*CSIS*

**Center for Strategic and International Studies**
**1800 K Street N.W.**
**Washington, DC 20006**
**(202) 775-3270**
**Fax: (202) 466-4740**
**(For Updates see CSIS.ORG)**

# Iran and Nuclear Weapons

## Background Paper for the Senate Foreign Relations Committee

**Anthony H. Cordesman**

**Senior Fellow for Strategic Assessment**
**Center for Strategic and International Studies**

**March 24, 2000**

# Table of Contents

The US has long expressed deep and continuing concern regarding Iran's search for nuclear weapons. In early 1995, President Clinton's first Secretary of State, Warren Christopher, stated:[1]

> "In terms of its organization, programs, procurement, and covert activities, Iran is pursuing the classic route to nuclear weapons which has been followed by almost all states that have sought a nuclear weapon.... Iran's efforts to acquire nuclear weapons also pose enormous dangers. Every responsible member of the world community has an interest in seeing those efforts fail. There is no room for complacency. Remember Iraq...."

This statement came at a time when a number of western intelligence sources were leaking reports that Iran was trying to establish a secret gas centrifuge uranium-enrichment program. an had approached German and Swiss firms to purchase balancing machines, as well as diagnostic and monitoring equipment—all dual-use items potentially valuable for laboratory-scale centrifuge development. In addition, Iranian agents were said to have contacted a British company to obtain samarium-cobalt magnetic equipment, potentially useful in the development of centrifuge top bearings.[2]

Christopher was also quoted as saying that Iran has tried for years to buy heavy water reactors to produce plutonium, is "devoting resources" to enriching uranium to weapons grade levels, and has "scoured" the states of the former Soviet Union for nuclear materials, technology, scientists, and technicians. [3]

President Clinton's new Secretary of State, Madeleine Albright, renewed this warning in trip to Europe in February, 1997. She expressed particular concern that Europe and Russia cease the supply of dual-use and nuclear weapons-related technology to Iran.[4] Similarly, John Holum, the Director of the US Arms Control and Disarmament Agency, testified in March 1997, that Iran was actively developing nuclear weapons, although he indicated that the effort was proceeding slowly and that Iran would not have a bomb using Iranian-produced weapons grade material until 2005-2007.[5]

The European Union has also expressed concerns of its own. On January 16, 1998, officials of the UAE presented the United States with a list of 15 steps they were taking to prevent Iran from acquiring weapons of mass destruction and spoke out strongly on the need to oppose Tehran's sponsorship of terrorism. British Foreign Secretary Robin Cook, whose country just assumed the EU's rotating presidency, and Sir Leon Brittan, vice president of the European Commission, presented the US Secretary of State Madeline Albright with a memo "covering all the things the European countries are doing to halt the equipment and material for weapons of mass destruction from getting into the hands of Iran."[6]

No details were available, but the memo supplemented one given to the United States in 1997. Brittan stated that the memo, "shows the continuing resolution and determination of the European Union ... to take vigorous action ... against both the development of weapons of mass destruction and the use of Iran as a terrorist base." Asked if there might be some flexibility in approaching Iran, Cook said: "There must be no room for flexibility in our resolve to halting Iran

getting weapons of mass destruction or preventing Iran from acquiring missile capability or stopping Iran from sponsoring state terrorism....On all these fronts we must be quite clear that these are unacceptable dangers based on unacceptable behavior by elements within the government of Iran." [7]

Cook did state, however, that the US effort to isolate the Islamic state would not work. ``We must respond to the dangers posed by Iran as well as the opportunities. But isolating Iran is not the right response." Cook condemned the Iran-Libya Sanctions Act, under which Washington punishes foreign companies trying to invest in Iran's oil and gas sectors, saying it was unacceptable to European states and counterproductive. "Isolating Iran won't hit the target we want -- economic measures will not have any serious effects on Iran's attempts to acquire weapons of mass destruction...There are the first signs of Glasnost appearing in Iran and we must do what we can to encourage it." [8]

## Iranian Statements and Denials Regarding Nuclear Weapons

Iran has never confirmed these charges and suspicions. Iran's Deputy President Ayatollah Mohajerani did state in October, 1991, that Iran should work with other Islamic states to create an "Islamic bomb." However, the Iranian government has normally denied that it is seeking nuclear weapons and has repeatedly made proposals to create a nuclear-free zone in the Middle East.[9] Iran has countered such charges by repeatedly denying that it has a nuclear weapons program. For example, President Rafsanjani was asked if Iran had a nuclear weapons program in an interview in the CBS program *60 Minutes* in February 1997. He replied, "Definitely not. I hate this weapon." [10] As has been noted earlier, President Khatami, his foreign minister, and his new head of the Iranian Atomic Energy Organization have repeated similar denials ever since Khatami became president.

