# Chapter 5

# Iran

> "While there is currently consensus across the political spectrum with respect to the necessity of sustaining a nuclear research program, no such agreement is evident on the issue of actually crossing the nuclear weapons threshold."– Ray Takeyh[1]

## 5.1 Introduction

In the previous chapter, I discussed US counterproliferation policy toward the DPRK. I found that economic and military threats were only useful in a limited set of circumstances (only in the short term, and if credible), while social benefits were productive in a wider set (both in the short and long term). However, the conditions under which social strategies worked were also circumscribed. Due to repeated social snubs, the North Koreans had inverted their patterns of response to US strategies by the end of 2002, and subsequently took significant strides towards a nuclear capability.

In this chapter, I test a similar set of hypotheses with respect to the Islamic Republic of Iran (hereafter Iran). Relative to the US strategy toward the DPRK, the US strategy toward Iran over three administrations has been relatively constant. Moreover, much of the US strategy has been indirect, attempting to convince other countries not to cooperate with Iran rather than negotiating directly with the Iranians. These attempts can be evaluated and

[1] Takeyh 2003.

compared with what is known about Iran's clandestine programs to determine the overall effects of US strategy on Iran's nuclear program. Next to North Korea, during the post-Cold War period, Iran has probably come the closest to developing nuclear weapons, although (as I argue in this chapter) they are still some distance away from achieving success.

It is more difficult to determine proper cutoff points for analysis in the Iranian case than it is in the North Korean case due to less clear variation in Iran's nuclear program. I therefore examine two periods: the Iranian nuclear program from the Revolution until the revelations of Iran's uranium enrichment facilities in August 2002, then until the end of the first round of the current crisis in November 2003. I argue that while the US was fairly successful in preventing imports from first-tier nuclear suppliers, the effort to oppose Iran's nuclear power program (in particular, the Bushehr reactor) was counterproductive, in that it gave Iran a justification for developing a complete fuel cycle; additionally, bilateral efforts to negotiate with Iran were too meager to make a difference, as can be seen in the contrast between US actions and EU actions regarding Iran's clandestine program.

Since US strategies mainly focused on supply, multiple-party interactions (H7) were key to restricting Iranian progress. Most of the evidence in the Iranian case relates to hypotheses 8-10, which specify the importance of incentives and disincentives of a military, economic, or social nature respectively. The US never used military leverage towards suppliers, so most of the evidence has to do with using economic or social leverage in order to cut off Iran's access to nuclear technology. The majority of the incidents involved used economic benefits to convince suppliers, while in a few cases the implicit threat of sanctions or social incentives were used to convince states to cut off support. The US made a limited number of attempts to deal directly with Iran, which were complicated by both Iranian and US domestic politics (H4). Due to a general lack of direct interaction, feedback (H5) did not play an important role, and the causal roles of interaction and structure (H6) could not be evaluated.

In this chapter, I first discuss possible Iranian nuclear motivations during the mullahs' rule while describing the positions of important players within its domestic political structures. I then give a brief background for Iran's nuclear program during the time of the shah, followed by a technical overview of Iran's nuclear progress since 1979. The next

section deals with US policy broken up by country, detailing how the United States attempted to influence Russia, China, and other states to stop them from assisting Iran. I also examine bilateral relations with Iran, focusing on the multiple layers of US sanctions placed on Iran over the past two and a half decades. I then look at the clandestine elements of Iran's program during these years, tracing the intelligence community's (usually pessimistic) warnings about Iran, describing Iran's attempts to acquire uranium and uranium enrichment technologies, and giving a brief overview of the IAEA's failures to detect the clandestine elements of Iran's program. In the final section, I chronicle the first year of the current crisis, from discovery of Iran's enrichment facilities in August 2002 until its first agreement with the EU3 in November 2003.

## 5.2 The Roots of the Iranian Nuclear Program, 1957–2003

### 5.2.1 Iranian Motivations

Since the Iranian Revolution, ultimate responsibility and underlying motivations for the Islamic Republic's nuclear program have been quite murky. Nonetheless, some powerful individuals have made statements or have been named as particular backers of either the nuclear project in general or nuclear weapons in particular. The AEOI has had only two directors since the 1979 revolution—first Reza Amrollahi, then Reza Aghazadeh. Other key players include Hashemi Rafsanjani and Hassan Rowhani. In this section, I look into some of Iran's motivations for developing nuclear weapons, chronicle key individuals and their apparent roles, and list the various statements that have been interpreted as being in favor of nuclear weapons development by Iran (denials of intent or ability to acquire nuclear weapons are so prevalent as to not be worth mentioning).

Iran's desire for a nuclear weapons capability seems to be related to several factors. The most overt statements supporting a weapons program cite Iraq, Israel, and the United States as potential threats. Regional powers Russia and Pakistan also possess nuclear weapons, although relations with Russia have generally been much better than with Pakistan. While the 2003 Iraq War removed Iraq itself as Iran's most immediate threat, Iran now has the

United States military as a direct neighbor on both sides. Kenneth Pollack argues that while Iran has many incentives for a nuclear program, deterring a US attack is the most important.[2] Pollack recommends a 'triple track' approach to Iran's nuclear program, including a 'Grand Bargain,' a 'True Carrot-and-Stick' approach, and 'Preparing for a New Containment Regime.'[3] Economics seems to at least not stand in the way of Iran's nuclear program; although the Shah cut back significantly on the scale of his program in the late 1970s in part due to a lack of funds, Iran's program appears to have been well funded, at least after the end of the Iran-Iraq War.

Prestige seems to be a major motivator for nuclear facilities, if not necessarily weapons. Sharam Chubin has argued that Iran's motivations are linked to Iran's desire for status and its view of itself as a major Islamic power, and not to military needs.[4] While Iran may seek a nuclear weapons capability, it does not necessarily seek weapons; Iran's desire to create an indigenous capability indicates prestige motives as much as anything else.[5] Chubin argues that with prestige as a motive, it may be more difficult to get Iran to give up a nuclear program than if it is motivated by security needs, since outside interference is likely to backfire.[6] George Perkovich argues similarly that a clear military need for nuclear weapons is ephemeral, and that international prestige and status help drive Iran's program.[7] Perkovich recommends offering technological and economic benefits, and argues that economic and social sanctions have proven to be ineffective.[8]

This contrasts with neoconservative perspectives, which argue that Iran is 'dead set' on proliferating;[9] from this perspective, Iran's pursuit of nuclear weapons is intrinsic to its regime, requiring regime change to cut short its program. A committee of prominent neoconservatives has called for governmental change in Iran.[10]. This perspective presumes that support for a nuclear program is limited to a few powerful figures in the current Iranian

[2]Pollack 2004, 259.
[3]Pollack 2004, 400-416.
[4]Chubin 1994, 53-5.
[5]Chubin 2002, 71-85.
[6]Chubin 2002, 111.
[7]Perkovich 2003.
[8]Perkovich 2005.
[9]Bolton 2004.
[10]Committee on the Present Danger 2004.

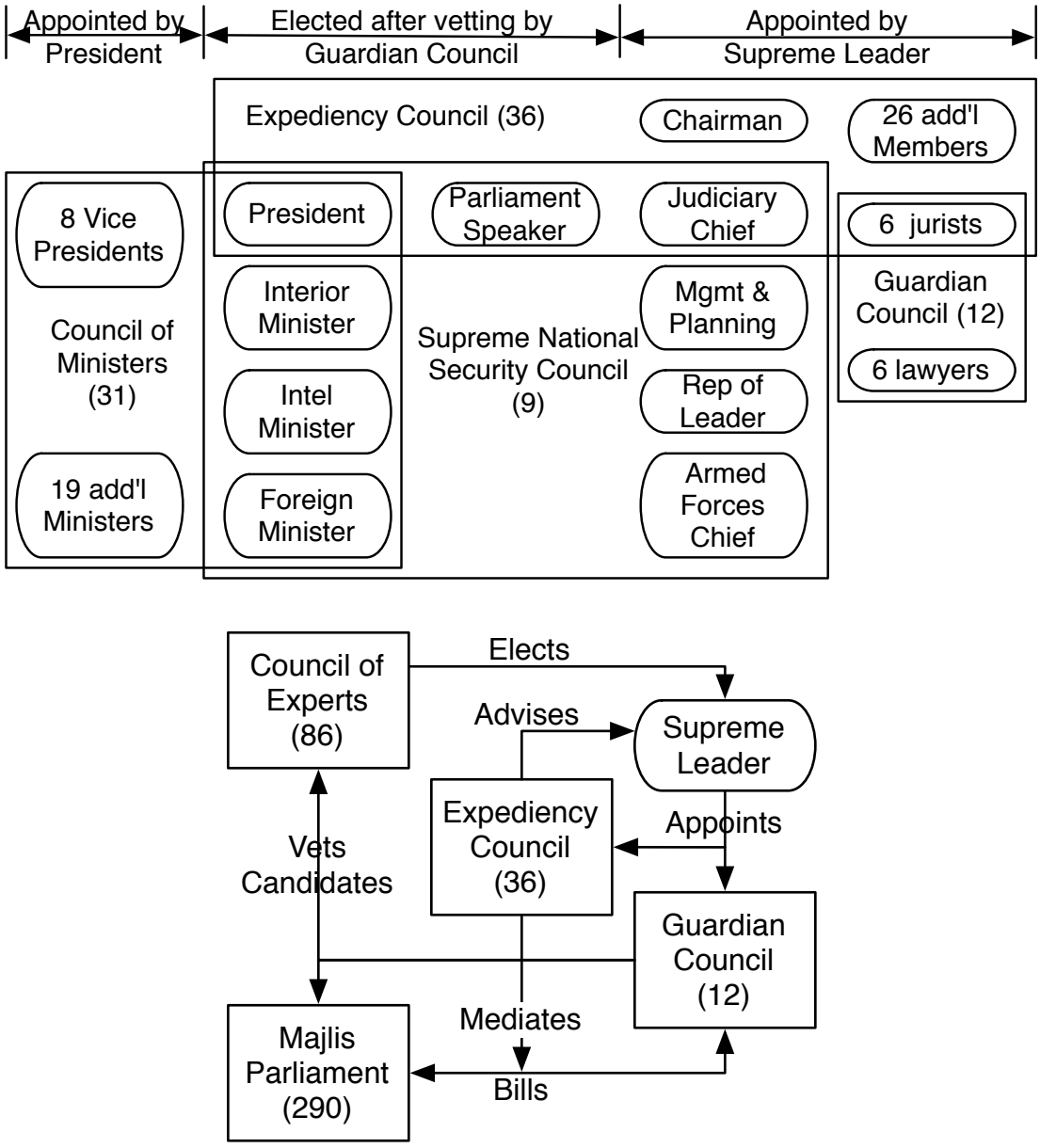
government.

However, domestic support for an Iranian nuclear program is uniformly high;[11] although some are suspicious of Iran's nuclear power program due to the high cost in general of nuclear power around the world, Iran has managed to get Russia to complete the Bushehr for a fraction of its actual cost; consequently, power over the long run will be competitive with other sources, even for an oil- and gas-rich country. The low marginal price for Bushehr also undercuts domestic opposition, who might object to wasting money on a nuclear power plant otherwise. Others argue that Iran has no reason to obtain a uranium enrichment plant for fuel reasons, due to a glut of global fuel; however, Iran's ambassador to the UN contends that the fuel facilities are needed because US pressure could potentially undermine foreign fuel sources.[12] Given the past record of the United States with respect to any and every aspect of Iran's program, these contentions are difficult to reject out of hand.

Responsibility for the nuclear program is difficult to trace, due to the complex power relationships within the Iranian government and the small number of people who run the nuclear program.[13] The structure of the Iranian government is split in two (see the top of Figure 5.1 for the overlapping membership of various bodies and the relationships between these bodies)[14]; on one side are the elected officials, which include the President, the Parliament, and the Council of Experts, while on the other side lies the Guardian Council (half appointed by the Supreme Leader directly, half by the chief of the judiciary, who is appointed by the Supreme Leader) and most of the Expediency Council. The Supreme National Security Council (SNSC) lies somewhere between, with a mix of appointed and non-appointed members. At first glance, the system has many checks and balances (see the bottom of Figure 5.1), since the President, Parliament, and the Council of Experts (who elects the Supreme Leader) are all popularly elected; in practice, since the Supreme Leader appoints the Guardian Council, which vets all candidates for election, the Supreme Leader, advised by the Expediency Council and the SNSC (not in Figure 5.1), wields most of the

[11] Takeyh 2003; *Perkovich 2005*
[12] *Lynch 2003*.
[13] Perkovich 2003, 4.
[14] Figures based on Pike 2003 and Public Broadcasting System 2004.

