information Centre assessed in 2009 that “any diversion of more than 48 grams of low enriched uranium would raise the alarm and trigger an in-depth [IAEA] investigation” (Andreas Persbo, *Safeguards in Iran: Prospects and Challenges*, presentation given to “Prospects for Dialogue in the Middle East,” British Pugwash, April 30, 2009).

<sup>187</sup> For more details about cascade configuration, see Houston G. Wood, Alexander Glaser, and R. Scott Kemp, “The Gas Centrifuge and Nuclear Weapons Proliferation,” *Physics Today*, September 2008; International Institute for Strategic Studies, *Iran’s Strategic Weapons Programmes: A Net Assessment*, (UK: Routledge, 2005), pp. 53-54.

<sup>188</sup> Transcript available at <http://www.armscontrol.org/events/RoleSanctionsIranNuclear>.

<sup>189</sup> No state that has been found in good standing with the IAEA has ever used this tactic. North Korea restarted its nuclear weapons program after announcing its withdrawal from the NPT in 2003, but the IAEA has never completed an assessment of that country’s nuclear activities.

<sup>190</sup> Background Briefing with Senior Intelligence Officials, December 3, 2007.

<sup>191</sup> Kahl, *Foreign Affairs*, January 17, 2012.

statements to the agency.<sup>192</sup> Moreover, although Iran's cooperation with the agency has improved, the IAEA has repeatedly criticized Tehran for failing to cooperate fully with the agency's investigation of certain issues concerning Iran's nuclear program.

Second, many observers have questioned Iran's need for nuclear power, given the country's extensive oil and gas reserves. The fact that Tehran resumed its nuclear program during the Iran-Iraq war has also cast doubt on the energy rationale. Furthermore, many countries with nuclear power reactors purchase nuclear fuel from foreign suppliers—a fact that calls into question Iran's need for an indigenous enrichment capability, especially since Russia has provided fuel for the Bushehr reactor. Moreover, Iranian officials acknowledge that Iran lacks sufficient uranium deposits for its planned nuclear power program.<sup>193</sup>

However, Iran maintains that its enrichment program has always been exclusively for peaceful purposes; as noted, the Iranian government says that it plans to expand its reliance on nuclear power in order to generate electricity. Some experts have documented Tehran's projected difficulty in exporting oil and natural gas without additional foreign investment in its energy infrastructure.<sup>194</sup> Iran has explained its covert nuclear procurement efforts by arguing that it has been forced to conceal these efforts in order to counter Western efforts to deny it nuclear technology—a claim that appears to be supported by a 1997 CIA report.<sup>195</sup>

Tehran argues that it cannot depend on foreign suppliers for such fuel because such suppliers have been unreliable in the past.<sup>196</sup> At least one expert has described Iran's inability to obtain nuclear fuel from an international enrichment consortium called Eurodif. During the 1970s, Iran had reached an agreement with Eurodif that entitled Iran to enriched uranium from the consortium in exchange for a loan.<sup>197</sup> Former Atomic Energy Organization head Aghazadeh has also argued that, although Iran does not need to produce fuel for the Bushehr reactor, the Natanz facility needs to be completed if it is to be able to provide fuel for the planned Darkhovin reactor.<sup>198</sup>

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<sup>192</sup> For example, Iran sanitized a facility where Iranian scientists had enriched uranium, falsely told the IAEA that it had not enriched uranium, and falsely claimed that it had not procured any foreign components for one of its centrifuge programs.

<sup>193</sup> *Iranian Students News Agency*, April 17, 2007. Wood, et al, *Nonproliferation Review*, March 2007.

<sup>194</sup> See, for example, *U.S.-Iranian Engagement: The View from Tehran*, International Crisis Group, June 2, 2009; Roger Stern, "The Iranian Petroleum Crisis and United States National Security," *Proceedings of the National Academy of Sciences of America*, January 2007; and George Perkovich and Silvia Manzanero, "Plan B: Using Sanctions to End Iran's Nuclear Program," *Arms Control Today*, May 2004. Projections of Iranian oil depletion are not new. A 1975 U.S. government report stated that "Iran has decided now to introduce nuclear power to prepare against the time – about 15 years in the future – when Iranian oil production is expected to begin to decline sharply." ("Report of the NSSM 219 Working Group Nuclear Cooperation Agreement with Iran," April 1975).

<sup>195</sup> CIA, *Report of Proliferation-Related Acquisition in 1997*. The report says that Iran had responded to "Western counterproliferation efforts by relying more on legitimate commercial firms as procurement fronts and by developing more convoluted procurement networks."

<sup>196</sup> For an official Iranian perspective on the issue, see *The Root Cause of Iran's Confidence Deficit vis a vis Some Western Countries on Assurances of Nuclear Fuel Supply*, INFCIRC/785, March 2, 2010. Perhaps significantly, Iranian officials argued for an independent fuel production capability during the 1970s; see U.S. Embassy Tehran Airgram A-76 to State Department, "The Atomic Energy Organization of Iran," April 15, 1976.

<sup>197</sup> Oliver Meier, "Iran and Foreign Enrichment: A Troubled Model," *Arms Control Today*, January/February 2006.

<sup>198</sup> "Iran to Follow Nuclear Timetable Regardless of IAEA Reports – Official," *Islamic Republic of Iran News Network*, February 25, 2009.

Iran's stated rationale for its Arak reactor has also been met with some skepticism. Tehran says it needs the reactor to produce medical isotopes and to replace the Tehran Research Reactor. However, that reactor is capable of producing such isotopes and has unused capacity. Furthermore, as noted, Iran has expressed the desire to obtain more fuel for the reactor. In addition, non-proliferation experts have argued that the new reactor would be unnecessary for producing such isotopes.<sup>199</sup>

## U.S. Government Estimates

Since at least 2007, the U.S. intelligence community has assessed that Iran has not decided whether to develop nuclear weapons. According to the 2007 NIE, "Iranian military entities were working under government direction to develop nuclear weapons" until fall 2003, after which Iran halted its nuclear weapons program "primarily in response to international pressure." The NIE defines "nuclear weapons program" as "Iran's nuclear weapon design and weaponization work and covert uranium conversion-related and uranium enrichment-related work." The NIE adds that the intelligence community also assessed "with moderate-to-high confidence that Tehran at a minimum is keeping open the option to develop nuclear weapons."<sup>200</sup> The NIE also states that, because of "intelligence gaps," the Department of Energy and the National Intelligence Council assessed "with only moderate confidence that the halt to those activities represents a halt to Iran's entire nuclear weapons program." The NIE added that "[s]ince fall 2003, Iran has been conducting research and development projects with commercial and conventional military applications—some of which would also be of limited use for nuclear weapons."