The Iranian media has been equally consistent in making such denials. The Iranian government-run Voice of the Islamic Republic of Iran has described such charges as "baseless," and has referred to various articles about the transfer of weapons-related technology as, "a propaganda ploy by Western media affiliated to the Zionist regime." It has stated that, "Iran's efforts to reach nuclear energy are centered around the axis of the creation of electricity, which is required for the country's developing industry, and using this energy for medical and agricultural objectives," and the IAEA has found Iran's nuclear programs "respect all the technical and legal aspects of non-proliferation." It has claimed in contrast that, "The Zionist regime has more than 200 nuclear warheads."[11]

The Atomic Energy Organization of Iran (AEOI) issued another denial that it had a nuclear weapons program on August 19, 1997, and that Amrollahi had sought aid from South Africa in obtaining items for its nuclear weapons program during a meeting in March, 1995 with Dr. Waldo Stumpf, the chief executive of South Africa's Atomic Energy Commission. [12] The AEOI also stated that all nuclear activities in Iran were peaceful. that Iran was a signatory to the Non-Proliferation Treaty, the nuclear safety program agreement, and the test ban; that all Iranian activities were under the supervision of the International Atomic Energy Agency (IAEA) and that recent inspection reports showed that Iran fully cooperated; and that the charges against Iran were a Zionist plot. Stumpf issued an equally firm denial, although it was a bit ironic he indicated that that the only Iranian official he had ever met with was Gholamreza Aghazadeh --

whom he described as the oil minister but who was soon to become the new head of Iran's nuclear program.[13]

The timing of these denials is interesting because they came only days after President Khatami replaced Reza Amrollahi, the head of the Atomic Energy Organization, with Gholamreza Aghazadeh, Iran's former oil minister. The reasons for Gholamreza Aghazadeh's appointment are not clear. Some experts believe that that it represented an effort to improve the administration of Iran's nuclear programs (Amrollahi had developed a reputation as an awful administrator and manager). Others feel it might be part of an effort to make Iran's nuclear power program more efficient, and still others feel that it might have been part of an effort to review whether such a program was cost-effective at all, or even a down-playing of Iran's nuclear weapons program. [14]

Iran's new Foreign Minister, Kamal Kharrazi, stated on October 5, 1997, that,[15]

> "We are certainly not developing an atomic bomb, because we do not believe in nuclear weapons... We believe in and promote the idea of the Middle East as a region free of nuclear weapons and other weapons of mass destruction. But why are we interested to develop nuclear technology? We need to diversify our energy sources. In a matter of a few decades, our oil and gas reserves would be finished and therefore, we need access to other sources of energy...Furthermore, nuclear technology has many other utilities in medicine and agriculture. The case of the United States in terms of oil reserve is not different from Iran's. The United States also has large oil resources, but at the same time they have nuclear power plants. So there is nothing wrong with having access to nuclear technology if it is for peaceful purposes..."

Some Western experts outside government agree with Iran's claims that it does not have a nuclear weapons program. For example, Eric Arnett of the Stockholm Institute of Peace Research Institute argues that Iran has offered to open any site to IAEA inspection, has agreed to accept improved safeguards for such inspections if they are universally adopted, and has been a strong supporter of regional arms control measures. [16]

In contrast, most Western experts with direct access to their government's intelligence data do believe that Iran has a nuclear weapons program. They base such conclusions largely on human intelligence and on the analysis of the long history of Iranian efforts to acquire nuclear weapons-related technology and dual-use equipment which has little other value to Iran. What they do not believe is that Iran has been able to establish the kind of massive nuclear program that Iraq established.