Figure 5.1: Iranian government structure and relations



power. Support for the nuclear program in general is uniform; support for nuclear weapons in particular has shifted frequently since the Iranian Revolution.

In May 1979, during the Iranian Revolution, Khomeini adviser Ayatollah Muhammad Beheshti reportedly told energy specialist Dr. Fereydun Fesharaki, "It is your duty to build the atomic bomb for the Islamic Republican Party."[15] Fesharaki, claimed to be the head of the secret Iranian program under the Shah, left the country only to return in 1987.[16] Yet Khomeini had also called the Shah's nuclear program "the work of the devil."[17] In 1982, Reza Amrollahi took over the directorship of AEOI,[18] and was later appointed to one of Iran's vice president positions in the Council of Ministers (see Figure 5.1) in 1989;[19] some sources claim that Amrollahi was a major backer of a nuclear weapons option in the mid-1980s.[20] However, others argue that he did not have complete control over AEOI.[21]

A concerted effort instigated by Hashemi Rafsanjani (speaker of the parliament from 1980-1989, president of Iran between 1989-1997, and head of the Expediency Council thereafter) was made to send students abroad for nuclear training as well as bring back nuclear scientists living abroad starting in the late 1980s.[22] Rafsanjani also reportedly commissioned preliminary studies in 1987 on a nuclear option for Iran,[23] and is claimed by some to be the chief director of Iran's nuclear effort.[24] However, the effort by Iran to pursue nuclear technology in the 1980s was much less than that taken by Iraq; one source notes that estimates of the total number of people working on Iran's nuclear program in the late 1980s was around 500, versus 7500 for Iraq's program, a more typical number for a nuclear weapons program.[25]

Like the bombing of the Osiraq reactor, the bombing of the Bushehr power plant by

[15] Spector and Smith 1990, 208;Rubin 2002.
[16] *Middle East Defense News 1992a*.
[17] Krosney 1993, 189.
[18] Krosney 1993, 237. Krosney also notes that he is a relative of Rafsanjani
[19] Timmerman 1992, 43.
[20] Krosney 1993, 238.
[21] *Hibbs 1991a*.
[22] Timmerman 1992, 42.
[23] *Pinkas 1992*.
[24] *Middle East Defense News 1992a*.
[25] Cordesman 2000, 4.

Iraq during the later years of the Iran-Iraq war may have led the target—in this case Iran—to seek out other, more clandestine methods of acquiring nuclear knowledge.[26] In any case, Iran's reinvigoration of its nuclear program was directly connected by Iranian leaders first to the Iran-Iraq war and to the Israeli nuclear threat; In October 1988 while acting commander-in-chief of the armed forces, Rafsanjani argued that "we should fully equip ourselves both in the offensive and defensive use of chemical, bacteriological, and radiological weapons."[27] In a similar vein, Vice President Atalollah Mohajerani called in October 1991 for Muslim states to acquire an "atomic capacity" equivalent to Israel's.[28]

Iranian statements regarding nuclear weapons aspirations became increasingly scarce after 1991. Amidst a great deal of denial, former Iranian Defence Minister Akbar Torkan implied an Iranian desire for nuclear weapons in 1993; when asked what Iran would do against a threat from the United States, he responded, "The way to go about dealing with such a threat requires a different solution entirely."[29] In September 1994, Iran threatened to withdraw from the NPT since it was not being given access to Western technology,[30] but said that a decision would be postponed until after the final Prepatory Committee meeting for the 1995 NPT Review and Extension conference. Iran's delegate to the Chemical Weapons Convention in the Hague on September 30, 1995, declared that Iran was "keeping its nuclear options open."[31] Like the NPT review, Iran threatened to block the CTBT in 1996 due to its lack of a commitment to begin wider disarmament talks,[32] but later agreed to sign it.

With the surprise election of reformer Mohamad Khatami as president of Iran in May 1997 (supported by AEOI head Amrollahi), one report argued that "hard-core Islamicists in the middle ranks at the AEOI and nuclear hawks in the Organization of Revolutionary Guards will be on the defensive."[33] However, Amrollahi was replaced as the head of

[26] Krosney 1993, 188.

[27] Krosney 1993, 192. Note that a distinction can be made between radiological and nuclear weapons, so this quote may not constitute a direct call for *nuclear weapons.*

[28] *Middle East Defense News 1991*.

[29] Eisenstadt 1999, 128.

[30] *Hibbs 1994b*.

[31] *Iran Brief 1995*.

[32] *Financial Times (London) 1996*.

[33] *Hibbs 1997*.

AEOI in September 1997 with former oil minister Gholam Reza Aghazadeh,[34] a move seen variously as replacing an incompetent manager, de-emphasizing Iran's nuclear weapons program, or simply increasing the efficiency of spending.[35] In reaction to the election of Khatami, Supreme Leader Khameini appointed Former President Rafsanjani as the head of the Expediency Council in 1998; formerly this council had been headed by the President. Additionally, the council was given the new power to pass legislation.[36]

After the May 1998 nuclear tests by India and Pakistan, Judiciary Chief Ayatollah Mohammad Yazdi declared in a June 1998 speech that "we are living at [a] time when the United States supports Israel, which has the biggest arsenals of the mass destruction and nuclear weapons [and] an atomic power is needed in the world of Islam to create a balance in the region."[37] On June 14, 1998, Mostafa Zare'i, a Majlis deputy from Sarvestan, called for the Islamic Republic of Iran to acquire nuclear weapons to counter the Israeli nuclear threats.[38]

Iranian elections to the Majlis (Parliament) on February 18, 2000 left reformists in power of this branch of government as well as the presidency. However, reforms were slow in coming and were generally blocked by the Guardian Council; it is thought that the reformers in general quietly opposed a nuclear weapons program, although probably not a nuclear power program.[39] In public, reformers tended to support both. The Expediency Council generally sided with the Guardian Council on these matters in any case. Expediency Council head Rafsanjani warned in a speech on December 17, 2001 that "The use of even one nuclear bomb inside Israel will destroy everything."[40] Through 2003, both reform and conservative politicians continued to express support for a nuclear weapons option for Iran.[41]

Although in early years Iranian rhetoric in favor of a nuclear option was outspoken, nuclear threats became less strident and more indirect after about 1991. Broad support for

[34] *Agence France Presse 1997b*.
[35] Cordesman 2000, 4.
[36] Pike 2003.
[37] Eisenstadt 1999, 129.
[38] *Tehran Kar va Kargar 1998*.
[39] Pollack 2004, 303-342.
[40] *Rubin 2002*.
[41] *Vick 2003*.

nuclear technology in general and often for nuclear weapons (or a nuclear weapons option) in particular has spread across the conservative-reformer divide, although conservatives have seemed to be more strident in general. Recently, the Iranian nuclear program has become motivated by pride as much as anything else—the program is extremely popular, not just with the government, but with the population.[42]

### 5.2.2 The Origins of the Program

During the rule of the Shah, Iran received assistance from many Western countries, including the United States, Germany, and France. The Shah had an ambitious nuclear program, much of which never got past the initial drawing board. However, the Shah's programs laid the groundwork for later expansion by the Islamic Republic of Iran, including hot cells, a partially constructed nuclear power facility at Bushehr, and the beginnings of a laser enrichment program that was to continue through 2003. US policy during this period shifted from favoring reprocessing to opposing reprocessing under the Carter administration; however, Iran still received the "Most Favored Nation" status in reprocessing—meaning mostly that if the United States permitted other states to reprocess, Iran would also be permitted.[43] and, ironically, was encouraged to develop complete fuel cycle facilities within the Middle East, presumably with Pakistan.[44]

Under Atoms for Peace, the United States supported Iran's nuclear program, signing a cooperation agreement in 1957, followed by the purchase in 1959 of a 5 MWt research reactor for Tehran University that ran on 93% HEU, which was installed in 1967;[45] at the same time, the United States supplied its first load of fuel as well as 112 g of plutonium for start-up sources.[46] A few hot cells suitable for radioisotope production (but not plutonium separation from spent fuel) were also installed.[47]

Iran signed the NPT on July 1, 1968, and ratified it on February 2, 1970, signing a safeguards agreement in 1973 that entered into force the next year. In 1974, the Shah

[42] *Perkovich 2005; MacFarquhar 2005*.
[43] Poneman 1982, 88.
[44] Cahn 1975, 190-1.
[45] Poneman 1982, 84-5.
[46] Department of State 1980.
[47] Albright 1995, 25.

announced a plan to build nuclear power stations totaling 23,000 MWe, then established the Atomic Energy Organization of Iran (AEOI)in March 1974. Iran initially sought to master all parts of the nuclear fuel cycle, investing in a uranium enrichment plant in France being constructed by the Eurodif consortium, seeking uranium supplies from Australia and South Africa, and purchasing a 15% stake in the Rossig uranium mine in Namibia in 1975.[48]. Iran also ordered two nuclear plants to be built by a French company (Framatome) at Darkhovin near Ahwaz and two plants from a German company (A subsidiary of Siemens, Kraftwerke Union, a.k.a. KWU) to be built at Bushehr. Iran also discussed purchasing six additional reactors from France and four from Germany. Iran also held talks with the United States regarding providing up to eight nuclear power plants as well as reprocessing facilities. All except the Bushehr reactors were canceled before or during the 1979 revolution due to funding difficulties.[49]

In June 1974, when a French interviewer asked whether Iran would have its own nuclear arms, the Shah responded, "Without a doubt and sooner than one would think." He soon backed away from the statement.[50] However, studies of the Iranian nuclear program generally date Iran's initial attempt at acquiring weapons from about this date. A secret nuclear weapon design group may have been set up by the Shah in the 1970s.[51] Suspicion also surrounds the beginnings of a laser enrichment program: a laboratory was established in 1975 to investigate laser enrichment.[52] In 1976, scientist Jeff Eerkens traveled to Iran; in 1978, he exported four lasers from the United States to Iran. The lasers operated at a different wavelength than that required for enrichment, but could be easily adapted to the purpose of enrichment.[53]. The US government at the time didn't oppose the export since it was thought that laser enrichment was a technological dead-end.

One unfortunate side effect of early Western support for the Shah's nuclear program is that the Islamic Republic has been able to object to subsequent Western export controls on the grounds that they are discriminatory. While this argument gets little traction in

[48]Spector and Smith 1990, 205;*Charbonneau 2005*.
[49]Cahn 1975, 190-199;Poneman 1982, 84-98.
[50]Cahn 1975, 199.
[51]Spector 1987, 50.
[52]IAEA Board of Governors 2003a, 10.
[53]Spector 1987, 46-48.

the West, it has gained Iran significant support with the Non-Aligned Movement within the IAEA,[54] giving Iran the ability to decrease the threat of being reported to the Security Council and making Iran's accession to the Additional Protocol a bargaining chip rather than an expected concession.

### 5.2.3 The Post-Revolution Program

Iran's program can be split into three areas: general activities that could apply to either a highly enriched uranium or a plutonium program, such as training, uranium acquisition, and uranium processing, listed in Table 5.1; activities that involve enrichment of uranium through laser or centrifuge technologies, listed in Table 5.3; and activities that pertain to fabrication of fuel rods, building of reactors, or isotope separation. Unlike North Korea, for most of its history Iran has been in good standing with the IAEA. Its actions with respect to the treaty during the latest crisis are detailed later. Most of these activities have parallel justifications in a civilian program. The current status of Iran's nuclear facilities as of the end of 2004 is listed in Table 5.4. A flowchart that outlines Iran's current claimed flow of nuclear materials that is associated with these facilities is pictured in Figure 5.2.