The NIE also states that "Tehran's decision to halt its nuclear weapons program suggests it is less determined to develop nuclear weapons than we have been judging since 2005."<sup>201</sup> The change in assessments, a senior intelligence official said December 3, 2007, was the result of "new information which caused us to challenge our assessments in their own right, and illuminated previous information for us to be able to see it perhaps differently than we saw before, or to make sense of other data points that didn't seem to self-connect previously."<sup>202</sup> According to press accounts, this information included various written and oral communications among Iranian officials which indicated that the program had been halted.<sup>203</sup> As noted, the United States may

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<sup>199</sup> Robert J. Einhorn, "Iran's Heavy-Water Reactor: A Plutonium Bomb Factory," November 9, 2006, available at [http://www.armscontrol.org/pressroom/2006/20061109\\_Einhorn.asp?print](http://www.armscontrol.org/pressroom/2006/20061109_Einhorn.asp?print).

<sup>200</sup> Prior to the NIE, some non-governmental experts had argued that Iran had stopped its nuclear weapons program. See, for example, Paul Kerr, "Divided From Within," *Bulletin of the Atomic Scientists*, November/December 2006; Jeffrey Lewis, "Iran Roundup: Negotiations and Wonkporn," July 27, 2005, available at <http://www.armscontrolwonk.com/703/iran-roundup-negotiations-and-wonkporn>; and George Perkovich, *Changing Iran's Nuclear Interests, Policy Outlook, Carnegie Endowment for International Peace*, May 2005, available at <http://www.carnegieendowment.org/files/PO16.perkovich.FINAL2.pdf>.

<sup>201</sup> Although the 2005 NIE stated that "Iran currently is determined to develop nuclear weapons despite its international obligations and international pressure," that assessment was somewhat qualified. Titled "Iran's Nuclear Program: At A Crossroads," the estimate stated that Iran was not "immovable" on the question of pursuing a nuclear weapons program and also addressed the possibility that Tehran may not have had such a program. Moreover, the word "determined" was used in lieu of "pursuing" a nuclear weapon because the authors believed the latter to be a stronger term. The NIE was issued as a Memorandum to Holders of NIE 2001-15HC, "Iran's Nuclear Weapons Program: Multifaceted and Poised to Succeed, But When?"

<sup>202</sup> Background Briefing with Senior Intelligence Officials, December 3, 2007.

<sup>203</sup> Dafna Linzer and Joby Warrick, "U.S. Finds that Iran Halted Nuclear Arms Bid in 2003," *Washington Post*, December 4, 2007; Greg Miller, "Iran's Nuclear Ambitions on Hold, U.S. Agencies Conclude," *Los Angeles Times*, (continued...)

also have obtained information from Iranian officials who defected as part of a CIA program to induce them to do so,<sup>204</sup> as well as from penetration of Iran's computer networks.<sup>205</sup> Additionally, the NIE also incorporated open-source information, such as photographs of the Natanz facility that became available after members of the press toured the facility.

According to the 2007 NIE, the intelligence community assesses "with moderate-to-high confidence that Iran does not have a nuclear weapon." The community assesses "with low confidence that Iran probably has imported at least some weapons-usable fissile material," but still judges "with moderate-to-high confidence" that Tehran still lacks sufficient fissile material for a nuclear weapon.

On several occasions, the U.S. intelligence community has reaffirmed the 2007 NIE's assessment that Iran halted its nuclear weapons program but is keeping its options open.<sup>206</sup> Leon Panetta, then-Director of the Central Intelligence Agency, did so in May 2009.<sup>207</sup> Moreover, press accounts indicated that, as of September 2009, the community did not believe that Tehran has restarted its weapons program.<sup>208</sup> The late-September 2009 revelation of the Fordow facility has increased suspicions that Iran may have restarted its nuclear weapons program; as noted, U.S. officials have indicated that the facility is likely intended for a nuclear weapons program. Nevertheless, Administration talking points made public September 25, 2009, stated that the intelligence community still assessed that "Iran halted its nuclear weapons program in 2003." More recently, Director of National Intelligence Clapper stated during a January 31, 2012, Senate Select Intelligence Committee hearing that, although Iran "is keeping open the option to develop" nuclear weapons, "[w]e do not know... if Iran will eventually decide to build nuclear weapons."<sup>209</sup>

The November 2011 report from IAEA Director-General Amano appears to support the U.S. assessment.<sup>210</sup> As noted, the report states that Iranian activities related to building a nuclear explosive device "took place under a structured programme," but senior Iranian officials ordered a halt to the program in late 2003. Echoing the judgment of the 2007 NIE, Amano's report mentions "indications that some activities relevant to the development of a nuclear explosive device continued after 2003," adding that some such activities "may still be ongoing." Most of

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December 4, 2007; David E. Sanger and Steven Lee Myers, "Details in Military Notes Led to Shift on Iran, U.S. Says," *New York Times*, December 6, 2007; Peter Baker and Dafna Linzer, "Diving Deep, Unearthing a Surprise; How a Search for Iran's Nuclear Arms Program Turned Up an Unexpected Conclusion," *Washington Post*, December 8, 2007.

<sup>204</sup> Miller, *Los Angeles Times*, December 9, 2007.

<sup>205</sup> David Sanger and William Broad, "U.S. and Allies Press Iran over Nuclear Plant 'Deception'," *The New York Times*, September 26, 2009.

<sup>206</sup> See, for example, February 12, 2009, testimony before the Senate Intelligence Committee by Director of National Intelligence Dennis Blair; "Annual Threat Assessment of the Intelligence Community for the Senate Intelligence Committee," February 12, 2009; and March 10, 2009, testimony before the Senate Armed Services Committee by Director of the Defense Intelligence Agency Michael Maples.

<sup>207</sup> "Remarks of Director of Central Intelligence Agency, Leon E. Panetta, at the Pacific Council on International Policy," May 18, 2009.

<sup>208</sup> Mark Hosenball, "Intelligence Agencies Say No New Nukes in Iran: Secret Updates to White House Challenge European and Israeli Assessments," *Newsweek*, September 16, 2009; David E. Sanger, "U.S. Says Iran Could Expedite Nuclear Bomb," *The New York Times*, September 10, 2009.

<sup>209</sup> James R. Clapper, Director of National Intelligence, *Worldwide Threat Assessment to the Senate Select Committee on Intelligence*, January 31, 2012.