Most such experts feel that Iran has lacked the funds to establish such a program, and Iran has found it difficult to obtain much of the nuclear technology it desires because of various export control and intelligence efforts. Few Western experts seem to support a report by a former member of the US National Security Council staff that Iran had developed a $10 billion strategy for acquiring nuclear weapons.[17] Iran also does not have anything approaching Iraq's manpower base of several thousand nuclear technicians. Some estimates indicated that Iran had less than 500 nuclear physicists, engineers, and senior technicians in the late 1980s -- compared to around 7,500 in Iraq.

Iran's nuclear weapons program seems to be slow and evolutionary. In fact, US estimates of Iran's progress in acquiring nuclear weapons have become more conservative with time. In 1992, the CIA estimated that Iran would have the bomb by the year 2000. In 1995, John Holum testified that Iran could have the bomb by 2003. In 1997, after two years in which Iran might have made progress, he testified that Iran could have the bomb by 2005-2007.[18] As a result, US experts increasingly refer to Iran's efforts as "creeping proliferation" -- *although this description must be carefully caveated as one based on the assumption that Iran cannot buy weapons grade material from any outside source.*

## Nuclear Weapons Efforts Under the Shah

Iran's nuclear effort was much more ambitious when it first began. It began no later than the early 1970s, when the Shah acquired Iran's first nuclear reactor from the US. for the Amirabad Nuclear Research Center (now called the Amirabad Technical College) in Tehran. The five megawatt reactor started up in 1967, and has operated ever since. It is regularly inspected by the IAEA, but it uses a core with 93% enriched uranium, which is suitable for some forms of nuclear weapon.[19]

The Shah established the Atomic Energy Organization of Iran in 1974, and rapidly began to negotiate for nuclear power plants. He concluded an extendible ten year nuclear fuel contract with the US in 1974, with Germany in 1976, and France in 1977. In 1975, he purchased a 10% share in a Eurodif uranium enrichment plant being built at Tricastin in France that was part of a French, Belgian, Spanish, and Italian consortium. Under the agreement the Shah signed, Iran was to have full access to the enrichment technology Eurodif developed, and agreed to buy a quota of enriched uranium from the new plant.[20]

He created an ambitious plan calling for a network of 23 power reactors throughout Iran that was to be operating by the mid-1990s, and sought to buy nuclear power plants from Germany and France. By the time the Shah fell in January, 1979, he had six reactors under contract, and was attempting to purchase a total of 12 nuclear power plants from Germany, France, and the US. Two 1,300 megawatt German nuclear power plants at Bushehr were already 60% and 75% completed, and site preparation work had begun on the first of two 935 megawatt French plants at Darkhouin that were to be supplied by Framatome.[21] Thousands of Iranians were training in nuclear technology in France, the Germany, India, the UK, and the US.

Iran signed the Nuclear Non-Proliferation Treaty and followed nuclear safeguard procedures. Nevertheless, US experts believe that Shah began a low-level nuclear weapons research program, centered at the Amirabad Nuclear Research Center.[22] This research effort included studies of weapons designs and plutonium recovery from spent reactor fuel. It also involved a laser enrichment program which began in 1975, and led to a complex and highly illegal effort to obtain laser separation technology from the US. This latter effort, which does not seems to have had any success, continued from 1976 until the Shah's fall, and four lasers operating in the critical 16 micron band were shipped to Iran in October, 1978.[23] At the same time, Iran worked on other ways to obtain plutonium, created a secret reprocessing research effort to use enriched uranium, and set up a small nuclear weapons design team.[24]

In 1976, Iran signed a secret contract to buy $700 million worth of yellow cake from South Africa, and appears to have reached an agreement to buy up to 1,000 metric tons a year.[25] It is unclear how much of this ore South Africa shipped before it agreed to adopt IAEA export restrictions in 1984, and whether South Africa really honored such export restrictions. Some sources indicate that South Africa still made major deliveries as late as 1988-1989.[26] Iran also tried to purchase 26.2 kilograms of highly enriched uranium; the application to the US for this purchase was pending when the Shah fell.