Iran has made steady, albeit slow, progress toward a nuclear capability. Some preliminary activities were taken between 1979 and 1984, including initial construction at the Isfahan nuclear complex; however, the bulk of Iran's program has been built much more recently. Iranian nuclear scientists have been sent abroad since the mid-1980s to China, Pakistan, and Russia for training.[55] After the discovery of uranium at Saghand in 1985, Iran's uranium mining and milling facilities have been slowly improved. It performed bench-scale experiments on all of the different parts of the uranium conversion cycle and fuel fabrication in the 1980s and early 1990s. Iran attempted to acquire pilot-scale or full-scale facilities for uranium conversion and fuel fabrication starting in the early 1990s. Using Chinese blueprints acquired in 1997, Iran began construction of a full-scale facility to convert uranium and fabricate fuel at Isfahan in 1999, and has conducted small-scale hot

[54] See, for example, the NAM statement of support for Iran in September 2003. Non-Aligned Movement 2003.

[55] Boureston and Ferguson 2004.

Table 5.1: Iran nuclear program timeline
* = *unknown prior to 2003 IAEA visits*

| Year | Event |
|---|---|
| | Training |
| 1988 | Pakistan (AEOI/Munir Khan) agrees to train Iranians |
| 1989-1991 | China agrees to train Iranians |
| 1995 | Russia agrees to train Iranians |
| | Uranium acquisition |
| 1985 | Yazd (Saghand) deposits discovered |
| 1989 | Yazd mine construction started |
| 1991 | Iran receives 1.8 tons of NU from China* |
| 1992-1993 | Iran seeks LEU from Kahazkstan |
| 2004 | Bandar Abbas (Gehine) ore production started |
| 2006 | Yazd ore production to start |
| | Uranium processing |
| 1981-1984 | Iran seeks FFL/UCL at Isfahan from foreign supplier |
| 1987-1993 | Tehran bench-scale AUC/$UO_3$/$UF_4$/$UF_6$ experiments* |
| 1984 | Isfahan opens |
| 1981-1993 | Isfahan bench-scale $UO_2$ experiments* |
| 1988 | Iran seeks pilot $UO_2$ from Argentina; US pressure blocks |
| 1991 | Iran seeks full-scale UCF from China |
| 1994 | Iran receives TBP from China |
| 1995-2000 | Tehran JHL $UF_4$ to U conversion experiments* |
| 1997 | Isfahan UCF canceled due to US pressure |
| 1998 | Iran seeks AHF from China; US pressure blocks |
| 1999 | Isfahan full-scale UCF construction started |
| 2000 | Iran informs IAEA of Isfahan UCF |

tests of parts of the facility.

Less progress has been made towards a plutonium capacity. Iran conducted bench-scale isotope separation experiments starting in the late 1980s from irradiated uranium targets, but currently has only small-scale isotope separation capabilities, which requires significantly less shielding than plutonium reprocessing from fuel rods. Iran received several small reactor facilities from China in the early 1990s. Iran also sought a medium-sized research reactor (ideal for plutonium production) starting in the late 1980s, then decided in the mid-1990s to construct a heavy-water reactor after these attempts were blocked by the United States. Construction on a heavy-water plant at Arak was mostly completed by the end of 2004, and construction of a 40MWt research reactor there was started in 2003. Hot cells are planned for Arak, but little design information has been provided; Iran has

Table 5.2: Iran Pu program timeline
* = *unknown prior to 2003 IAEA visits*

| Year | Event |
|---|---|
| | Fuel Fabrication |
| 1985 | Iran seeks pilot facility from Argentina |
| 1985-1993 | Isfahan bench-scale fuel fabrication* |
| 1997 | Iran seeks Zr tube facility from China |
| 1988 | Iran seeks Pilot HW production facility from Argentina; US pressure blocks |
| 2007 | Isfahan FMP to be commissioned |
| | Reactors |
| mid-1980s | Iran begins HWR research* |
| 1985 | Iran seeks conversion of Tehran reactor by Argentina |
| late 1980s | Iran seeks research reactor from India; US pressure blocks 1991 |
| 1992 | Iran received two sub-critical facilities from China |
| 1994 | Isfahan MNSR critical |
| 1995 | Isfahan HWZPR critical |
| 1984-1988 | Bushehr attacked by Iraq |
| 1990 | China agrees to supply 27 MWt reactor |
| 1990 | USSR signs cooperation protocol |
| 1991 | China agrees to supply 27 kWt reactor |
| 1991 | Germany refuses to finish Bushehr |
| 1992 | China agrees to supply 300 MWe reactors |
| 1993 | Russia cancels research reactor due to US pressure |
| mid-1990s | Iran decides to build HWR* |
| 1995 | China cancels 300 MWe reactors under US pressure |
| 1995 | Russia agrees to finish Bushehr |
| 1996 | Ukraine considers cooperation on Bushehr; US pressure blocks |
| 2000 | Czech Rep. considers cooperation; US pressure blocks |
| 2002 | Russia agrees to take back spent fuel from Bushehr |
| 2002 | Arak HW facility construction started* |
| | Isotope separation |
| 1988-1999 | Tehran irradiation, processing of $UO_2$ targets* |
| 1988-1993 | Tehran separates Pu* |
| 1989-1993 | Tehran irradiation of Bi for Po separation (unsuccessful)* |
| 1995 | MIX facility construction begins* |

been rumored to be seeking hot cells capable of plutonium reprocessing, not just isotope separation, which would require much less shielding.

Table 5.3: Iran HEU Program Timeline
* = *unknown prior to 2003 IAEA visits*

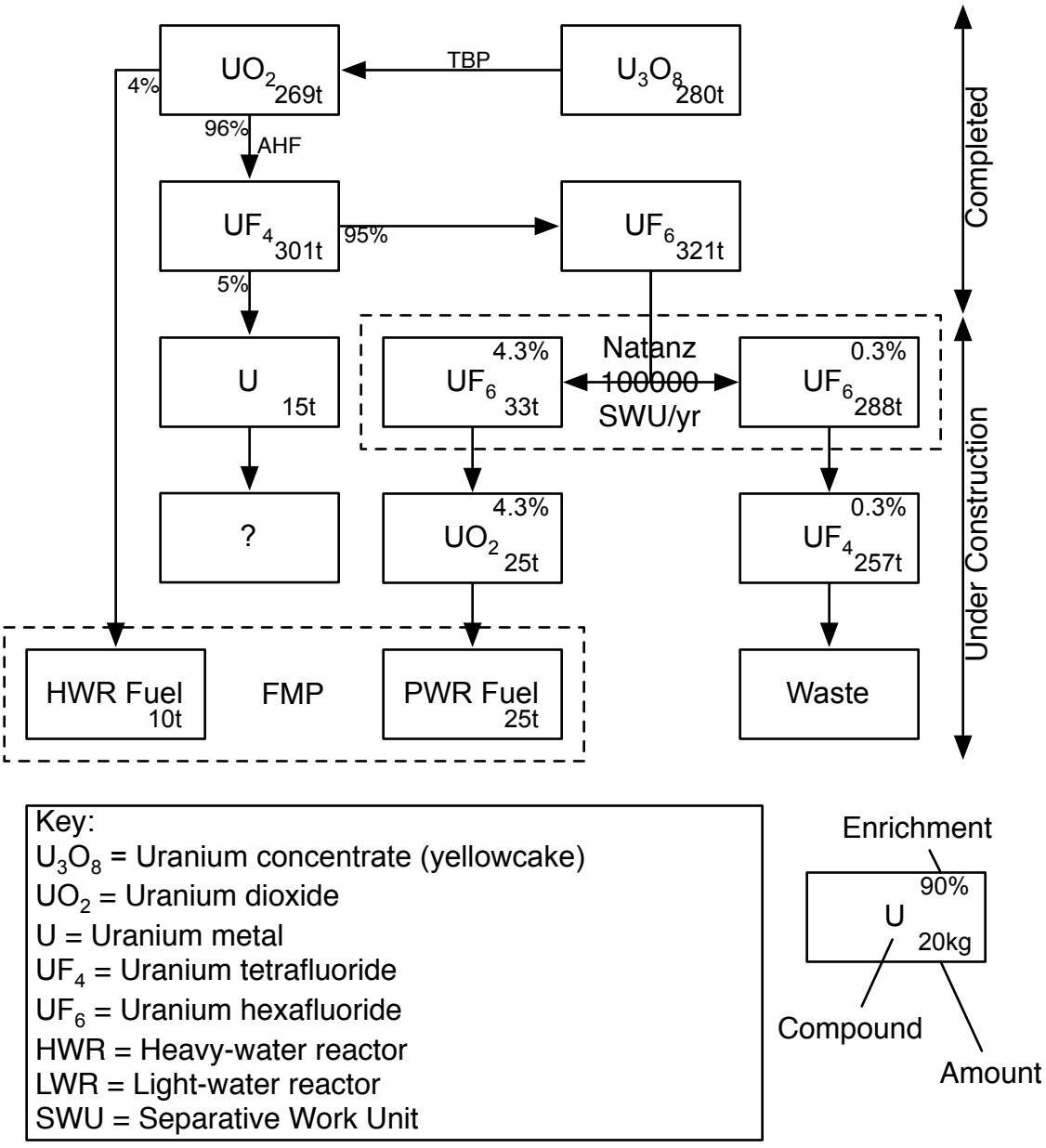
| Year | Event |
|---|---|
| | Uranium enrichment |
| 1985 | Beginning of Literature search |
| 1987 | Iran meets with, receives P1 plans from A.Q. Khan* |
| 1988-1995 | Tehran conducts R&D* |
| 1990 | Iran seeks technology from China |
| 1994-1996 | Iran receives centrifuge parts, P2 plans from A.Q. Khan* |
| 1995 | Iran seeks technology from USSR; US pressure blocks |
| 1995-2002 | Kalaye centrifuges assembled, tested from 1997* |
| 2001 | Iran seeks Al tubes from Russia; US alerts Russia |
| 2001 | Natanz construction started* |
| 2002-2003 | Tehran P2 research conducted* |
| 2003 | Natanz research starts; $UF_6$ introduced |
| | Laser enrichment |
| 1975-1998 | Iran receives laser equipment from four states |
| 1987 | Iran holds laser enrichment conference |
| 1993-2000 | Tehran laser program |
| 1994 | Iran receives copper-vapor laser from China |
| 2002-2003 | Lashkar Ab'ad laser program (dismantled 2003)* |

Iran's laser and centrifuge enrichment programs date back to the mid-1970s and mid-1980s respectively. After receiving plans for the P1 centrifuge from A.Q. Khan in the late 1980s, Iran conducted basic research and development at the Tehran Nuclear Research Center. However, once centrifuge parts were received in the mid-1990s from the A.Q. Khan network, development shifted to the Kalaye Electric Company until 2002, when work moved to the Natanz uranium enrichment facility. In parallel, Iran's laser enrichment program continued slowly, acquiring laser enrichment equipment from four states,[56] although it had little success; it was moved from Tehran to Lashkar Ab'ad in 2002, then dismantled in 2003.

Currently, Iran is building facilities that will complete the nuclear fuel cycle (See Table 5.4). Uranium mining and milling will take place at Yazd and Bandar Abbas; conversion to $UF_6$ will occur at Isfahan; enrichment will take place at Natanz; fuel fabrication from

[56]The United States, China, Russia, and a fourth unnamed state

Figure 5.2: Iran materials production flowchart



the enriched uranium will be done back at Isfahan; finally, irradiation of fuel will be done at Bushehr and Arak. Of course, these facilities could just as easily be used for fissile materials production; uranium could be enriched to weapons-grade levels at Natanz, then cast into pits at an unknown location, or plutonium could be separated from the rods removed from Arak and cast into pits elsewhere. However, many of these facilities are not operating now, and will not be for a number of years. For example, the heavy water reactor will not be operating until 2010; Natanz has less than one percent of the total number of centrifuges it needs; and Isfahan is far from completion. Iran would be at least five years away from a nuclear weapon if it decided to seek one, and then only if no additional difficulties were encountered with its facilities.

Although the IAEA revealed a great deal of information in 2003 and 2004 about Iran's nuclear program, many of Iran's nuclear activities—in particular, those that involved outside suppliers other than the A.Q. Khan network—were already known to the United States; many of these activities were stopped by US pressure on these suppliers. Three areas of Iran's nuclear program that were previously unknown were revealed by the IAEA: a limited number of clandestine experiments involving uranium conversion and plutonium separation; the extent and progress of Iran's centrifuge program, including the Natanz facilities; and the Arak heavy-water production facility (the Arak reactor was only recently started). However, most of the other major facilities were already known to the IAEA and the United States. In the first section below, I chronicle Iranian attempts to acquire nuclear technology and US attempts to block them; in the next major section, I give an overview of clandestine activities, intelligence attempts to discover them, and the IAEA's failure to detect them.