<sup>210</sup> GOV/2011/65.

the activities listed in the report occurred before the end of 2003. During a November 8, 2011, briefing about Amano's report, a senior Administration official described Iran's post-2003 weapons-related work as "a much less coordinated ... more sporadic set of research activities," some of which "are sort of related to nuclear weapons development."<sup>211</sup> As noted, an April 2012 Department of Defense report described Amano's report as containing "extensive evidence of past and possibly ongoing Iranian nuclear weapons-related research and development work."<sup>212</sup>

Some foreign intelligence agencies apparently concur with the U.S. assessment that Iran has not yet decided to build nuclear weapons. Director of the French General Directorate of External Security Erard Corbin de Mangoux stated in an interview published in 2010 that "[w]e do not yet know whether Tehran's objective is to enable itself to acquire such a capability (so-called 'threshold status') or actually to possess it."<sup>213</sup> In March 2012, Israeli Foreign Minister Avigdor Lieberman appeared to confirm reports that Israeli intelligence shares this U.S. assessment.<sup>214</sup> German intelligence assessments also reportedly concur with this assessment.<sup>215</sup>

Other factors also suggest that Iran may not have an active nuclear weapons program. First, as noted, the IAEA has resolved most of the outstanding issues described in the August 2007 Iran-IAEA work plan. Indeed, the agency has not discovered significant undeclared Iranian nuclear activities for several years (although, as noted above, the IAEA's ability to monitor Iran's nuclear facilities has decreased). Second, Tehran, beginning in 2003, has been willing to disclose previously undeclared nuclear activities to the IAEA (though, as previously discussed, Iran has not been fully cooperating with the agency). Third, Iran made significant changes to the administration of its nuclear program in fall 2003—changes that produced greater openness with the IAEA and may have indicated a decision to stop a nuclear weapons program.<sup>216</sup>

Fourth, as noted above, Iranian officials have stated numerous times that Tehran is not seeking nuclear weapons, partly for religious reasons—indeed, Khamenei has issued a fatwa against nuclear weapons, according to Iranian officials.<sup>217</sup> A change in this stance could damage Iranian religious leaders' credibility. Moreover, Mark Fitzpatrick of the International Institute for Strategic Studies argued in May 2008 that "given the pervasive religiosity of the regime, it is

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<sup>211</sup> "Press Briefing by Senior Administration Officials on IAEA Report on Iran's Nuclear Activities," November 8, 2011.

<sup>212</sup> *Annual Report on Military Power of Iran*, April 2012.

<sup>213</sup> Isabelle Lasserre, "Intelligence and the New Threats," *Politique Internationale*, January 1-March 31, 2010.

<sup>214</sup> "Israeli Foreign Minister Says Iran Nuclear Programme 'of Military Nature,'" *Voice of Israel*, March 19, 2012. The reports appeared in James Risen, "U.S. Faces a Tricky Task in Assessment of Data on Iran," *New York Times*, March 17, 2012, and Amy Teibel, "Israelis Agree Iran Hasn't Decided on Atom Bomb," *The Associated Press*, March 18, 2012.

<sup>215</sup> "Iran Striving for Nuclear Bomb"—Security Sources: Political Decision Still Pending," *Main Frankfurter Allgemeine*, July 1, 2011.

<sup>216</sup> This argument is explained in more detail in Kerr, *Bulletin of the Atomic Scientists*, 2006. For an in-depth discussion of Iran's nuclear decision-making process, see Abbas William Samii, "The Iranian Nuclear Issue and Informal Networks," *Naval War College Review*, Winter 2006, and Chen Kane, *Nuclear Decision-Making in Iran: A Rare Glimpse*, Middle East Brief, Brandeis University: Crown Center for Middle East Studies, May 2006.

<sup>217</sup> Statement by H.E. Dr. M. Javad Zarif, Permanent Representative of the Islamic Republic of Iran Before the Security Council, December 23, 2006. Khamene'i issued a fatwa as early as 2003 against nuclear weapons, according to Iranian officials ("Iran: Rowhani Says Khamene'i Considers Attempts To Access Nuclear Weapons 'Religiously Illegal,'" *Islamic Republic News Agency*, October 25, 2003).

unlikely that Iran's supreme leader would be secretly endorsing military activity in explicit contradiction of his own religious edict."<sup>218</sup>

Fifth, Iranian officials have made several arguments that nuclear weapons would not improve the country's security. They argue that Iran would not be able to compete with the arsenals of larger countries, such as the United States.<sup>219</sup> Moreover, Tehran has asserted that "Iran today is the strongest country in its immediate neighborhood. It does not need nuclear weapons to protect its regional interests."<sup>220</sup> The U.S.-led spring 2003 invasion of Iraq which overthrew Iraqi leader Saddam Hussein and thereby eliminated a key rival of Iran, may also have induced Tehran to decide that it did not need nuclear weapons. The government has also argued that a nuclear weapons program "would be prohibitively expensive, draining the limited economic resources of the country."<sup>221</sup>

## **Living with Risk**

Other findings of the NIE indicate that the international community may, for the foreseeable future, have to accept some risk that Iran will develop nuclear weapons. According to the 2007 NIE, "only an Iranian political decision to abandon a nuclear weapons objective would plausibly keep Iran from eventually producing nuclear weapons—and such a decision is inherently reversible." As noted, the estimate also asserted that "Iran has the scientific, technical and industrial capacity eventually to produce nuclear weapons if it decides to do so," adding that, "since fall 2003, Iran has been conducting research and development projects with commercial and conventional military applications—some of which would also be of limited use for nuclear weapons."

This is not to say that an Iranian nuclear weapons capability is inevitable; as noted above, Iran does not yet have such a capability. But Tehran would likely need to accept additional constraints on its nuclear program in order to provide the international community with confidence that it is not pursuing a nuclear weapon.

## **Other Constraints on Nuclear Weapons Ambitions**

Although the production of fissile material is widely considered to be the most difficult step in nuclear weapons development, Iran would, even with the ability to produce weapons-grade HEU, still face challenges in producing nuclear weapons, such as developing a workable physics package and effective delivery vehicles. A 1978 CIA report points out that there is a

great difference between the development and testing of a simple nuclear device and the development of a nuclear weapons system, which would include both relatively sophisticated nuclear designs and an appropriate delivery system.<sup>222</sup>

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<sup>218</sup> *The Iranian Nuclear Crisis*, p. 13.

<sup>219</sup> "Interview with Iran's Ambassador to IAEA," June 29, 2008.

<sup>220</sup> Iran's Permanent Mission to United Nations in New York, "An Unnecessary Crisis: Setting the Record Straight about Iran's Nuclear Program," Published as advertisement in *New York Times*, November 18, 2005.

<sup>221</sup> *Ibid.*

<sup>222</sup> "RE: Pakistan Strong Motivations To Develop Their Nuclear Capability," Central Intelligence Agency, April 26, 1978. For a more detailed discussion, see Office of Technology Assessment, *Technologies Underlying Weapons of* (continued...)



Moreover, Iran would face significant challenges if it were to attempt developing and producing HEU-based nuclear weapons covertly, although, as noted, this would probably be Tehran's preferred option. Covert centrifuge facilities are notoriously difficult for intelligence agencies to detect,<sup>223</sup> but Iran may well not be able to complete a covert centrifuge facility without detection. A 2005 International Institute for Strategic Studies report concluded that "an Iranian planner would have little basis for confidence that significant nuclear facilities could be kept hidden."<sup>224</sup> Tehran would need to hide a number of activities, including uranium conversion, the movement of uranium from mines, and the movement of centrifuge feedstock.<sup>225</sup> Alternatively, Iran could import uranium ore or centrifuge feedstock, but would also need to do so covertly.