## The Revitalization of Iran's Nuclear Weapons Effort

The new Khomeini government let much of the Shah's nuclear program collapse during 1978-1980. It terminated the French and German contracts supporting the program. In March, 1979, Iran refused the request of KWU in Germany to mothball the Bushehr reactor projects, rather than simply turn them immediately over to Iran. As a result, KWU turned the reactor sites over to Iran in late August 1979, and Iran fully abrogated all past agreements with KWU in late November, 1979. According to one report, the scientific cadre was reduced to only 13 people. [27]

The Iran-Iraq War, however, soon led the Khomeini government to revive Iran's nuclear program and interest in nuclear weapons. The Iranian government provided new funds to the research teams operating the US-supplied reactor at the Amirabad Nuclear Research Center, although it continued to operate the reactor under IAEA safeguards. At least one senior official of the new government, the Ayatollah Mohammed Hussein Beheshti; stated to officials managing the nuclear research effort in 1981, that the mandate of Iran's nuclear program had become the development of a nuclear weapon. Khamenei implied the same thing in a speech to Iran's Atomic Energy Organization of Iran (AEOI) in 1987.

Some experts feel that the IRGC moved experts and equipment from the Amirabad Nuclear Research Center to a new nuclear weapons research facility near Isfahan in the mid-1980s, and formed a new nuclear research center at the University of Isfahan in 1984 -- with French assistance.[28] Unlike many Iranian facilities, the center at Isfahan was not declared to the IAEA until February 1992, when the IAEA was allowed to make a cursory inspection of six sites that various reports had claimed were the location of Iran's nuclear weapons efforts.[29]

Further, these Western experts believe that Iran's efforts to acquire nuclear weapons accelerated in the late 1980s -- although it is not possible to separate such efforts definitively from efforts to acquire nuclear power generating facilities. Iran's Yazd Province has significant uranium deposits (at least 5,000 tons) in the Shagand region, and Iran announced in 1987 that it had plans to set up a yellow cake plant in Yazd Province.[30] This facility was under construction by 1989 and Iran may have begun to build a uranium processing or enrichment facility.[31]

Iran may also have opened a new uranium ore processing plant close to its Shagand uranium mine in March, 1990, and it seems to have extended its search for uranium ore into three additional areas. Iran may have also begun to exploit stocks of yellow cake that the Shah had obtained from South Africa in the late 1970s while obtaining uranium dioxide from Argentina by purchasing it through Algeria.[32]

Iran began to show a renewed interest in laser isotope separation (LIS) in the mid-1980s, and held a conference on LIS in September, 1987.[33] On February 7, 1990, the speaker of the Majlis publicly toured the Atomic Energy Organization of Iran and opened the new Jabir Ibn al Hayyan laboratory to train Iranian nuclear technicians.[34] Reports then surfaced that Iran had at least 200 scientists and a work force of about 2,000 devoted to nuclear research. [35]

Iran opened a new nuclear research center in Isfahan in 1984, located about four kilometers outside the city and between the villages of Shahrida and Fulashans. This facility was built at a scale far beyond the needs of peaceful research, and Iran sought French and Pakistani help for a new research reactor for this center. The Khomeini government may also have obtained several thousand pounds of uranium dioxide from Argentina by purchasing it through Algeria. Uranium dioxide is considerably more refined than yellow cake, and is much easier to use in irradiating material in a reactor to produce plutonium.[36]

Iran sought foreign support from a range of sources. Pakistan signed a nuclear cooperation agreement with Iran in 1987. Specialists from the Atomic Energy Organization of Iran began to train in Pakistan, and Dr. Abdul Kadr Khan, who has directed much of Pakistan's effort to develop nuclear weapons material, visited Tehran and Bushehr in February 1986, and January 1987.[37]

Iran also strengthened its nuclear research ties to the People's Republic of China. The two countries signed a formal nuclear research cooperation agreement in 1990, although cooperation had begun as early as 1985 -- after Iran had suffered its first major chemical attacks from Iraq and had started to give its nuclear effort high priority. Iranian nuclear engineers appear to have begun training in China, and China seems to have transferred nuclear research technology for reactor construction and other projects, and possibly some technology for LIS, to an Iranian facility at Isfahan.[38]

While Iran proved unable to get a reactor from France or Pakistan, it had more success with China. It obtained a subcritical research reactor from the People's Republic of China in 1985, and a small Calutron to use in enrichment research in 1987. This Calutron was only a one milliamp machine, versus the 600 milliamp machines used by Iraq in its weapons enrichment efforts, and was so small that it was suitable only for research purposes -- specifically to test insulators and liners and to produce stable isotopes of zinc for pharmaceutical purposes.