## 5.3 Iranian Actions, US Reactions, 1979–2002

Between 1979 and 2002, US (and European) policy towards Iran's nuclear program consisted primarily of attempts to avoid assisting any aspect of Iran's nuclear capabilities, civilian or otherwise. While in Europe this was primarily restricted to export controls, the United States placed layer after layer of sanctions and restrictions, both on Iran and

Table 5.4: Iranian nuclear facilities

| Site | Type | Abb. | Name | Status (Nov 2004) |
|---|---|---|---|---|
| 1.Tehran | Uranium Enrichment (Laser) | LSL | *Laser Separation Laboratory | Dismantled |
| | Uranium Enrichment (Laser) | CSL | *Comprehensive Separation Laboratory | Dismantled |
| | Reactor (research) | TRR | Tehran Research Reactor | Operating |
| | Reprocessing | MIX | MIX Radioisotope Production Facility | Constructed, but not operating |
| | General | JHL | *Jabr Ibn Hayan Multipurpose Laboratories | Operating |
| | Waste | WHF | *Waste Handling Facility | Operating |
| 2.Kalaye(Tehran) | Uranium Enrichment (Centrifuge) | | *Kalaye Electric Company | Dismantled pilot enrichment site |
| 3.Bushehr | Reactor (power) | BNPP | Bushehr Nuclear Power Plant | Under construction |
| 4.Esfahan | Reactor (research) | MNSR | Miniaturized Neutron Source Reactor | Operating |
| | Reactor (research) | LWSCR | Light Water Sub-Critical Reactor | Operating |
| | Reactor (research) | HWZPR | Heavy Water Zero Power Reactor | Operating |
| | Uranium Processing | UCL | Uranium Chemistry Laboratory | Closed down |
| | Uranium Processing | UCF | Uranium Conversion Facility | Hot testing/commissioning stage |
| | Reactor (research) | GSCR | Graphite Sub-Critical Reactor | Decommissioned |
| | Fuel Fabrication | FFL | Fuel Fabrication Laboratory | Operating |
| | Fuel Fabrication | FMP | *Fuel Manufacturing Plant | Construction to begin in 2004, operation 2007 |
| | Fuel Fabrication | ZPP | *Zirconium Production Plant | Under construction |
| 5.Natanz | Uranium Enrichment (Centrifuge) | PFEP | *Pilot Fuel Enrichment Plant | Operational (suspended) |
| | Uranium Enrichment (Centrifuge) | FEP | *Fuel Enrichment Plant | Under construction (suspended) |
| 6.Lashkar Ab'ad | Uranium Enrichment (Laser) | PULEP | *Pilot Uranium Laser Enrichment Plant | Dismantled |
| 7.Arak | Reactor (research) | IR-40 | *Iran Nuclear Research Reactor | In detailed design phase |
| | Isotope Separation | | *Hot cell facility for radioisotopes | In design phase |
| | Reactor Construction | HWPP | *Heavy Water Production Plant | Under construction |
| 8.Yazd | Uranium Mining | | Saghand Mine, Yellowcake Production Plant | Operational end 2006 |
| 9.Bandar Abbas | Uranium Mining | | Gehine mine/mill | Operational |
| a.Karaj | Waste | | *Radioactive Waste Storage | Partially operating |
| b.Anarak | Waste | | *Waste storage site | Waste to be transferred to JHL |
| c.Qom | Waste | | Qom disposal site | Operational |

on foreign entities cooperating with Iran, whether on nuclear-related issues or not.[57] In doing so, the United States successfully managed to block Iran's attempted acquisition of a proliferation-prone heavy-water reactor and other nuclear technologies from multiple sources, yet at the same time spent a large amount of diplomatic capital attempting to block various countries from assisting Iran with projects unlikely to significantly increase Iran's potential to develop nuclear weapons.

In particular, the United States spent a great deal of time attempting to keep multiple countries from assisting Iran with Bushehr. While this may have delayed significantly construction of the plant, failure to cut off all potential sources of technology (in particular, the A.Q. Khan network) meant that Iran was able to undermine export controls in its uranium enrichment program. However, ultimately a lack of effort on Iran's part, coupled with the many difficulties they had in operating imported technology, has kept Iran from gaining the ability to develop nuclear weapons.

### 5.3.1 Russia and Bushehr

#### Bushehr and the Initial Russian Deal, 1979–1994

Due to the Iranian revolution, KWU stopped construction on the Bushehr power plants in 1979. Litigation ensued and continued throughout the 1980s between KWU, the renamed Islamic Republic of Iran, and the German government; Iran attempted to hold KWU to its contract, KWU tried to find a suitable compromise, and the German government refused to allow for export licenses due to the ongoing war between Iran and Iraq (the Bushehr power plant site was attacked several times by Iraq between 1984 and 1988)[58]. After the war ended and under diplomatic pressure from the United States, Germany decided in early 1991 to definitively tell Iran that the reactors would not be finished; even the parts that were already manufactured and paid for were not delivered.[59] Similar litigation occurred between Iran and the Eurodif consortium.

[57] Perkovich and Manzanero 2004.
[58] Cordesman 2000, 7.
[59] *Hibbs 1991b*.

Iran also (unsuccessfully) sought assistance in finishing the Bushehr power plants starting in 1982 from China, India, Sweden, South Korea, Czechoslovakia, Argentina, Spain, and Brazil (the latter three in connection with, or subcontracted from, KWU). Finally, in 1990, Prime Minister Rafsanjani signed first a cooperation protocol with the Soviet Union[60] then later an agreement to construct two 440MW plants and two larger plants in October 1990.[61] Once the German government refused to allow the necessary export licenses, this agreement evolved into an agreement to finish one of the Bushehr reactors instead.

Russian cooperation with Iran continued to grow throughout the 1990s. However, negotiations with Iran over a natural-uranium proliferation-prone research reactor were canceled in 1993 under US pressure.[62] Additionally, President Boris Yeltsin agreed in October 1994 to halt $1 billion of arms exports to Iran.[63] Plans to have Russia finish the Bushehr reactor moved forward haltingly, although the holdups were often due to disagreements about funding rather than US pressure; for example, Iran wanted to maximize the amount of "in kind" barter, while Russia wanted to maximize the cash part.[64] Initial predictions made in 1994 and 1995 that the plant would be completed in 1999 proved to be excessively optimistic; as of July 2005, the plant is still not complete.

### US Pressure Mounts, 1995

In 1995 rumors of an extra protocol that included gas centrifuge technology and training of Iranian scientists caused a crisis between the United States and Russia. This was initially sparked by the signing of an $800 million contract on January 8, which included provisions for a uranium enrichment centrifuge plant; it appears that the inclusion of the latter was due to Minister of Atomic Energy Viktor Mikhailov's independent initiative, rather than the Kremlin.[65] In a meeting with his counterpart the next week in Geneva, Secretary of State Christopher pressed Foreign Minister Andrei V. Kozyrev of Russia on the sale; this plea to terminate it was rejected.

[60] *Nucleonics Week 1990*.
[61] *Hibbs 1990*.
[62] *Greenhouse 1995b*.
[63] *Bruce 1994*.
[64] *Hibbs 1995b*.
[65] *Smith and Dobbs 1995*.

In mid-March, the US Senate voted 97–3 in favor of cancelling funding on nuclear safety projects to Russia in the event that it supplied a nuclear power plant to Iran, and Republican members of Congress urged Clinton to cancel the US-Russian summit scheduled for May 9.[66] Russia rejected these moves and said that it would go ahead with the construction of Bushehr on March 18;[67] a meeting between the Russian Foreign Minister and the US Secretary of State the next week failed to reach a compromise. On March 28, the United States postponed signing a nuclear agreement with Russia in response.[68] A compromise that included "very stringent constraints on the fuel that is generated" was mooted as a secondary, albeit much less preferred, option by US Secretary of Defense William Perry on April 3; subsequently, termination of the contract was again rejected despite US efforts to mollify Russia with additional sweeteners such as participation in KEDO.[69]

Perhaps fearing a US agreement with Russia that canceled the plant, Iran announced its intention to return spent fuel to Russia just days before the Clinton-Yeltsin summit.[70] During the summit, Yeltsin agreed that all aspects of the deal which would leave Iran in a position to create nuclear weapons from the reactor project would be eliminated (uranium enrichment, leaving the spent fuel rods in Iran),[71] which was formalized by the Gore-Chernomyrdin Commission in June 1995.[72] An agreement between Iran and Russia was officially signed in late August regarding the return of fuel to Russia; work on Bushehr was scheduled to start in October, with a timeframe of 55 months to completion.[73] Senate Republicans threatened to prevent $250 million in economic aid shortly after the agreement was signed.[74] However, the Russian Deputy Atomic Energy Minister in charge of nuclear fuel cycle activities (Yevgeniy Mikerin) claimed in an interview in December that Russia might not repatriate the fuel.[75]

The US's attempt to coerce Russia into stopping the Bushehr reactor deal in 1995 was

[66] *Gertz 1995*;*Smith and Dobbs 1995*
[67] *Washington Times 1995*.
[68] *Mannion 1995*.
[69] *Hiatt 1995*.
[70] *Greenhouse 1995a*.
[71] *Erlanger 1995*.
[72] Eisenstadt 2001.
[73] *Konovalov 1995*.
[74] *Smith 1995*.
[75] *Hibbs 1995a*.

in part hamstrung by three linked policy issues; first, a desire to continue aid to Russia, since the Nunn-Lugar nuclear safety and security programs that were in danger of being canceled directly contributed to US security; second, the simultaneous discussion of expansion of NATO, which left the Russians in an uncooperative mood; third (ironically), the US promise to build light-water reactors for North Korea.[76] While the United States attempted to draw a distinction between swapping North Korea's plutonium production reactors for light water reactors and Iran's attempts to gain a reactor in the first place, these claims fell on deaf Russian ears. Moreover, both the United States and Russia were highly constrained by hard-line domestic opposition to cooperation.[77]

### More Obstacles, 1996–2000

The Ukraine temporarily flirted with cooperating with Iran in 1996 and 1997, when the Turboatom plant offered to supply turbines for Bushehr for $45 million.[78] However, later in 1997 Ukrainian President Leonid Kuchma announced that his country would not supply equipment for Iran's Bushehr nuclear plant project.[79] Through 1998, the United States continued to put substantial pressure on Ukraine to not assist in the Bushehr project, including holding up a $1.2 billion sale of a reactor to Ukraine.[80] In March 1998, Secretary Albright signed an agreement with Ukrainian Foreign Minister Hennadiy Udovenko to block the Ukraine from participating in the Bushehr reactor deal, although turmoil continued in the Ukraine for months after.[81] Later, officials complained that they had suffered "significant economic losses," one putting the tally at $1.5 billion,[82] an unlikely figure given that Russia was only charging $800 million for the entire plant at the time.