The difficulty of the above task becomes clearer when one considers that foreign intelligence agencies apparently possess a significant amount of information about the Iran's enrichment program. First, both the Natanz and Fordow facilities were discovered by foreign governments before they became operational. Second, the development of the Stuxnet computer worm, discussed above, indicates that at least one foreign government possesses a large amount of information about Iran's centrifuge program which could not have been obtained via IAEA reporting, according to some experts.<sup>226</sup> Notably, National Security Advisor Donilon asserted in November 2011 that the United States can detect any additional secret Iranian enrichment facilities.<sup>227</sup>

It is also worth noting that Iran could produce only fairly simple nuclear weapons, which are not deliverable by longer-range missiles, without conducting explosive nuclear tests. Such tests, many analysts argue, would likely be detected.<sup>228</sup> It is also worth noting that moving from the production of a simple nuclear weapon to more sophisticated nuclear weapons could take several additional years.<sup>229</sup>

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*Mass Destruction* (OTA-BP-ISC-115), December 1993.

<sup>223</sup> International Institute for Strategic Studies, February 2011, p.68. See also, David Albright, Paul Brannan, and Jacqueline Shire, *Can Military Strikes Destroy Iran's Gas Centrifuge Program? Probably Not.*, Institute for Science and International Security, August 7, 2008.

<sup>224</sup> International Institute for Strategic Studies, *Iran's Strategic Weapons Programmes: A Net Assessment*, (UK: Routledge, 2005).

<sup>225</sup> The 2005 IISS report also explains that concealing a plutonium-based nuclear weapons program would be even more difficult (pp. 62-63).

<sup>226</sup> David Albright, Paul Brannan, Andrea Stricker, Christina Walrond, and Houston Wood, *Preventing Iran From Getting Nuclear Weapons: Constraining Its Future Nuclear Options*, Institute for Science and International Security, March 5, 2012; R Scott Kemp, "Worm Holes - Virus Attacks Iran's Enrichment Operation," *Jane's Intelligence Review*, September 15, 2011.

<sup>227</sup> Donilon, November 22, 2011.

<sup>228</sup> For a detailed discussion of this issue, see Steven A. Hildreth, statement before the House Committee on Oversight and Government Reform, Subcommittee on National Security and Foreign Affairs, March 5, 2008, available at <http://nationalsecurity.oversight.house.gov/documents/20080305141600.pdf>. Iran is a party to the Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water, also known as the Limited Test Ban Treaty. Iran has signed, but not ratified, the Comprehensive Nuclear-Test-Ban Treaty. The latter has not entered into force.

<sup>229</sup> *Iran's Nuclear and Missile Potential: A Joint Threat Assessment by U.S. and Russian Technical Experts*, EastWest Institute, May 2009. pp. 5-6.

## **Appendix A. May 2010 Tehran Declaration**

France, Russia, and the United States expressed concerns about the May 2010 agreement concluded by Brazil, Iran, and Turkey, known as the Tehran Declaration,<sup>230</sup> in a June 2010 joint paper sent to the International Atomic Energy Agency (IAEA) titled “Concerns about the Joint Declaration Conveyed by Iran to the IAEA”.<sup>231</sup> This appendix describes both the concerns expressed in the paper, as well as and differences between the October 2009 IAEA draft proposal and the Tehran Declaration.

First, the paper notes that the declaration “does not address Iran’s production or retention” of LEU enriched to about 20% uranium-235. Iran began enriching uranium to this level in February 2010. Notably, the October 2009 IAEA draft did not include an explicit prohibition on enriching uranium to this level. Instead, the agreement’s proponents thought that the supply of fuel for the Tehran Research Reactor (TRR) would obviate the need for Tehran to produce the fuel.<sup>232</sup>

Second, the joint paper notes that the declaration “asserts a right for Iran to engage in enrichment activities despite the fact that several U.N. Security Council resolutions prohibit Iran from pursuing such activities.” Presumably, the joint paper’s authors were concerned that agreeing to the “right” asserted in the declaration could weaken the suspension provisions in the resolutions. It is worth noting that those resolutions actually require Iran only to suspend its enrichment activities.

Third, the paper notes that the declaration does not contain a true deadline for removing low-enriched uranium (LEU) from Iran, since such removal would depend on the conclusion of an agreement with France, Russia, the United States, and the IAEA. However, it is unsurprising that the declaration would lack such a deadline, since Turkey and Brazil were not negotiating on the part of France, Russia, or the United States and, therefore, could not commit those governments to negotiate the necessary agreement. The declaration indicates that Iran is willing to conclude such an agreement.

Fourth, the paper notes that the declaration is ambiguous regarding Iran’s intention to discuss its nuclear program. The declaration states that “the nuclear fuel exchange is a starting point to begin cooperation and a positive constructive move forward among nations,” perhaps suggesting that Tehran may be willing to resolve those issues.

Fifth, the joint paper describes the declaration’s call for all of the TRR fuel to be delivered to Iran “in no later than one year,” as a condition that “would be impossible to meet.” The paper notes that the draft IAEA agreement “called for initial delivery of fuel within about one year to ensure the uninterrupted operation of the TRR, with remaining fuel to be delivered at a later date.”

Sixth, the paper states that the Tehran declaration “does not account for Iran’s accumulation of LEU since the IAEA first proposed the TRR deal,” a fact which would decrease “the confidence-building value of the original proposal.” The October 2009 IAEA proposal called for Iran to

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<sup>230</sup> The text is available at [http://www.brasil.gov.br/news/history/2010/05/17/joint-declaration-by-iran-turkey-and-brazil?set\\_language=en](http://www.brasil.gov.br/news/history/2010/05/17/joint-declaration-by-iran-turkey-and-brazil?set_language=en).

<sup>231</sup> The text appears in “Text: Powers Dismiss Iran Fuel Offer Before U.N. Vote,” *Reuters*, June 9, 2010.

<sup>232</sup> Analyst interview with knowledgeable U.S. official, June 16, 2010.

export 1,200 kilograms of LEU. If 1,200 kilograms of LEU had been removed from Iran as of May 31, 2010, Tehran would still have had a quantity of LEU which, if further enriched, could theoretically have produced enough HEU for a nuclear weapon. This would not have been the case in fall 2009.

The joint paper notes some other differences between the Tehran declaration and the previous proposals, but the importance of these differences is unclear. The paper states that, according to the “previous ‘escrow’ proposal,” Iran’s LEU could be returned to the country “if the parties failed to deliver fuel assemblies to Iran as agreed.” The declaration would allow Iran, unilaterally and without conditions, to demand the return of its LEU. The paper also notes that the declaration “states that Iran’s LEU would be the ‘property’ of Iran while in Turkey,” but the IAEA proposal “stated the IAEA would maintain ‘custody’ of the LEU throughout the process.” As noted, the Tehran declaration would provide for IAEA monitoring of the LEU in Turkey.