Iran recruited Iranian nuclear scientists living overseas and tried to renew its power reactor program as a way of getting enriched material. In 1984, the Khomeini government began to restart work at the Bushehr reactor complex. The two 3,765 megawatt reactors were located on the Gulf about 18 kilometers southwest of the city. While most estimates indicate they were about 60% complete, others indicate that 85% of the construction work, and 65% of the electrical and mechanical work, were complete.[39]

These Iranian efforts suffered major set backs, however, when Iraq repeatedly bombed Iran's reactor projects at Bushehr. These Iraqi bombings occurred on March 24, 1984, February 12, 1985, March 4, 1985, July 12, 1986, November 17, 1987, November 19, 1987, and July 19, 1988. At least some foreign technicians died during these bombings, and work on the reactors was often suspended. It is interesting to note that the 1987 and 1988 raids may have been a

response to the fact that Iran had begun to move IAEA safeguarded material to the area in February, 1987.[40]

## Creeping Proliferation Under Rafsanjani

The course of the Iranian nuclear program has become harder to trace since the end of the Iran-Iraq War. It has been the source of many unconfirmed rumors which exaggerate the size and progress of Iran's effort -- more than a few inspired by untrustworthy extremist opponents of the Iranian regime like the Iraqi-financed Iranian People's Mujahideen.[41]

Most Western experts believe, however, that Iran's program has a far lower scale than Iraq's program before the Gulf War. One key source of such estimates is the character of Iran's imports of dual-use technology, and continuing covert Iranian attempts to illegally import controlled technologies from the West. The details of such import efforts are often classified, but Iran's imports follow a pattern that is clearly part of a nuclear weapons program and Iran's efforts over any given period of time provide a rough picture of its progress.[42]

Those aspects of Iran's program that are visible indicate that Iran has had only uncertain success. Argentina agreed to train Iranian technicians at its Jose Balaseiro Nuclear Institute, and sold Iran $5.5 million worth of uranium for its small Amirabad Nuclear Research Center reactor in May 1987. A CENA team visited Iran in late 1987 and early 1988, and seems to have agreed to sell Iran the technology necessary to operate its reactor with 20% enriched uranium as a substitute for the highly enriched core provided by the US, and possibly uranium enrichment and plutonium reprocessing technology as well.[43]

Changes in Argentina's government, however, made it much less willing to support proliferation. The Argentine government announced in February, 1992, that it was canceling an $18 million nuclear technology sale to Iran because it had not signed a nuclear safeguards arrangement. Argentine press sources suggested, however, that Argentina was reacting to US pressure.[44]

In February, 1990 a Spanish paper reported that Associated Enterprises of Spain was negotiating the completion of the two nuclear power plants at Bushehr. Another Spanish firm called ENUSA (National Uranium Enterprises) was to provide the fuel, and Kraftwerke Union (KWU) would be involved. Later reports indicated that a 10 man delegation from Iran's Ministry of Industry was in Madrid negotiating with the Director of Associated Enterprises, Adolofo Garcia Rodriguez.[45] Iran also negotiated with Spain to repair and complete the reactors that the Shah had begun at Bushehr, as well as with Kraftwerke Union and CENA of Germany in the late 1980s and early 1990s. Iran attempted to import reactor parts from Siemens in Germany and Skoda in Czechoslovakia.[46] None of these efforts solved Iran's problems in rebuilding its reactor program, but all demonstrate the depth of its interest.

Iran took other measures to strengthen its nuclear program during the early 1990s. It installed a cyclotron from Ion Beam Applications in Belgium at a facility in Karzaj in 1991. It signed an agreement with China's Commission on Science, Technology, and Industry for National Defense on January 21, 1991, to build a small 27-kilowatt research reactor at Iran's nuclear weapons research facility at Isfahan. This reactor was evidently to be plutonium fueled,

and may have come on-line in 1994.[47] On November 4, 1991, China stated that it had signed commercial cooperation agreements with Iran in 1989 and 1991, and that it would transfer an electromagnetic isotope separator (Calutron) and a smaller nuclear reactor, for "peaceful and commercial" purposes.