Progress on Bushehr was slow due to technical problems with fitting the horizontal VVER steam generators in place of the vertical Siemens generators.[83] Other major issues included financing difficulties stemming from barter versus cash agreements, objections to

[76] *Hiatt 1995*.
[77] *Katz 1995*.
[78] *Kohler 1996*;Cordesman 2000, 12.
[79] *Brall 1997*.
[80] *Agence France Presse 1998*.
[81] *Gordon 1998b*.
[82] *Deutsche Presse-Agentur 2002*.
[83] *Hibbs 1996d*.

having Jewish Russians financing parts of the project, earthquake mitigation, friction between Iranians and Russians at the work site, and problems with Iranian subcontractors, who performed so poorly that in a 25 month period, they set back the project by 20 months. Iran converted the project to a "turnkey" in February 1998 due to past problems with the Iranian portion of the Bushehr plant; this may in part have been due to bad management by the AEOI head Amrollahi, who was replaced in late 1997.[84] In early March 1998, the Russian Atomic Energy Minister, Viktor Mikhailov, was replaced by Yevgeniy Adamov;[85] however, no change in Russia's policy towards Iran occurred. Russia promised to make the turbines in St. Petersburg instead of the Ukraine shortly after the Albright-Udovenko agreement. Adamov announced in April that Russia was also planning on building a research reactor in Iran.[86] However, this reactor was never built. Madeleine Albright issued an ultimatum to Russian Foreign Minister Igor Ivanov to pull out of nuclear projects with Iran or risk a reduction in funding for nuclear disarmament and nonproliferation issues (it appeared that this was directed at new projects, as opposed to Bushehr); in response to the threats, Russian officials spoke in favor of tougher control over the export of technology and equipment by Russian enterprises to Iran.[87]

After vetoing legislation that would have required the administration to implement sanctions against Russian entities unless the president determined that a waiver of sanctions was "essential" to U.S. national security, in 1998 the Clinton administration modified an existing executive order to be able to implement such sanctions—but at its instigation—to prevent an override of the veto.[88] The administration then targeted seven Russian entities for sanctions instead of warning the Russian government directly.[89] Apparently these targeted sanctions were successful in convincing some of these entities to cease cooperation; however, others took over instead.[90] The House also cut IAEA funding by the amount that the IAEA spent assisting Iran with Bushehr.[91] Pressure on other governments regarding

[84] Cordesman 2000, 12-13;4.
[85] *Gordon 1998a*.
[86] *Washington Post 1998*.
[87] *Antonov 1998*.
[88] Rice 2000.
[89] *Interfax (Moscow) 1998*.
[90] Eisenstadt 2001.
[91] *Abrams 1998*.

Bushehr continued; the Czech company ZVVZ Milevsko was to provide air-conditioning equipment for Bushehr, but the threat of sanctions from the United States and Great Britain caused the Czech government to pass a bill in April 2000 to ban Czech companies from participating in the project; ZVVZ Milevsko was compensated for the loss of business.[92]

In April 2000, Russian Security Council Secretary Sergei Ivanov modified a 1995 Russian-American protocol to halt arms exports to Tehran to include previously agreed-upon conracts, and Russian President Vladimir Putin altered the 1992 presidential decree "On Controlling the Export of Nuclear Materials, Equipment and Technologies From the Russian Federation" to allow Russia to export nuclear technology to countries whose programs are not completely monitored by the IAEA (with Iran, Cuba, and India as the likely recipients).[93] In late November 2000, Russia abrogated the 1995 Gore-Chernomyrdin agreement on sales of conventional arms to Iran.*Samii 2000c*

The Clinton Administration was initially successful in its strategy to attempt to confound foreign involvement in the Bushehr project, cancelling sales from the Ukraine and the Czech Republic. However, these moves simply redistributed the sources of those components to Russia, while spending diplomatic capital and potentially harming relations with both countries, as the companies had to be compensated for their losses by their governments. Sanctions targeted at individual companies rather than governments had some limited success (although these were also preferable to the previous situation, in which Russia occasionally reacted to leaks passed on from the United States regarding potential violations of export controls simply by silencing leaks rather than solving the problem). However, these were (and continued to be) more symbolic than effective, since some targeted companies did not do any business with the United States, and others that gave up their activities were simply replaced by new companies who did not have ties with the United States.

[92] *Samii 2000a*;*Risk Report 2000*.
[93] *Kozyrev 2000*.

**Bush and Russia, 2001–2002**

At the end of March 2001, Russian President Vladimir Putin replaced Minatom head Yevgeny Adamov with Aleksandr Rumyantsev, director of the Kurchatov Institute.[94] No changes in Iran policy were expected; Putin reaffirmed around the same time that nuclear cooperation would continue with Iran, blaming delays on "sluggishness on both the Iranian and Russian side."[95] A shipment of aluminum in June 2001 suspected to be intended for use as centrifuge rotors from Russia was boarded; the Russian inspectors claimed that the aluminum was to be used for aircraft.[96] In December, Russia signed a new partnership agreement with Iran including the "peaceful use of the nuclear atom."[97] Concerns about Russian export control policy continued; a few "bottom-feeder" companies were blamed for unauthorized transfers.[98] Reports surfaced in February 2002 claiming that Iranian scientists being trained at Nikiet ostensibly for reactor technology were actually part of an Iranian nuclear weapons program.[99] However, in June 2002, Deputy Atomic Energy Minister Valery Lebedev affirmed that Russia would take back spent fuel—after three years had passed to allow the fuel to cool off.[100] Russian Atomic Energy Minister Alexander Rumyantsev confirmed this in July, saying that a protocol with Iran for taking back the fuel would be signed that fall. The protocol had been written in November 1998 but had not yet been signed, since the Duma did not pass a law until 2001 to allow reimporting the spent fuel.[101] However, a full agreement wasn't completed until 2005.

Following the Clinton administration's shift to placing sanctions directly on foreign companies and entities that are suspected of contributing to Iran's weapons programs, the Bush administration placed penalties on Chinese, Armenian, and Moldovan companies (the latter two as Russian companies operating in the former Soviet states) in January and May 2002 under the Iran Nonproliferation Act.[102]

[94] *Tyler 2001*.
[95] Boese 2001.
[96] *Dobbs 2001*.
[97] *Agence France Presse 2001b*.
[98] *Peterson 2002b*.
[99] *Baxter and Franchetti 2002*.
[100] *Agence France Presse 2002b*.
[101] *Engleman 2002*.
[102] *Reuters News 2002*.

A much-mooted proposal for Russia to build additional reactors in Iran was released in late July 2002, but formal contracting was postponed until the completion of the Bushehr plant.[103] The United States raised objections to this move; President Bush had thought that he had been assured by Russian President Putin that cooperation would be limited to the Bushehr reactor.[104] Some members of the Bush administration supported a pre-emption option on the reactors; Israel publicly warned Iran that it considered Bushehr to be a threat to its national security.[105] In October 2002, John Bolton implicitly threatened Russia with further delays of nonproliferation funds: "Concerns about Russia's performance on its arms control and nonproliferation commitments have already adversely affected important bilateral efforts, and unless resolved could pose a threat to new initiatives."[106] However, US officials reportedly offered assistance in lowering barriers to Russia's importation of spent fuel from the rest of the world(a potentially lucrative market) in exchange for a cessation of nuclear activities with Iran, which was rejected by Russia.[107]

Iran claimed that fuel for Bushehr would be supplied by May 2003, and that construction on the Isfahan uranium conversion facility would be inaugurated around the same time.[108] However, this optimistic deadline hasn't been met either.

### 5.3.2 China

After Russia, China has made the largest contribution towards Iran's nuclear power program (Pakistan notwithstanding). In 1984, Iran opened up a new nuclear research center at Isfahan with assistance from China.[109] China also provided training for nuclear engineers through agreements signed in 1989 and 1991;[110] Iran received a calutron from China in 1989, which IAEA inspectors viewed at Karaj in 1992.[111] Iran's calutron was only one milliamp, versus the 600 milliamp machines used by Iraq, making it unsuitable for uranium

[103] *Charlton 2002*.
[104] Kerr 2002.
[105] *Priest 2002*.
[106] *Sands 2002*.
[107] *Baker 2002*.
[108] *Hafezi 2003*.
[109] *Middle East Defense News 1992c*.
[110] Krosney 1993, 250-1.
[111] Timmerman 1992, 47;*Hibbs 1992c*

enrichment on a scale of interest to proliferators.[112] In 1990, an agreement was reached for additional calutrons, uranium enrichment technology, and a 27 MWt reactor to be added to Isfahan.[113] An initial contract was also signed for the delivery of two 300 MWe reactors in 1992. China signed another contract with Iran for a 27 kWt research reactor in 1991,[114] and delivered 1.8 tons of uranium to Iran, which went undeclared until 2003. Two sub-critical facilities were delivered in 1992.[115] However, US pressure on China over most-favored-nation (MFN) trading status stopped the sale of the 27 MWt heavy-water reactor in 1993.[116]

Chinese cooperation with Iran continued through the mid-nineties. Around 1994, a copper-vapor laser and a supply of tri-butyl phosphate (TBP), a chemical used to separate uranium and plutonium from other elements, were also supplied by China.[117] In particular, extensive negotiations regarding the two 300MWe reactors agreed to in 1992. The United States objected strongly to the sale; in talks with Chinese foreign minister Qian Qichen in April 1995, US Secretary of State Warren Christopher warned that nuclear cooperation with Iran was "too dangerous to justify."[118] However, for multiple reasons, including US pressure and extensive use of components manufactured in other countries that could be embargoed (i.e. Germany and Japan), the Chinese promised to cancel the deal for the two reactors in a meeting with US Secretary of State Warren Christopher in September 1995.[119] The only reactor projects completed in this period by China were a small 27 kWt miniature neutron source reactor at Isfahan, which went critical in mid-1994, and a zero-power heavy water reactor that went critical in 1995.[120] US pressure also kept Pakistan from allowing Iranian access to a Chinese-supplied reactor in Pakistan.[121] Iran also appears to have been seeking a uranium hexafluoride conversion plant from China around the same time, which was only started before being blocked by the United States; however, China left extensive

[112] Cordesman 2000, 7.
[113] Timmerman 1992, 47.
[114] Skootsky 1995.
[115] *Hibbs 1992c*.
[116] *Hibbs 1992b*;Krosney 1993, 253.
[117] *Hibbs 1994a*.
[118] *Walker 1995*.
[119] *Sciolino 1995*.
[120] Skootsky 1995;Koch and Wolf 1998
[121] *Hibbs 1994c*.

blueprints, which Iran used to build the facility. At the time, Iran claimed that it was going to use the facility to create uranium hexafluoride from natural uranium, then export the hexafluoride to be enriched for use as nuclear fuel in the Bushehr reactor; its clandestine domestic enrichment program was only discovered later.

The Chinese contribution to Iran's nuclear program continued to waver; after having promised that the two 300 MWe power plants would be canceled, Iranian and Chinese officials claimed in late 1995 that there were simply disagreements over the site. On January 9, 1996, China announced that the reactors were canceled again.[122] However, in mid-April, Chinese technicians arrived to begin construction of a facility to create uranium hexafluoride.[123] US pressure in November 1996 by US Undersecretary of State for Arms Control and International Affairs Lynn Davis led to a Chinese pledge to withdraw from the project; however, the IAEA continued to report that China was still preparing to complete it.[124] In response, the United States postponed certification under a 1984 nuclear cooperation agreement that would allow export of certain nuclear components to China from the United States.[125] In October 1997, Chinese Foreign Minister Quian Qichen made a pledge in a meeting with US Secretary of State Madeleine Albright to discontinue nuclear assistance to Iran,[126] with the exception of two small projects (a zero-power research reactor that used natural uranium and heavy water, and a zirconium tube factory); the $UF_6$ facility was to be scrapped.[127] Formal certification of China's nonproliferation credentials were transmitted to Congress in December.[128]

Interactions between China and the United States continued in 1998; in January, President Clinton certified China as meeting its non-proliferation commitments, although suspicions lingered.[129] In March, the Chinese agreed to suspend the sale of hundreds of tons of anhydrous hydrogen fluoride (AHF), enough for "a lifelong supply" of the chemical,

[122] *Associated Press 1996*.
[123] *Gertz 1996*.
[124] *Iran Brief 1997*.
[125] *Hibbs 1996a*.
[126] *Agence France Presse 1997a*.
[127] *Hibbs and Kna 1997*.
[128] *Weiner 1997*.
[129] *Gertz 1998*.

needed to convert uranium dioxide to uranium tetrafluoride for enrichment.[130] However, the contract was with a private supplier and was only in the very early stages.[131] After 1998, however, Chinese cooperation with Iran seems to have ended.

US efforts with China were more successful than its efforts with Russia. In the case of China, the United States had greater leverage, including a threat to revoke MFN status, which seemed to work to get China to cancel the research reactor deal.[132] Additionally, since unlike Russia, China could not manufacture all of the components of the proffered 300MWe reactors, there were more susceptible to outside pressure. The United States also had an excellent carrot: the supply of nuclear technology that have already been agreed to back in 1984, but which was based on Chinese compliance with nonproliferation. Unlike the Nunn-Lugar funding, the United States only had a financial, not a security stake in this program, and so could more credibly threaten to withhold funds.