## **Appendix B. Possible Military Dimensions of Iran's Nuclear Program**

Then-International Atomic Energy Agency (IAEA) Director-General Mohamed ElBaradei told the agency's Board of Governors on June 2, 2008, that questions regarding "possible military dimensions" to Iran's nuclear program constitute the "one remaining major issue" concerning the IAEA's investigation of the program. A November 2011 report by current IAEA Director-General Yukiya Amano to the IAEA board contains the most detailed account to date of the IAEA's evidence regarding Iran's suspected nuclear weapons-related activities.<sup>233</sup> Unless otherwise noted, this appendix is based on Amano's November 2011 report.

The IAEA has "credible" information that Iran has carried out activities "relevant to the development of a nuclear explosive device." Although some of these activities have civilian applications, "others are specific to nuclear weapons," the report notes. Most of these activities were conducted before the end of 2003, though some may have continued. The Iranian government managed these activities via a program structure which included "senior Iranian figures." Amano's report contains a detailed description of the program's structure, which was set up in the late 1980s. The program's activities were managed via an institution called the Physics Research Center and overseen by an Iranian Ministry of Defense entity. About a decade later, the center's activities were consolidated under a new entity called the AMAD Plan. After the Iranian regime halted the AMAD Plan's work in 2003, "staff remained in place to record and document the achievements of their respective projects," according to information provided to the IAEA by unnamed governments. Later, "equipment and work places were either cleaned or disposed of so that there would be little to identify the sensitive nature of the work which had been undertaken." The IAEA has "other information" from governments which "indicates that some activities previously carried out under the AMAD Plan were resumed later." Some of these activities "would be highly relevant to a nuclear weapon programme."

The IAEA has information that the AMAD Plan either obtained or attempted to obtain dual-use "equipment, materials and services which ... would be useful in the development of a nuclear explosive device." Additionally, the program may have conducted studies on uranium conversion, missile reentry vehicles for delivering nuclear warheads, and conventional explosives used in nuclear weapons.

### **Nuclear Explosive Device Components**

The IAEA has information indicating that Iran may have conducted work on components for nuclear weapons. Iran possesses a document "describing the procedures" for reducing uranium hexafluoride to uranium metal, as well as "machining ... enriched uranium metal into hemispheres," which are "components of nuclear weapons."<sup>234</sup> Tehran has previously told the IAEA that it was offered equipment for casting uranium but never actually received it.<sup>235</sup>

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<sup>233</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions in the Islamic Republic of Iran*, GOV/2011/65, November 8, 2011.

<sup>234</sup> *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006), 1747 (2007), and 1803 (2008) in the Islamic Republic of Iran*, Report by the Director General, GOV/2008/15, May 26, 2008.

<sup>235</sup> According to Iran, its nuclear suppliers, many of whom were affiliated with the Khan network, provided the (continued...)

Moreover, a member of a clandestine nuclear supply network run by former Pakistani nuclear official Abdul Qadeer Khan told the IAEA that Iran “had been provided with nuclear explosive design information.” However, this information may not be sufficient to produce a nuclear weapon. (See “Nuclear Weapon Development Capabilities.”) The IAEA has also received information from an unnamed government that Iran carried out “preparatory work, not involving nuclear material, for the fabrication of natural and high enriched uranium metal components for a nuclear explosive device.”

As noted, the AMAD Plan may have conducted studies on conventional explosives used in nuclear weapons. Implosion-type nuclear explosive devices use conventional explosives to compress a core of highly-enriched uranium or plutonium in order to start a nuclear chain reaction. Specifically, Iran developed detonators which have limited non-nuclear applications, but also could be used in a nuclear explosive device. Tehran also may have experimented with a multipoint initiation system which could be used in conjunction with the detonators. Additionally, Iran may have conducted high explosive testing, possibly in association with nuclear materials, at a military site (see “Parchin” below). Iran also may have worked on neutron initiators, which are used in implosion-type nuclear weapons.

### **Re-Entry Vehicle**

As noted, the IAEA suspects that the AMAD Plan conducted studies on missile reentry vehicles for delivering nuclear warheads. Iran may have conducted “engineering studies to examine” integrating a payload into the re-entry vehicle of Iran’s Shahab-3 ballistic missile. Although these activities “may be relevant to the development of a non-nuclear payload, they are highly relevant to a nuclear weapon programme.” Iran also may have conducted work on a “prototype firing system” that would enable a missile’s nuclear payload “to explode both in the air above a target, or upon impact of the re-entry vehicle with the ground.”

### **Parchin**

Parchin is an Iranian military site.<sup>236</sup> The Institute for Science and International Security described the complex in a 2004 report as “a huge site dedicated to the research, development, and production of ammunition, rockets, and high explosives,” adding that the site “is owned by Iran’s military industry and has hundreds of buildings and test sites.”<sup>237</sup> IAEA inspectors previously investigated the Parchin site after receiving “information ... from a Member State in the early 2000s alleging that Iran was conducting high explosive testing, possibly in association with nuclear materials.”<sup>238</sup> Such testing could contribute to the development of implosion-type nuclear explosive devices. IAEA inspectors visited the site twice in 2005, but “did not uncover anything of relevance.”

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document in 1987 at their own initiative, rather than at Tehran’s request. Islamabad has confirmed to the IAEA that “an identical document exists” in Pakistan.

<sup>236</sup> Iranian Ambassador Ali Asghar Soltanieh described Parchin as “a military site” in a March 2012 statement. (Statement by H.E. Ambassador Soltanieh Resident Representative of the Islamic Republic of Iran to the IAEA Before the IAEA Board of Governors, March 8, 2012). Similarly, the IAEA described Parchin as a “military complex” (GOV/2011/65).

<sup>237</sup> David Albright and Corey Hinderstein, *Parchin: Possible Nuclear Weapons-Related Site in Iran*, Institute for Science and International Security, September 15, 2004.

<sup>238</sup> GOV/2011/65.

Parchin is not under IAEA safeguards. However, the IAEA wants Tehran to respond to information which the agency obtained from unnamed governments indicating that “Iran constructed a large explosives containment vessel” in 2000 at Parchin “in which to conduct hydrodynamic experiments.”<sup>239</sup> Such experiments are conducted to validate the design of an implosion-type nuclear weapon and are “strong indicators of possible weapon development.” The report does not say whether Iran actually conducted these experiments at Parchin. The IAEA has also asked Iran to provide agency inspectors with access to the facility. The inspectors in 2005 did not visit “the location now believed to contain the building which houses the explosives chamber.”<sup>240</sup>

### **Other Issues**

The IAEA has asked Tehran about other indications, some of which do not appear in Amano’s November 2011 report, suggesting that the country may have pursued nuclear weapons.<sup>241</sup> These include

- “information about a high level meeting in 1984 on reviving Iran’s pre-revolution nuclear programme”;
- “the scope of a visit by officials” associated with Iran’s Atomic Energy Organization “to a nuclear installation in Pakistan in 1987”;
- information on 1993 meetings between Iranian officials and members of a clandestine procurement network run by former Pakistani nuclear official Abdul Qadeer Khan;
- information about work done in 2000 which apparently related to reprocessing;
- Iranian scientists’ mathematical research with nuclear weapons applications; and
- information indicating that Iran “may have planned and undertaken preparatory experimentation which would be useful were Iran to carry out a test of a nuclear explosive device.”