The Chinese reactor and Calutron were small research-scale systems and had no direct value in producing fissile material. They did, however, give Iran more knowledge of reactor and enrichment technology, and US experts believe that China provided Iran with additional data on chemical separation, other enrichment technology, the design for facilities to convert uranium to uranium hexaflouride to make reactor fuel, and help in processing yellowcake.[48]

Iran conducted experiments in uranium enrichment and centrifuge technology at its Sharif University of Technology in Tehran. Sharif University was also linked to efforts to import cylinders of fluorine suitable for processing enriched material, and attempts to import specialized magnets that can be used for centrifuges, from Thyssen in Germany in 1991. It is clear from Iran's imports that it has sought centrifuge technology ever since. Although many of Iran's efforts have never been made public, British customs officials seized 110 pounds of maraging steel being shipped to Iran in July 1996.

Iran seems to have conducted research into plutonium separation and Iranians published research on uses of tritium that had applications to nuclear weapons boosting. Iran also obtained a wide range of US and other nuclear literature with applications for weapons designs.[49] Italian inspectors seized eight steam condensers bound for Iran that could be used in a covert reactor program in 1993, and high technology ultrasound equipment suitable for reactor testing at the port of Bari in January, 1994.

Other aspects of Iran's nuclear research effort had potential weapons applications. Iran continued to operate an Argentine-fueled five megawatt light water highly enriched uranium reactor at the University of Tehran. It is operated by a Chinese-supplied neutron source research reactor, and subcritical assemblies with 900 grams of highly enriched uranium, at its Isfahan Nuclear Research Center. This Center has experimented with a heavy water zero-power reactor, a light water sub-critical reactor, and a graphite sub-critical reactor. In addition, it may have experimented with some aspects of nuclear weapons design.[50]

## Chinese Reactor Deals

After its failures in the West, Iran turned to China and Russia. On September 10, 1992, Rafsanjani made a visit to Beijing where he is reported to have finished negotiations to purchase one or two 300-330 megawatt reactors from the People's Republic of China. A tentative agreement to sell one such reactor was announced by Iran's Minister of Defense during the visit. Further, the Atomic Energy Organization of Iran seems to have tried to unilaterally transfer the reactor site from Darkovin to less seismically stable sites in Bushehr, and then refused to allow China to fully survey the site or pay for the increased cost of the move. [51] Interestingly enough, this was the same general period in which China joined the Nuclear Non-Proliferation Treaty (it had joined the IAEA in 1988.)

This announcement led to immediate US protests to the People's Republic of China. [52] As a result the sale was deferred, and China's willingness to sell to Iran has since fluctuated with the

quality of Chinese-US relations. For example, Iran and the PRC announced that they had signed an agreement for the PRC to build a 300 megawatt reactor near Tehran on July 4, 1994.[53] Since that time, Iran has expressed an interest in buying two 300 megawatt pressurized water nuclear reactors from China, similar to the Chinese plant at Qinshan in Zhejiang Province. At least one of these reactors was evidently to be sited near Esteghial, which is near Bushehr on the Gulf Coast.[54]

Iranian officials indicated in mid-May 1995, that Iran had already made an $800-$900 million down payment on the deal. Reports also surfaced in September 1995 that China was helping Iran develop Calutron production facilities at Karaij, about 160 kilometers northeast of Tehran, and the State Department indicated that China was helping Iran develop gas diffusion facilities near Isfahan in April 1996. Other reports surfaced that China might have revitalized its reactor deal with Iran in November 1996 and early 1997, and the CIA reported that Iran had made large -- but unspecified -- nuclear-related purchases from China.[55]

Each of these announcements has been followed, however, by new exchanges between the US and China that have delayed or blocked Chinese-Iranian deals. For example, discussions with the US helped lead China to pledge not to provide any assistance to a facility that was not under IAEA safeguards on May 11, 1996. China then issued detailed regulations to implement this pledge on September 11, 1996 -- after further talks with the US.[56]