### 5.3.3 Other States

The United States did manage to successfully exert pressure on nations apart from Russia and China to cut back on or eliminate the flow of nuclear technology to Iran. Three cases not connected to the Bushehr reactor stand out: cooperation with Argentina, India, and Kazakhstan. The United States successfully convinced Argentina not to cooperate with Iran apart from replacing the HEU fuel in Iran's US-made research reactor with LEU. When the United States cut off Iran's supply of uranium for its research reactor, the availability of another potential supplier may have undercut the US ability to monitor the Teheran research center without limiting proliferation, since the amount of HEU in the reactor was much smaller than the amount required to construct a weapon.

In 1985, Argentina signed a general nuclear cooperation agreement with Iran to (among other things) reconfigure the US-built research reactor to run on 20% enriched uranium rather than HEU and to sell Iran the required fuel; a specific agreement was signed in 1987; the IAEA approved the transfer of enriched uranium in September 1988.[133] Argentina is

[130] *Gellman and Pomfret 1998.*
[131] Rubin 1998.
[132] *Hibbs 1992b.*
[133] *Kessler 1987*;Skootsky 1995

also suspected of having transferred a few tons of uranium dioxide to Iran via Algeria, although evidence of this has yet to appear in any of the extensive IAEA reports on Iran's undeclared uranium imports.[134] However, the United States shared information with Argentina that kept the deal from progressing past this point, preventing the sale of a pilot fuel fabrication facility and a uranium dioxide conversion plant, essential equipment that had been ready for shipping; the collapse of this deal also pre-empted negotiations between Iran and Argentina on the supply of a pilot heavy water production facility.[135]

Iran also sought a small research reactor from India,[136] which was suppressed due to US pressure.[137] In these cases, the pressure exerted was primarily through information-sharing and economic incentives rather than through economic or diplomatic sanctions; it appears that India's decision was due to a diplomatic visit by Assistant Secretary of State Bartholomew in 1991 that convinced the Indians that Iran's aims were suspicious;[138] the Argentine firm that stood to lose business was compensated through promises of better ties with US firms.[139]

Concern was also raised in the early 1990s over Iranian visits to a beryllium plant in Kazakhstan in 1992-3, and whether the Iranians had sought beryllium, LEU, or HEU. The discovery that 600 kg of HEU was inadequately safeguarded at or near the plant which the Iranians had visited led the United States and Britain to conduct Operation Sapphire, in which the HEU was purchased and removed in November 1994. However, US and Kazakh sources later said that the Iranians were seeking LEU and did not try to purchase or steal the fuel.[140] It was subsequently discovered that the material in question was only enriched to between 30 and 60 percent $^{235}$U, some of it had been already used as naval reactor fuel, and that much of it was contaminated with other isotopes.[141]

[134] Cordesman 2000, 7;IAEA Board of Governors 2004a, 19-20
[135] Krosney 1993, 240;Skootsky 1995;*Hibbs 1992a*
[136] *Middle East Defense News 1992c*.
[137] Krosney 1993, 249.
[138] Krosney 1993, 249;*Wallfish 1993*.
[139] *Coll 1992*.
[140] *Hibbs 1995c*.
[141] *Dizard III 1994*.

### 5.3.4 Bilateral Actions

The United States cut off supplies of HEU for the Tehran University reactor in 1979 and began an embargo on the import of Iranian oil as well as the export of weapons and spare parts for weapons. Another layer of sanctions was placed on Iran in 1984 when they were added to the State Department's State Sponsors of Terrorism list. Most US imports from Iran were banned in late 1987.[142] A third layer was added when Congress passed the 1992 Iran-Iraq Arms Non-Proliferation Act, which prohibited the export of dual-use technology and required sanctions against foreign entities that export items that "materially contribute to either country's acquiring chemical, biological, nuclear, or destabilizing numbers and types of advanced conventional weapons."[143]

The United States also attempted to exert direct pressure on Iran; Secretary of State Warren Christopher warned Iran in June 1993 that it could not have "normal commercial relations" while attempting to develop nuclear weapons.[144] Clinton announced that he would ban all US trade with Iran on April 30, 1995, including $326 million in US exports to Iran and approximately $800 million in imports of Iranian oil; this was imposed by executive order on May 8.[145] However, a US call for a multilateral embargo failed.[146] A bill was passed and signed in December 1995 (the Iran and Libya Sanctions Act) to place sanctions on foreign firms that contribute to the development of oil in Iran.[147]

The replacement of Warren Christopher as Secretary of State with Madeleine Albright in January 1997 in also opened up the possibility that US policy would also soften.[148] However, the softening of the administration was undercut by a Congress determined to keep the pressure on Iran. After a fight with President Clinton in 1998 which led to a veto of Iran Missile Proliferation Sanctions Act, the US House passed a similar bill in September 1999 (followed by passage of a slightly different bill by the Senate in February 2000) to require the president to submit every six months to Congress a list of foreign entities that aid Iran

[142] Schott 1997.
[143] House of Representatives 1992.
[144] *Kempster 1993*.
[145] *Devroy 1995*.
[146] *Barbash 1995*.
[147] *Lippman 1995*.
[148] *Hibbs 1997*.

in its weapons acquisition; the bill also directed the president to impose sanctions if he so chooses.[149] President Clinton signed the bill (entitled the Iran Nonproliferation Act of 2000) in March 2000; although its main effect was to increase reporting requirements,[150] it didn't help relations with either Russia or Iran, since it called for cutting back cooperation with Russia (at least this time with respect to the international space station, not nonproliferation objectives) if the president did not certify that Russia was not "demonstrating a sustained commitment to seek out and prevent" aid to Iranian weapons programs. Secretary of State Albright made a concessionary speech on March 17, 2000 that admitted US support for the Shah in 1953 and for Iraq between 1980-1988. She also promised an easing of sanctions; in the context of the recently passed Iran Nonproliferation Act, however, it engendered a hostile official response from Iran.[151] Similarly, the 2000 Iran Nonproliferation Act mainly increased tensions with Russia.

A temporary thaw in US-Iranian relations after September 11, which culminated in a handshake between Secretary of State Colin Powell and Iranian Foreign Minister Kamal Kharazi after a UN meeting on the future of Afghanistan,[152] quickly disappeared once President Bush named Iran as part of an "Axis of evil" in his 2002 State of the Union speech, and Iran was one of seven countries mentioned in the leaked Nuclear Posture Review; Iran protested to the UN.[153] In May, Iran was found to have placed air defense batteries around the Bushehr plant.[154]

The cumulative effect of US sanctions (both economic and social) on Iran has been largely nonexistent or negative. Since the United States effectively ran out of bilateral sanctions in the 1980s, it turned to sanctioning third parties in the 1990s. The 1992 Iran-Iraq Arms Non-Proliferation Act was directed specifically at biological, chemical, and nuclear weapons (as well as advanced conventional weapons); however, the 1996 Iran and Libya Sanctions Act broadened this to other commercial dealings, which primarily had the effect of increasing tensions with Europe, but little effect on Iran.[155] The Clinton administration

[149] *Associated Press 2000.*
[150] Rice 2000.
[151] *Samii 2000b*;*Samii 2000d.*
[152] *Agence France Presse 2001a.*
[153] *Agence France Presse 2002a.*
[154] *Gertz and Scarborough 2002.*
[155] Schott 1997.

attempted to open up a 'dialogue of civilizations,' between 1998 and 2000. Unfortunately, the peak of this policy—Madeleine Albright's apology to Iran for previous US actions—occurred long after conservatives had re-established control of Iranian institutions, and therefore fell on deaf ears.[156]

## 5.4 Iranian Clandestine Action, 1979-2002

US policy was consistent, and in general successful, against Iranian nuclear moves that involved outside suppliers. Unfortunately, US intelligence failed to discover or stop transfers from the A.Q. Khan network to Iran. Oddly enough given this lapse, US intelligence (and other services) consistently overestimated Iran's progress in its nuclear program. While these estimates proved to be useful in the short term in convincing certain suppliers (notably India and Argentina), in the long term it has undermined US intelligence credibility. The IAEA fared little better; for years, it visited Iranian nuclear facilities and failed to detect any clandestine experiments. Still, this is in part due to a lack of power on the IAEA's part; most inspections were only visits without monitoring equipment. In the next three subsections, I give an overview of intelligence about Iran's clandestine program, a description of the actual covert experiments that Iran carried out, and IAEA attempts to uncover these experiments through inspections.

### 5.4.1 Intelligence Estimates

Estimates of Iran's nuclear capabilities have varied greatly over the years; here I list a small sampling of the most widely cited estimates (almost all proven to be wrong so far). The most reasonable (and nuanced) estimate was made by Bill Perry in the mid-1990s, who separated the estimate into two parts: less than five years if they already had fissile material, and more than five years if they didn't. Most estimates are usually based on (implicitly) assuming one of these two conditions.

[156] Pollack 2004.

In 1984 came the first report of an impending Iranian nuclear weapon from West German intelligence, supposedly within two years.[157] US intelligence officials in 1987 reportedly said that Iran was close to producing a suitcase bomb.[158] Another scare came in 1991, when numerous reports claimed that Iran purchased three nuclear warheads from Kazakhstan; the stories turned out to be false, and the supposedly missing warheads were apparently at the bottom of three test shafts at the Semipalatinsk test site.[159]

During the 1990s, concerns about Iran seeking centrifuge technology abroad continued to grow. Around the time of the 1995 crisis with Russia, many predictions surfaced. One senior official noted that "Iran is concentrating on centrifuge designs and looking toward a pilot plant," and likely had plans for "G1 and G2" centrifuges (which turned out to be quite close to the truth, unlike most estimates).[160] Predictions of when Iran would produce a nuclear weapon range varied greatly, with the low end two to five years. Secretary of Defense William Perry offered two ranges, one with fissile material (maximum five years), the other without (minimum five years).[161] Secretary of State Warren Christopher in 1995 described Iran's program as a "crash effort to develop nuclear weapons."[162]

Dire warnings of Iranian nuclear capacity slowed somewhat after 1995. Israeli Prime Minister Shimon Peres claimed in April 1996 that Iran could have nuclear weapons within four years.[163] However, John Holum, director of the US Arms Control and Disarmament Agency, predicted in 1997 that Iran would not be able to produce enough fissile material until 2005-2007, versus 2003 two years previously.[164] In 1998, an Israeli paper cited "experts" as claiming that Iran could have a weapon within three years, Iran and Pakistan were cooperating, and that Iran was working to acquire uranium enrichment technology.[165]

The CIA changed its assessment of Iran in 2000, arguing that it could not rule out Iran's development of a bomb simply because it could not reliably track Iran's acquisition.[166]

[157] Timmerman 1992, 43.
[158] Perkins 1987.
[159] *Middle East Defense News 1992b*.
[160] Albright 1995.
[161] Albright 1995.
[162] *Greenhouse 1995b*.
[163] *Agence France Presse 1996*.
[164] *Hanley 1997*.
[165] *Tel Aviv Ma'ariv (Internet version) 1998*.
[166] *Risen and Miller 2000*.

Israeli intelligence, which had formerly predicted an Iran nuclear weapon by 2000, came up with a new prediction (2005) when that date passed; however, this new estimate was disputed by the defence minister, who argues that Iran was further behind.[167]

CIA director George Tenet gave an unusually long timeframe for Iranian acquisition of nuclear weapons in February 2002, predicting proliferation by the end of the decade if Iran received no fissile materials from outside the country.[168] By contrast, Amin Tarzi, an analyst at Monterey, argued that "Iran's [nuclear] program is in shambles, and the people who read all the intelligence know that."[169]

The difficulty with these estimates is threefold: first, they all tend to be worst-case scenarios in which no errors or problems are assumed to crop up; second, they tend to assume that Iran will acquire fissile materials; third, they often come up in a context for the United States is attempting to convince other states to curtail cooperation with Iran, producing short-term gains while sacrificing long-term credibility. However, sharing estimates of intentions with friendly suppliers seems to be a highly effective tool; in India and Argentina, diplomatic visits that stressed Iran's intentions seemed to work. Such tactics were less effective in Russia and China.

### 5.4.2 Domestic and Clandestine Uranium Experiments

Iran has developed its domestic capabilities significantly, in part due to consistent US attempts to block supplies of foreign technology. While it imported small amounts of uranium from other countries (in particular, China), it has worked steadily on mining and milling uranium domestically. Its uranium and laser enrichment programs, initially reliant on foreign suppliers, have become increasingly self-reliant. However, Iran has encountered substantial difficulties with both programs as a result.