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<sup>239</sup> GOV/2011/65. The report also notes that the IAEA “has obtained commercial satellite images that are consistent with this information. From independent evidence ... the Agency has been able to confirm the date of construction of the cylinder and some of its design features.”

<sup>240</sup> GOV/2011/65.

<sup>241</sup> The first four items are discussed in GOV/2008/15. The last two items are in GOV/2011/65.

## Appendix C. Iranian Centrifuge Workshops and Related Entities

This appendix lists Iranian entities which appear to manufacture centrifuges or related components.<sup>242</sup> It also includes some entities which appear to conduct work closely related to these activities. The appendix excludes entities which have only been identified as involved in procuring materials or components for Iran's centrifuge program. This list is probably not exhaustive and at least some of the publicly available information about Iran's centrifuge workshops may be outdated. International Atomic Energy Agency (IAEA) inspectors had access to Iranian centrifuge workshops until early 2006 in order to verify the October 2003 agreement under which Iran suspended its enrichment program. However, the agency's knowledge of Iran's workshops has deteriorated since Iran ended this access in early 2006. Since then, Iran may well have moved centrifuge-related work to other locations<sup>243</sup> and has likely built more such workshops.<sup>244</sup>

### Kalaye Electric

U.N. Security Council Resolution 1737 describes Kalaye Electric, which is located in Tehran, as a "provider" to Iran's pilot centrifuge facility located at Natanz. According to an August 2008 Institute for Science and International Security report, the Atomic Energy Organization of Iran (AEOI) controls the country's centrifuge program, but the program "is operated by the Kalaye Electric Company."<sup>245</sup> The report stated that

Even today, the centrifuge program still acquires vacuum pumps and much of its measuring equipment via illicit trade with foreign suppliers. Work at Kalaye Electric is aimed at creating an indigenous capability to make this equipment and reduce its dependence on smuggling, which has become more difficult under increased economic sanctions. However, it is unknown which Iranian facilities would make vacuum or measuring equipment.

A European Union Council regulation adopted in December 2011 describes several entities as current suppliers to Kalaye Electric, suggesting that the company was involved in Iran's centrifuge program at that time.<sup>246</sup>

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<sup>242</sup> For this appendix, CRS consulted IAEA reports, European Council documents, U.S. Department of the Treasury documents, a 2008 report from the Institute for Science and International Security, and relevant United Nations Security Council resolutions.

<sup>243</sup> A former top Middle East intelligence analyst at the Department of State, expressed concern in 2006 that Tehran could be moving some components related to its nuclear program. See Paul Kerr, "News Analysis: IAEA Limits Leave Iran Intel Gaps," *Arms Control Today*, October 2006.

<sup>244</sup> A U.S. official told CRS in April 2011 that there "could be lots of workshops" in Iran. And a former U.S. government official with direct experience on the issue told CRS in February 2012 that Iran's centrifuge production is widely distributed and that the number of workshops has probably multiplied "many times" since 2005 because of an increase in Iranian contractors and subcontractors working on the program.

<sup>245</sup> David Albright, Paul Brannan, and Jacqueline Shire, *Can Military Strikes Destroy Iran's Gas Centrifuge Program? Probably Not*, Institute for Science and International Security, August 7, 2008.

<sup>246</sup> *Council Implementing Regulation (EU) No 503/2011 Implementing Regulation (EU) No 961/2010 on Restrictive Measures Against Iran*, May 23, 2011.

### **7<sup>th</sup> of Tir**

Resolution 1737 describes this entity, which is located in Esfahan, as “directly involved” in Iran’s nuclear program. 7<sup>th</sup> of Tir was involved in manufacturing centrifuge components, according to the ISIS report, which added that Iran moved “the key centrifuge manufacturing equipment and components to Natanz and other AEOI sites” when the IAEA began monitoring the 2003 suspension agreement. Whether and to what extent the facility is still involved in manufacturing centrifuge components is unknown, the report says.

### **Farayand Technique**

Resolution 1737 describes this entity, which is located in Esfahan, as “involved in” Iran’s centrifuge program. The facility was involved in “making and assembling” centrifuge components, according to the 2008 ISIS report. According to a 2010 European Council regulation, another entity, called the Iran Centrifuge Technology Company, “has taken over the activities of Farayand Technique,” which include “manufactur[ing] uranium enrichment centrifuge parts.”<sup>247</sup>

### **Iran Centrifuge Technology Company**

As noted, this entity, which is apparently located in Esfahan, “has taken over the activities of Farayand Technique,” which include “manufactur[ing] uranium enrichment centrifuge parts,” according to the 2010 European Council regulation.<sup>248</sup>

### **Pars Trash**

Resolution 1737 describes this entity, which is located in Tehran, as “involved in” Iran’s centrifuge program. According to the ISIS report, the company manufactured centrifuge components. The report does not say whether Pars Trash is still involved in Iran’s centrifuge program.

### **Kaveh Cutting Tools Company**

This entity, according to the 2008 ISIS report, manufactured centrifuge components. The company is “part of” Khorasan Metallurgy Industries, the ISIS report says. Both of these entities are located in Mashad. Khorasan Metallurgy Industries is “involved in the production of centrifuge components,” according to the 2010 European Council regulation.

### **Khorasan Metallurgy Industries**

This entity, which is located in Mashad, is “involved in the production of centrifuge components,” according to the 2010 European Council regulation.

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<sup>247</sup> Council Regulation (EU) No 961/2010 on Restrictive Measures Against Iran and Repealing Regulation (EC) No 423/2007, October 25, 2010.

<sup>248</sup> *Ibid.*



### **Sanam Electronic Industry Group**

Located in Tehran, this entity was, according to ISIS, “involved in making centrifuge components.”

### **Abzar Boresh Kaveh Company**

U.N. Security Council Resolution 1803, which the Council adopted in 2008, describes this company as “[i]nvolved in the production of centrifuge components.” CRS could not determine its location.

### **Parto Sanat Company**

The 2010 European Council regulation describes this company, which is located in Tehran, as a “[m]anufacturer of frequency changers ... capable of developing/modifying imported foreign frequency changers in a way that makes them usable in gas centrifuge enrichment.”