According to US reports, China also agreed not to sell Iran a Uranium Hexafluoride conversion plant in December, 1996.[57] Similarly, China's Prime Minister Li Lanqing is reported to have assured Israel's Prime Minister Benjamin Netanyahu that China would not supply Iran with reactor technology or other technology that could be used in a nuclear weapons program during Netanyahu's visit to China in August, 1997.[58] The Chinese Foreign Ministry also issued a statement on October 21, 1997, that, "Our peaceful use of nuclear energy with Iran has not been carried out because of some disputes over the contract."[59]

President Clinton gave the issue high priority during President Jiang Zemin's visit to the US in late October, 1997. In spite of protests by its own National Nuclear Corporation, China agreed to halt nuclear assistance to Iran in return for a US agreement to allow US firms to sell China the technology it needed for nuclear power plants. While China did not agree to join the Nuclear Supplier's Group -- because of its nuclear sales to India and Pakistan -- it did agree not to provide further nuclear support of any kind to Iran, regardless of whether it was permitted under the terms of the NPT.

The Clinton Administration also stated during the visit that China had not provided any assistance to a facility that was not under IAEA safeguards once it had pledged not to do so on May 11, 1996. John Holum, the Acting Under Secretary of State for Arms Control and International Security Affairs repeated these claims on March 26, 1998, during a visit to China. President Clinton repeated them when he visited China in June.[60]

These statements are interesting because China only really seems to have suspended the sale of hundreds of tons of anhydrous hydrogen fluoride (AHF or hydrofluoric acid), a chemical used in enriching Uranium by the China Nuclear Energy Industry to the Isfahan Nuclear Research Center in February 1998. China only did so three years after US intelligence had first

detected the sale, and nearly two years after it had agreed not to make such sales of this kind. The sale was so large that it would have given Iran half a decade worth of material for an ambitious nuclear program. Furthermore, China was still contracted for the sale although AHF is also listed as a precursor to nerve gas.[61]

China has limits on what it can sell. Its nuclear industry is still in the developmental stage, and China has had serious problems in bringing some of its reactors on line and keeping them operating. The Chinese reactor at Qinshan uses a Japanese-made reactor vessel and German primary cooling pumps, and it is not clear if this technology will be exportable to Iran.[62] When these uncertainties are coupled with Iran's financial problems, they make any major Chinese deal with Iran a continuing uncertainty, particularly if China does become a major importer of nuclear technology from the US.[63]

Nevertheless, Iran may still be getting nuclear technology from China. Iran denied that China had halted nuclear cooperation on March 15, 1998, and called US claims "unsubstantiated propaganda." There are some indications that China also continues to supply maraging steel to Iran and components that can be used for centrifuges.[64]

## Russian Reactor Deals

Iran first began to seek nuclear reactors from Russia in the mid-1980s, and has conducted negotiations with Russia ever since.[65] Reports surfaced in the late 1980s that Russia had signed a contract to sell two nuclear reactors to Iran -- although the existence of any such contracts was not made public and no tangible steps seemed to follow. Reporting by the Atomic Energy Organization of Iran indicates that the deal may have broken down because Iran proposed a site at Gorgan that was not properly stable and then attempted to move the site back to Bushehr without proper coordination. [66]

Iran's negotiations with Russia resumed, however, and had more success. On November 20, 1994, Iran announced that Russia had agreed to a $780 million deal to complete a reactor at Bushehr that German companies had begun during the time of the Shah.[67] Iran signed this agreement with Russia on January 8, 1995, by which time its cost had escalated to $850 million.[68] The nuclear facility at Bushehr is about 730 miles south of Tehran, and 15 miles from the city of Bushehr. It is the site of the two incomplete 1200 megawatt reactors that Siemens had begun to construct in 1976.