Iran discovered uranium deposits at the Saghand mine in Yazd in 1985. Plans were drawn up in the late 1980s to exploit these deposits; a uranium processing center was

[167] *Jane's Foreign Report 2001*.
[168] *Gedda 2002*.
[169] *Peterson 2002a*.

reportedly finished in 1989,[170] and possibly opened in 1990.[171] Note that center itself is to process the ore; the mine itself is not expected to be fully operational until the end of 2006.[172] A supply of uranium from Namibia via South Africa was rumored to have continued through 1989,[173] when "large amounts" of uranium were transferred according to one report.[174] However, after extensive surveys, the IAEA only found two instances of unreported imports: 1.8 tons of natural uranium from China in 1991 and 50 kg of natural uranium metal in 1993 from an unidentified source as part of a laser enrichment project. The natural uranium consisted of $UF_6$ (1000 kg), $UF_4$ (400 kg) and $UO_2$ (400 kg).[175] Iran also sought LEU from Kazakhstan in 1992-1993.[176]

Iran has had an extensive clandestine uranium enrichment program that has primarily relied on cooperation with Pakistan. In 1985, Iran began a concerted effort to develop uranium enrichment facilities using open-source data and brought a small-scale fuel fabrication laboratory into operation.[177] The beginning date of cooperation between Pakistan and Iran is somewhat fuzzy. Some sources claimed that A.Q. Khan visited Bushehr in 1986 and 1987 and that Iran and Pakistan signed a nuclear cooperation agreement.[178] Another more recent source claims that a meeting occurred in 1987 in Dubai.[179] A third identifies a meeting in 1988.[180] In any case, cooperation began in the mid-to-late 1980s, although it is unclear to what extent this cooperation was sanctioned by Pakistan's government. Centrifuge research was carried out from 1988 until 1995 at the Teheran Nuclear Research Center, using the plans provided by A.Q. Khan as a starting point.[181]

A separate agreement was signed in 1987 or 1988 between Munir A. Khan, Chairman of the Pakistan Atomic Energy Commission and Reza Amrollahi, head of the AEOI, that

[170] Timmerman 1992, 47.
[171] Cordesman 2000, 6.
[172] IAEA Board of Governors 2004a, 3.
[173] Krosney 1993, 250.
[174] *Hibbs 1991a*.
[175] IAEA Board of Governors 2004a, 4,13.
[176] *Hibbs 1995c*.
[177] IAEA Board of Governors 2004a, 6,8,14.
[178] Timmerman 1992, 41-2;Krosney 1993, 249;*Middle East Defense News 1992a*.
[179] *Linzer 2005*.
[180] *Hibbs 1991a*.
[181] IAEA Board of Governors 2004a, 8.

permitted Iranian scientists to travel to Pakistan for general nuclear training.[182] Low-level cooperation may also have existed between North Korea and Iran on nuclear technology, although this cooperation is a speculative outgrowth of the ballistic missile ties between the two.[183]

There are also claims that AEOI head Amrollahi visited South Africa in early 1996 with a "comprehensive list of requested items," but the parties involved denied the meeting had taken place.[184] In July 1996, British customs seized 50 kg of maraging steel on its way to Iran, which can be used as rotors for G2-type centrifuges (although very few could be made out of only 50 kg)[185] Iran did receive plans for the P2 (a.k.a. G-2) centrifuge in the mid-1990s, but claimed to have put aside the plans until 2002 due to a lack of resources and an inability to manufacture the maraging steel rotors needed for the G-2.[186]

Iran received parts for 500 (used) P1 centrifuges from the network in two shipments, one in March 1994 and the other in July 1996.[187] Work on the P1 centrifuge was conducted at the Kalaye Electric Company from 1995 to 2003. The most extensive experiment conducted there occurred in 2002, when $UF_6$ was fed into a small test cascade of 19 machines. Work moved to the Natanz facility in 2003.[188] Many of the centrifuges Iran put together were found to be defective.[189]

Laser enrichment, first explored in the days of the Shah, was restarted in 1987, when a laser isotope separation conference was held.[190] Iran developed a small domestic industry during the 1990s, but still remained dependent on clandestine foreign imports.[191] Iran carried out testing at TNRC between 1993 and 2000. Iran contracted with a foreign supplier (possibly China) to deliver laser enrichment equipment in the early 1990s. Experiments were reportedly successful; an analysis carried out by the foreign supplier involved in the

[182]Dean 1988;Krosney 1993, 249.
[183]Krosney 1993, 249.
[184]*Venter 1997*;*Gilmore 1997*.
[185]*Coughlin 1996*.
[186]IAEA Board of Governors 2004a, 10-11.
[187]IAEA Board of Governors 2004a, 8.
[188]IAEA Board of Governors 2004a, 12-14.
[189]Albright and Hinderstein 2004.
[190]Cordesman 2000, 7.
[191]*Hibbs 1998*.

project claimed that the highest average enrichment achieved was 8%, and the peak enrichment was 13%; however, after 1994, Iran was unable to perform useful enrichment.[192]

In the late 1990s, the United States pressured Russia not to sell technology that could be used for laser enrichment to Iran, despite the fact that the United States Enrichment Corporation (USEC) abandoned the technology in 1999 as too expensive after investing $2 billion. Russia temporarily halted the sales, despite the wattage of the lasers falling well below the Nuclear Suppliers Group threshold of 40W.[193] Iran moved its research from TNRC to Lashkar Ab'ad in 2002 and attempted to set up a pilot plant, but dismantled the equipment there by 2003.[194]

Many US attempts to block clandestine activities were thus directed at the wrong targets; laser enrichment, as the USEC determined, is a technological dead end that the Iranians have had little success with. Iran's uranium enrichment program, on the other hand, has achieved much more success. Fortunately, due to the difficulty of passing on tacit knowledge (discussed in-depth in Chapter **??**), such lapses have not hurt as much as they might have.

### 5.4.3 IAEA inspections

If the intelligence agencies have not done well, neither have the inspectors on the ground. The IAEA made several visits to Iran between 1992 and 2000, most based on information from third parties.[195] However, these were not official inspections with full equipment, and uncovered nothing due to a lack of equipment; some of the sites were conducting nuclear activities that should have been reported. The IAEA made an initial visit in 1992 to six nuclear sites (Bushehr, the Isfahan Nuclear Technology Center, the Amirabad Nuclear Research Center in Tehran, the Karaj Agricultural and Medical Research Center, Saghand, and Moallem Kalayeh) without measuring equipment. The IAEA gave Iran a clean bill of health, but suspicions remained regarding additional sites, and whether the inspectors had

[192] IAEA Board of Governors 2004a, 12-13
[193] *Miller 2000*.
[194] IAEA Board of Governors 2004a, 12-13
[195] Zak 2004, 435.

been taken to the real suspected nuclear sites.[196] A second visit in 1993 included Isfahan, Karaj, and Tehran.[197]

The IAEA was sent a team to investigate charges that Iran had a clandestine uranium enrichment program in March 1996, but the inspectors' visits uncovered nothing.[198] Iran objected in October 1996 to environmental monitoring of its nuclear facilities, supposedly to prevent the United States from obtaining samples.[199] The IAEA also demanded that Pakistan curb its nuclear pursuits, including exports to Iran, Iraq, and North Korea; however, they appeared to be objecting to re-exports of West German technology rather than the exports of indigenous Pakistani technology that were taking place at that time.[200]

Hans Blix, the then-Director General of the IAEA, made a visit in July 1997 that included three smaller research centera (Karaj, Bonab, and Ramsar), and found nothing out of place. Karaj later turned out to be a radioactive waste storage facility A final visit in May 2000 by the new Director General, Mohammed El Baradei, included the Bushehr nuclear power plant and found nothing out of place.[201] However, Iran refused in May 2000 to sign INFCIRC-540, known as the Additional Protocol, without assurances that the United States would reciprocate by halting obstructions to Iran's nuclear program.[202]

Although the IAEA didn't manage to uncover any activities until 2002 due to a general lack of a mandate or intelligence to search Iran for suspect activities, solid support from member states and good intelligence have enabled the IAEA to uncover significant portions of Iran's program since then.

## 5.5 The Iranian Nuclear Crisis, 2002–2003

In mid-August 2002, the National Council of Resistance of Iran, formerly known as the Mujahedin-e Khalq, announced that Iran had two clandestine nuclear facilities: a "nuclear fuel production plant and research lab at Natanz and a heavy water production plant at

[196] Skootsky 1995.
[197] Zak 2004, 437.
[198] *Hibbs 1996b*.
[199] *Hibbs 1996c*.
[200] *Alam 1996*.
[201] Zak 2004, 437-8.
[202] *Hibbs 2000*.

Arak." Both were reported to be near completion.[203] These reports were confirmed by CNN in December.[204] However, IAEA head El Baradei said that he had known for six months about the facilities; Iran officially informed the IAEA of the facilities in September 2002. A visit by El Baradei originally planned for October was rescheduled by the Iranians for February 2003;[205] during the meeting, Iran agreed to provide design information on future new facilities in advance, a standard provision that most other states in the IAEA had already agreed to. Accordingly, in May, Iran informed the Agency that it would construct a 40 MWt heavy water research reactor at Arak (the IR-40) and build a fuel manufacturing plant at Isfahan planned to go into operation in 2007. Iran also admitted the receipt in 1991 of previously unreported natural uranium imported from China.[206] The total effective amount of uranium (i.e. $^{235}$U) was insufficient for a nuclear weapon, and when measured in the IAEA's slightly odd unit of "effective kilograms," was only 0.13,[207] which (as Iran pointed out in its reply)[208] was under the inspection (but not reporting) threshold.[209] Iran claimed that it had informed the IAEA of the facilities in June 2002,[210] while State Department spokesman Richard Boucher argued that they admitted the existence of the facilities only after they had been made public.[211]

In May, the United States lobbied to have Iran found in violation of the NPT by the IAEA; Secretary of State Colin Powell expressed concern, but said that it was not a matter for military action "at the moment."[212] However, the Pentagon urged a harder line; Senator Sam Brownback proposed the Iran Democracy Act to fund Iranian opposition groups,[213] which passed, albeit without funding. Members of the House also pushed the administration to use the 1996 Iran and Libya Sanctions Act to put sanctions on companies dealing

[203] *Lumpkin 2002*.
[204] Albright and Hinderstein 2002.
[205] *Dareini 2002*.
[206] IAEA Board of Governors 2003b, 2-5.
[207] Equal to plutonium's weight in kilograms, uranium with an enrichment of 1% or more to its weight in kilograms multiplied by the square of its enrichment, uranium with an enrichment below 1% and more than 0.5% to its weight in kilograms multiplied by 0.0001, and depleted uranium (0.5% and below) or thorium to its weight in kilograms multiplied by 0.00005.
[208] Iranian Delegation 2003, 3.
[209] International Atomic Energy Agency 1968.
[210] *Lynch 2003*.
[211] *Gedda 2003*.
[212] *Thatcher 2003*.
[213] *Dinmore 2003a*.

with Iran; through June 2003, it had never been used.[214] The US government shortly after imposed sanctions on Chinese and North Korean companies under the 2000 Iran Nonproliferation Act, however.[215] In general, the US response was hampered by internal divisions within the administration; as George Perkovich observed, "The administration does not have a strategy because there is a fight in the administration over whether you should even deal with this government in Iran."[216]

At the end of May, the EU also decided to step up diplomatic pressure regarding its weapons program;[217] Russia also threatened to not supply fuel for the Bushehr reactor unless Iran signed the Additional Protocol,[218] but in early June declined to make this a requirement, instead insisting on the return of the fuel.[219]

In its June 2003 meeting, the IAEA Board fell short of reporting Iran in violation of the NPT; however, the detection on June 11 of HEU particles at the Natanz facility raised suspicions, and Iran went ahead with introducing $UF_6$ into centrifuges at the PFEP (Pilot Fuel Enrichment Plant), first into single machines on June 25, then into a small ten-machine cascade on August 19.[220] After the negative report,[221] which the secretary of the Supreme National Security Council, Hassan Rohani, termed "technical problems," El Baradei visited Iran again on July 9.[222] Just before his July trip, El Baradei encouraged the Iranians to sign the Additional Protocol.[223] Iranian President Khatami promised ElBaradei during his trip that advance notice would be given on further construction, but stopped short of promising to sign the Protocol.[224] The inspection was cut short due to the post-war search for nuclear facilities in Iraq; El Baradei only visited Natanz, and not Arak or Bushehr. A small cascade of centrifuges was discovered already in place there, which El Baradei deemed "sophisticated."[225] A subsequent report revealed for the first time that Iran admitted