### **Eyvaz Technic**

The 2011 European Council regulation states that, as recently as 2011, this company, which is located in Tehran, supplied equipment relevant to centrifuge operations to Iran’s Natanz and Fordow centrifuge facilities.

### **Ghani Sazi Uranium Company**

According to the 2011 European Council regulation, this company, which is located in Tehran “has production contracts” with Kalaye Electric and Iran Centrifuge Technology Company.

### **Iran Pooya**

The 2011 European Council regulation describes this entity as “a major manufacturer of aluminium cylinders for centrifuges whose customers include” the AEOI and Iran Centrifuge Technology Company. CRS could not determine its location.

### **Mohandesi Toseh Sokht Atomi Company**

The 2011 European Council regulation describes this company, which is located in Tehran, as “contracted to” Kalaye Electric “to provide design and engineering services across the nuclear fuel cycle.” The company has “[m]ost recently ... been procuring equipment for the Natanz uranium enrichment site,” according to the regulation.

### **Saman Nasb Zayنده Rood**

The 2011 European Council regulation describes this company, which is located in Esfahan, as a “[c]onstruction contractor that has installed piping and associated support equipment at the uranium enrichment site at Natanz.” The company “has dealt specifically with centrifuge piping,” according to the regulation.

## Appendix D. Post-2003 Suppliers to Iran's Nuclear Program

Iran has obtained components, expertise, and material for its nuclear program from a variety of foreign sources. Tehran sought assistance for the program from the Russian and Chinese governments,<sup>249</sup> but also obtained relevant components, expertise, and material via deceptive procurement techniques.<sup>250</sup> Perhaps Iran's best-known source was a clandestine procurement network run by former Pakistani nuclear official Abdul Qadeer Khan. This network began supplying Iran's centrifuge program in 1987,<sup>251</sup> but U.S. and Pakistani officials have characterized the network as defunct since Pakistan publicly revealed the network in early 2004.<sup>252</sup>

It is worth noting that, according to former Deputy Director General of the International Atomic Energy Agency (IAEA) Olli Heinonen,<sup>253</sup> the IAEA has not determined the source of material that Iran obtained for its advanced centrifuges; CRS has not found additional information on this subject.

### Methodology

Because the original Khan network appears to be defunct, this appendix focuses on post-2003 suppliers to Iran's enrichment program. To obtain the information for this appendix, CRS reviewed official U.S. government reports,<sup>254</sup> as well as lists of entities sanctioned by the United States and the European Union since early 2004.<sup>255</sup> CRS also reviewed public information from the Department of Justice, reports from a U.N. Panel of Experts, and selected non-governmental reports.<sup>256</sup> In order to identify suppliers germane to this appendix, CRS excluded Iranian entities or nationals, Iranian ships under foreign flags, and entities associated with the Khan network.

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<sup>249</sup> A Russian entity agreed during the 1990s to provide Iran with a centrifuge facility but later canceled the transaction. See Robert J. Einhorn and Gary Samore, "Ending Russian Assistance to Iran's Nuclear Bomb," *Survival*, Summer 2002. The United States dissuaded China in 1997 from supplying Iran with a uranium conversion facility, although Iran did receive blueprints for the facility. See *Report of Proliferation-Related Acquisition in 1997*, and *Implementation of the NPT Safeguards Agreement and Relevant Provisions of Security Council Resolutions 1737 (2006) and 1747 (2007) in the Islamic Republic of Iran*, Report by the Director General, GOV 2007/58, November 15, 2007.

<sup>250</sup> According to *Report of Proliferation-Related Acquisition in 1997*, "Tehran is attempting to acquire fissile material and technology for weapons development and has set up an elaborate system of military and civilian organizations to support its effort."

<sup>251</sup> Iran began obtaining centrifuge-related technology from non-Khan network sources in 1985. See David Albright, *Peddling Peril: How the Secret Nuclear Trade Arms America's Enemies* (New York: Free Press), 2010, pp. 70-73.

<sup>252</sup> For more information, see CRS Report RL34248, *Pakistan's Nuclear Weapons: Proliferation and Security Issues*, by Paul K. Kerr and Mary Beth Nikitin.

<sup>253</sup> Analyst interview January 18, 2012.

<sup>254</sup> State Department reports to Congress covering 2004 through 2008 (submitted pursuant to Section 1308 of the Foreign Relations Authorization Act for Fiscal Year 2003; CRS does not have the report covering 2006); State Department reports reviewing countries' compliance with international arms control and nonproliferation agreements covering between 2004-2010 and December 31, 2008; and intelligence community reports mandated by section 721 of the Intelligence Authorization Act for Fiscal Year 1997 covering 2004-2010.

<sup>255</sup> Specially Designated Nationals List and lists of entities sanctioned pursuant to several nonproliferation laws (available at <http://www.state.gov/t/isn/c15231.htm>).

<sup>256</sup> *Panel of Experts*, 2011; *Panel of Experts*, 2012.

This methodology has limitations. Official reports generally do not provide enough information to identify specific suppliers to Iran's enrichment program and Federal Register announcements of the imposition of sanctions generally do not explain the specific transactions which warranted the sanctions.<sup>257</sup> Even if official reports do identify suppliers to Iran's *nuclear* program, they often do not say whether the entities were supplying Iran's *enrichment* program. For example, an October 2008 Justice Department fact sheet stated that the sales director of a California-based corporation attempted to export illegally to Iran "machinery and software to measure the tensile strength of steel," explaining that these items "can make a contribution to nuclear activities of concern." The fact sheet, however, did not provide additional information and neither 2007 testimony from a Department of Commerce official nor a 2008 Commerce Department announcement explained whether the exports were intended for Iran's enrichment program.<sup>258</sup> Similarly, a 2008 report from the Czech Republic's Security Information Service stated that an Iranian company "subject to sanctions because of its involvement in the Iranian nuclear program" attempted to acquire "specific machinery" from a Czech supplier, but the report did not specify further.<sup>259</sup>

### **Suppliers to Iran's Enrichment Program**

The information reviewed for this appendix indicates that Iranian-owned entities are using deceptive means in attempts to acquire enrichment technology from foreign entities.<sup>260</sup> However, the sources described above contain no evidence that foreign governments are currently supplying Iran's enrichment program. According to a 2009 State Department report, "all major suppliers, apart from Russia which is providing assistance to Iran's Bushehr Nuclear Power Plant, have agreed not to provide nuclear technology to Iran."<sup>261 262</sup> Additionally, State Department reports covering countries' compliance with international nonproliferation agreements between 2004 and 2010 indicate that the Chinese government is not involved in supplying Iran's suspected nuclear weapons program.<sup>263</sup>

### **Chinese Entities**

Robert J. Einhorn, State Department Special Advisor for Nonproliferation and Arms Control, stated in March 2011 that the United States "continue[s] to have concerns about the transfer of

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<sup>257</sup> CRS checked the lists of sanctioned entities against news reports and other sources in order to obtain additional information.

<sup>258</sup> Statement of Mark Foulon, Acting Under Secretary of Commerce for Industry and Security, Before Committee on Banking, Housing, and Urban Affairs, March 21, 2007; Order Denying Export Privileges, Bureau of Industry and Security, January 25, 2008.

<sup>259</sup> Annual Report of the Security Information Service (BIS) for 2008, available at <http://www.bis.cz/n/ar2008en.pdf>.

<sup>260</sup> The extent to which these attempts are successful is unclear.

<sup>261</sup> *Report on the Proliferation of Missiles and Essential Components of Nuclear, Biological, Chemical and Radiological Weapons. Report Submitted to the Congress Pursuant to Section 1308 of the Foreign Relations Act for Fiscal Year 2003*. January 2008-December 2008.

<sup>262</sup> Previous official statements from the United States and the United Kingdom appear to support this statement with respect to Russia. John Rood, then-Acting Under Secretary of State for Arms Control and International Security, stated during a June 12, 2008, House Committee on Foreign Affairs hearing that the Bush Administration did not believe there was "ongoing Russian nuclear assistance [to Iran] outside of the Bushehr project" that would cause concern. Similarly, the UK Foreign and Commonwealth Office stated in August 2007 that the "Russian relationship with Iran in connection with Bushehr is now the only significant foreign relationship Iran has in the nuclear field," adding that "[e]arlier plans for a wider Russian relationship with Iran on nuclear matters ... have been shelved."

<sup>263</sup> The report covering 2011 does not address this issue.

proliferation-sensitive equipment and materials to Iran by Chinese companies.”<sup>264</sup> Similarly, the State Department compliance reports mentioned above indicate that unspecified non-Chinese entities have attempted to acquire “nuclear-related” materials and equipment from Chinese entities. Furthermore, a CIA report covering 2007 stated that “private Chinese businesses continue to sell materials, manufacturing equipment, and components suitable for use in ballistic missile, chemical weapon and nuclear weapon programs to North Korea, Iran and Pakistan.”<sup>265</sup> The report did not specify further.<sup>266</sup> It is worth noting that Chinese entities may be supplying Iran with enrichment-related equipment obtained from Western suppliers. Indeed, according to court documents made public in July 2012, an Iranian national attempted to obtain U.S.-origin components for Iran’s enrichment program using entities in China and the Philippines.<sup>267</sup>

### Other Suppliers

Iranian has reportedly established front companies in Turkey in order to obtain nuclear-related items. Notably, Turkish entities were involved with the Khan network.<sup>268</sup> Iranian entities have also attempted to obtain nuclear-related items from companies in the Czech Republic, according to reports from that government’s Security Information Service.<sup>269</sup>

Iran has also attempted to obtain enrichment-related equipment from suppliers in Canada and the United States. For example, according to a January 2012 Justice Department fact sheet, a man was sentenced in 2010 for attempting in March 2009 to export pressure transducers to Iran via Canada and the United Arab Emirates; he had purchased the items in the United States.<sup>270</sup> “Pressure transducers have applications in the production of enriched uranium,” according to the fact sheet. Additionally, a California-based firm exported “vacuum pumps and pump-related equipment to Iran through a free trade zone located in the United Arab Emirates [UAE]” between December 2007 and November 2008. This equipment has “a number of applications, including in the enrichment of uranium,” according to the Justice Department fact sheet. Furthermore, declassified documents from the Canada Services Border Agency state that Iranian entities have been attempting to acquire items from Canada for Iran’s nuclear program, though the documents do not specifically mention Tehran’s enrichment program.<sup>271</sup> The documents also state that “Iranian procurement agents have ... been able to export items [from Canada],” international

<sup>264</sup> Available at <http://www.armscontrol.org/events/RoleSanctionsIranNuclear>.

<sup>265</sup> Director of Central Intelligence, *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January through 30 June 2007*, Washington, DC.

<sup>266</sup> For non-official reports on Chinese suppliers to Iran’s enrichment program, see also, John Pomfret, “Chinese Firms Bypass Sanctions on Iran, U.S. Says,” *The Washington Post*, October 18, 2010; and *Chinese Firms Continue to Evade Iran Sanctions*, Institute for Science and International Security, October 19, 2010.

<sup>267</sup> United States District Court for the District of Columbia, Grand Jury Indictment: *United States of America v. Parviz Khaki and Zongcheng Yi*, May 7, 2012, unsealed July 12, 2012.

<sup>268</sup> Aaron Stein, “Front Companies Use Turkey for Iran’s Nuclear Programme,” *Southeast European Times*, November 6, 2011; Andrea Stricker, *United States Indicts Man behind Alleged Multi-Million Dollar Iranian Smuggling Network*, Institute for Science and International Security, February 11, 2011. Available at [http://content.govdelivery.com/attachments/USDHSICE/2012/07/13/file\\_attachments/141298/Khaki%2B\\_Yi\\_Superseding\\_Indictment.pdf](http://content.govdelivery.com/attachments/USDHSICE/2012/07/13/file_attachments/141298/Khaki%2B_Yi_Superseding_Indictment.pdf).

<sup>269</sup> Annual Reports of the Security Information Service (BIS) for 2008 and 2004. Available at <http://www.bis.cz/annual-report.html>.

<sup>270</sup> *Summary of Major U.S. Export Enforcement and Embargo-Related Criminal Prosecutions: 2007 to the Present*.

<sup>271</sup> The Canadian press reported about the documents in August 2012 (Lee Berthiaume, “Canadian Goods Destined for Iran’s Nuclear Program Slip Through: Documents,” *Postmedia News*, August 22, 2012). One document is dated October 28, 2011. The other document is undated, but appears to have been created in 2011 or 2012.

sanctions notwithstanding. The documents, however, do not specify whether exported items were destined for Iran's nuclear program. Moreover, as noted, court documents made public in July 2012 state that an Iranian national attempted to obtain U.S.-origin components for Iran's enrichment program.

Entities in the UAE were part of the Khan network and have been cited as shippers for enrichment-related technology to Iran. Einhorn described the UAE in March 2011 as a "trans-shipment hub for Iran," but added that the UAE "has also taken strong steps in recent months to curtail illicit Iranian activities."<sup>272</sup> A 2011 European Council regulation identified two UAE entities, Modern Technologies FZC and Qualitest FZE, as "[i]nvolved in procurement of components for [the] Iranian nuclear programme," although the regulation did not specify whether the components were for uranium enrichment.<sup>273</sup>

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<sup>272</sup> For more information, see CRS Report R40344, *The United Arab Emirates Nuclear Program and Proposed U.S. Nuclear Cooperation*, by Christopher M. Blanchard and Paul K. Kerr.

<sup>273</sup> *Council Implementing Regulation (EU) No 503/2011 of 23 May 2011 implementing Regulation (EU) No 961/2010 on restrictive measures against Iran.*