[214] *Agence France Presse 2003c*.
[215] *Lee 2003*.
[216] *Frantz 2003*.
[217] *Dempsey 2003*.
[218] *Dinmore 2003b*.
[219] *Sands 2003*.
[220] IAEA Board of Governors 2003c, 2,7.
[221] IAEA Board of Governors 2003b.
[222] *Fathi 2003*.
[223] *Charbonneau 2003a*.
[224] *BBC News 2003a*.
[225] *Gordon 2003*.

it had received drawings of the centrifuges in 1987 and components, but no assistance with assembly or training.[226] Soon after, in an interview AEOI head Aghazadeh offered to sign the Additional Protocol if nuclear-related sanctions were lifted by Western countries.[227]

A technical demonstration was made to the IAEA on July 13 of the planned Iranian indigenously-designed heavy-water reactor which was claimed to be for the production of isotopes.[228] Some suspicions were raised over the purpose of this reactor, as no plans were included for hot cells to separate out the isotopes, and the heavy manipulators and leaded windows Iran sought had specifications that were excessive for isotope separation, but appropriate for fuel reprocessing (i.e. plutonium separation).[229]

During a trip to Iran in late June, British Foreign Minister Jack Straw called on the government to ratify the Additional Protocol; Iranian Foreign Minister Kamal Kharazi responded that such a move would require positive steps on the part of the international community.[230] In early August, the EU3 (Britain, France, and Germany) sent a letter to Iran promising access to advanced nuclear technology in exchange for cessation of its uranium enrichment program despite lobbying by the United States; President Khatami responded with a letter promising to enter negotiations to sign the Additional Protocol, but not to abandon enrichment.[231]

On August 24, the Iranian representative to the IAEA declared that they were prepared to begin negotiation on the Additional Protocol.[232] Russia offered to have the United States participate in the building of additional reactors in an attempt to mollify US concerns about Russian cooperation.[233] IAEA Director ElBaradei remarked at the IAEA board meeting in September that "testing with nuclear material must have taken place for Iran to reach the stage that it has."[234] The United States circulated a draft resolution declaring Iran in non-compliance, but quickly dropped it due to a lack of support.[235] The board passed

[226] IAEA Board of Governors 2003c, 6-7.
[227] *Associated Press 2003*.
[228] IAEA Board of Governors 2003c, 8.
[229] IAEA Board of Governors 2004b, 18.
[230] *Smith 2003*.
[231] *Taylor and Charbonneau 2003*.
[232] IAEA Board of Governors 2003c.
[233] *Dareini 2003c*.
[234] ElBaradei 2003.
[235] *Charbonneau 2003b*.

a resolution on September 12 that decided that Iran must provide a full declaration and grant unrestricted access by the end of October.[236] A spokesman for the State Department warned that failure to comply would result in referral to the Security Council,[237] while Assistant Secretary of State Bolton remarked that all states should be required to sign the Additional Protocol; on the Iranian side, conservative papers called for withdrawal from the NPT, as the Iranian delegation to the IAEA threatened before "storming" out of the IAEA meeting.[238] Other influential politicians also proposed leaving; Ayatollah Ahmad Janati, the head of the Guardian Council, argued that Iran should reconsider its membership.[239] Others argued for signing the Additional Protocol; Deputy Foreign Minister Mohsen Aminzadeh even claimed that it should have been signed years before.[240]

Over American objections, the EU3 (Germany, France, and the United Kingdom) offered incentives to Iran, which were initially rejected.[241] Although Iranian opinion was unanimous on seeing the October deadline as "an affront to Iran's national dignity," reformist elements supported signing an Additional Protocol, while more conservative ones supported leaving the NPT. AEOI head Aghazadeh assured the IAEA that Iran was not about to leave the treaty,[242] while Akbar Salehi, Iran's representative to the IAEA, claimed that they would scale back cooperation.[243] Foreign Minister Kamal Kharrazi said that Iran was willing to negotiate with the IAEA, but was concerned that would be insufficient for the United States.[244] He characterized Iran's nuclear program as "a matter of national pride to have this capability"[245] A split between hard-liners and reformers was visible, with Expediency Council head Rafsanjani in the middle.[246]

An IAEA delegation visited Iran, and found additional traces of HEU at the Kalaye Electric Company where initial testing of centrifuges had taken place (the earlier samples

[236] IAEA Board of Governors 2003d.
[237] *BBC News 2003c*.
[238] *Peterson 2003*.
[239] *Pouladi 2003*.
[240] *Samii 2003*.
[241] *De Luce 2003*.
[242] *Amin 2003*.
[243] *Dareini 2003b*.
[244] *Giacomo 2003*.
[245] *Agence France Presse 2003a*.
[246] *Haeri 2003*.

had been at Natanz).[247] At the end of September, ElBaradei said that the October 31 deadline was "decisive" and "non-negotiable" but that the deadline provided "ample time."[248]

Iran assembled a five-member panel to decide the country's policy towards the deadline. The panel consisted of Foreign Minister Kamal Kharrazi, Minister of Information Ali Yunessi, Defense Minister Ali Shamkhani, Secretary of the High National Security Council Hassan Rowhani, and the supreme religious leader's Adviser for International Affairs Ali Velayati.[249] This panel thus balanced three members of the relatively reformist Cabinet (Kharrazi, Yunessi, and Shamkhani) with appointees to the Executive Council (Velayati and Rowhani), although Yunessi was also a cleric. Former President Rafsanjani condemned the IAEA resolution, but indicated that Iran would be willing to meet some international demands for inspection as long as certain sites such as places of worship and military sites were excluded: "...that our national security not be endangered, that our (Islamic) values and our sacred sites not be affected, that (military) secrets unconnected with the nuclear program not be revealed and that others fulfill their duty" to assist Iran with its civilian nuclear program.[250] Salehi, Iran's IAEA representative, also claimed that Iran was not bound by the IAEA resolution, but would continue to cooperate. Yunessi said Iran would sign the protocol under certain conditions if Iran received more technological assistance with its nuclear program.[251]

External pressure for a military strike increased during this period. British Foreign Minister Jack Straw answered a question about military sanctions by responding that the government wished to see it resolved peacefully, which some took to imply a refusal to take military action off the table.[252] Mossad was reported in this period to have drawn up "achievable" attack plans against six targets in Iran.[253]

On October 16, representatives of the EU3 and ElBaradei flew separately to Iran to attempt to resolve the outstanding issues. The head of the parliament's National Security and Foreign Policy committee, Mohsen Mirdamadi, advocated a compromise on military

[247] *BBC News 2003b*.
[248] International Atomic Energy Agency 2003.
[249] *New York Times 2003*.
[250] *Ghazi 2003a*.
[251] *Ghazi 2003b*.
[252] *Crerar 2003*.
[253] *Agence France Presse 2003b*.

sites, expressing a strong desire to avoid being referred to the Security Council.[254] In a meeting on October 16 with the IAEA, Dr. Rohani, Secretary of the Supreme National Security Council of Iran, stated that a decision had been taken to provide a full disclosure of Iran's nuclear activities, its readiness to conclude an additional protocol, and act in accordance with the protocol pending its entry into force.[255] On October 18, Iran began negotiations with the IAEA over the Additional Protocol.[256] This willingness to cooperate was reinforced by a letter from Vice President Aghazadeh the next week. In this letter, Iran admitted that the 1.9 kg of $UF_6$ that had been formally reported as leaked had been used to test centrifuges at the Kalaye Electric Company between 1999 and 2002, it had had a laser enrichment program between 1992 and 2000 that had used 30 kg of uranium metal, and had irradiated 7 kg of $UO_2$ targets and extracted small amounts of plutonium between 1988 and 1992.[257] On October 21, the Iranian Government and the Foreign Ministers of France, Germany and the United Kingdom issued in Tehran an agreed statement in which Iran agreed to suspend all uranium enrichment and reprocessing activities, and the EU3 agreed that Iran could get easier access to foreign technology and supplies.[258] Iran also provided a letter to the IAEA that provided a "full picture" of Iran's nuclear activities.[259] In an additional letter on November 10, Iran accepted the draft text of the additional protocol and officially informed the IAEA of its suspension of uranium-related activities.[260]

Iran made two important decisions during this period. The first, to make a full disclosure to the IAEA, was made probably before October 16; the second was to halt enrichment activities (Iran hadn't reprocessed in years), which was probably made between the 16th and the 21st. The decision to cooperate with the IAEA was thus decided upon prior to halting enrichment; the offer of the EU3 to assist Iran with its nuclear program (as well as other potentially important incentives not mentioned in the statement on the 21st) probably tipped the balance between simply cooperating and actually halting its program. This freeze probably has set back Iran's nuclear ambitions between Nov 2003 and May 2005

[254] *Murphy 2003*.
[255] IAEA Board of Governors 2003a, 3-4.
[256] *Dareini 2003a*.
[257] IAEA Board of Governors 2003a, 3-4.
[258] Iran Ministry of Foreign Affairs 2003.
[259] IAEA Board of Governors 2004a, 7.
[260] IAEA Board of Governors 2003a, 3-4.

by at least a year (a rollback of the freeze between June 2004 and Nov 2004 somewhat undercut this benefit).

## 5.6 Conclusions

US policy towards Iran's nuclear program has been primarily focused on cutting off the supply of nuclear technology from foreign suppliers. Multiple-party interactions (H7) were therefore key to restricting Iranian progress, since US strategies were supply-side rather than demand-side; the United States had to convince many countries not to supply nuclear technology to Iran. The United States has been fairly successful in preventing known transactions from occurring; except for the Russian construction of Bushehr, no other major nuclear facilities have been provided by foreign entities. For the most part, the United States was able to do this through economic and diplomatic pressure using positive incentives rather than by threatening sanctions, supporting hypotheses H9a (Economic Incentives) and H10a (Social Incentives), while in a few cases the implicit threat of sanctions was used to convince states to cut off support. Over time such barriers are permeable, however. The A.Q. Khan network provided plans and parts for 500 P1 centrifuges as well as plans for P2 centrifuges; however, even without the parts, Iran has been able to construct its own centrifuge program. Similarly, the Chinese plans for a full-scale uranium conversion facility apparently were sufficient to enable Iran to construct the facility using domestic technology in about six years. Although this facility has not been fully tested and has problems (see Chapter **??**), this is still a significant achievement.

The diplomatic capital spent on trying to convince various countries not to aid Iran with the Bushehr plant was ineffective in the end; however, sharing of intelligence and gentle diplomatic pressure was effective in preventing Iran from acquiring a medium-sized research reactor, which would be a much more significant threat than Bushehr. As a result of the US campaign to stop Bushehr, Iran has gained support from the non-aligned movement; it has been able to partially justify its uranium enrichment program by pointing out that constant US threats have made future fuel supplies uncertain.

Very little effort has been put into attempting to convince Iran to give up its nuclear

program directly; layers of sanctions without any clear path of relief have proven entirely ineffective in convincing Iran. The US made a limited number of attempts to deal directly with Iran, which were complicated by both Iranian and US domestic politics (H4). The efforts by the Clinton administration to reach out to Iran were rebuffed, in part due to the near-simultaneous sanctions that were placed on Iran or other states if they cooperated with Iran. Ultimately, however, such efforts may have been futile, since reformists lost control of power in Iran, an event that would most likely not have been significantly affected by warming relations with the United States.

Significant opportunities for better relations with the United States have been lost. Offers from Iran to negotiate after the invasion of Afghanistan in 2001 and during the Iraqi War in 2003 were turned down or lost through harsh rhetoric such as calling Iran part of an "axis of evil." The relative success of the EU3 in halting Iran's uranium enrichment program through the potential of improved diplomatic and economic ties indicates that negotiation and the offer of improved relations can be significant bargaining chips. Now that Iran's primary security concern has been ameliorated by the US invasion of Iraq (although it may have simply promoted the United States to the top spot), social benefits such as recognition and integration into the world system may prove to be a useful substitute for nuclear weapons, since Iran would be motivated primarily by inertia and pride rather than military concerns if its concerns about US intentions were assuaged.

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