Although work stopped at the site in 1979, after the fall of the Shah, Iran kept the facility active, and some 300-400 Iranians normally lived on the site and maintained it during the period before Russia agreed to sell Iran a reactor. Iran had invested about $6 billion in the facility by the time the Shah fell. Construction of the main buildings and steel containment vessel for one of the reactors at Bushehr had reached 85% of completion at the time of the Shah's fall, and construction for the other was partially finished.[69] Facilities existed to house some 2,000 workers at the site, with a capacity to support up to 2,000 more. As a result, Russia was able to quickly deploy some 150 technicians to the reactor site once it signed an agreement with Iran. It began begin shipments of material in 1995, and announced that it planned to deploy up to 2,000 Russian workers and train some 500 Iranian technicians.[70]

The deal originally called for Russia to complete work on the first reactor by the year 2000.[71] The completion date and the cost of the contract depend, however, on whether Russia will be able to make the desired use of the existing facilities at the site, and whether Russia can tailor its VVER-1000 reactor design to fit these facilities.[72]

Both reactor facilities were damaged during the Iran-Iraq War, and the Russian VVER-1000 is physically different from a Siemens 1,300 megawatt reactor. Further, Siemens had not yet installed the reactors themselves and the steam generators which produce steam for the turbines.[73] Russian technicians and experts inspected the site in September 1994, and concluded that corrosion was extensive, that their work would be hampered by the absence of the German technical documentation, and that it would be necessary to modify the outdated 1970s design and redesign the buildings to take a Russian water-moderated water-cooled reactor with a capacity of 1,000 megawatts, the VVER-1000.[74]

As a result, Russia is at best able to use some of the remaining buildings and control facilities and bringing the reactor fully on-line will probably lag until at least 2005, although Reza Amrollahi, the head of the Atomic Energy Organization of Iran, still claimed in July 1997 that it would come on-line during the year 2000.[75] Past efforts to export reactor designs have led to significant delays and cost escalation -- without the complications inherent in Russia's attempt to make use of facilities designed for Germany's very different reactors.

On March 18 1996, Anatoliy Zhilinsky, the head of the Tehran office of Zarubezhatomenergostroy, is reported to have said that the Bushehr plant would be completed on schedule, some 55 months from the signing of the January 1995 nuclear cooperation accord between Russia and Iran. He also said that Iranian subcontractors would spend about a year restoring existing facilities at Bushehr, after which Russian specialists would take over., and that one key problem in meeting the schedule was that the technical documentation for the German made equipment originally installed at Bushehr was not available, and that Russia would have to provide replacement equipment if Iran could not obtain the documentation because Germany was unwilling to provide it. Zhilinsky went on to state that it would have been easier to build a new power station "from scratch," but Iran insisted on completion of the existing station.[76]

There are reports of other problems and delays. Iran is reported to have objected to the fact that some of the Russians in the bank financing the project were Jewish. There seem to be unanticipated problems with vulnerability to earthquakes that could delay progress by a year, and it is far from clear that Iran and Russia have established an efficient method of transferring payments and measuring progress. There is also considerable friction between the Iranian and Russian workers at Bushehr, and the Russians have experienced problems in getting visas and decent living and working conditions for the Russian workers at the reactor site.[77]

The US has tried to create problems by persuading the Ukraine to keep its state-owned AOA Turboatom from supplying the turbines for Bushehr. On March 6, 1998, the US and the Ukraine initialed an accord allow US firms to bid on work on Ukrainian nuclear power plants, after the Ukraine promised not to supply nuclear technology to Iran. This agreement meant that the Ukraine had to give up a $45 million contract for the turbines, but it also allowed it to obtain US bids on badly needed work to revitalize the Soviet supplied nuclear power plants in the Ukraine, work worth some $1.2 billion.[78]

It is doubtful that these US efforts have had much impact on Iran. Iran converted many of its subcontracts to "turn key" Russian projects on February 2, 1998. It did so in an effort to eliminate consistent delays and quality control problems in the work done by Iranian subcontractors, and give the Russian team greater control over the entire project effort and systems integration. Iranians were originally supposed to build the reactor hall, and the resulting delays were so serious that the project had only accomplished five months of work over a 25 month period – putting the project some 20 months behind. In November 1998, Iran is reported to have called for speeding up the construction of the Bushehr Nuclear Power Plant earlier that the scheduled date of the middle of May 2003. Russian Minister of Atomic Energy Yevgeniy Adamov confrimed during a visit to Iran that Russia was contining the construction of the Bushehr NPP with one VVER-1000 reactor despite US and Israeli opposition.

In February 1999, Iran agreed to buy turbines from a Russian factory in St. Petersburg and increased the cost of its contracts with Russia by a significant, although unstated, amount above the $850 million contracts that had previously been agreed to. Russian sources also report that Iran has improved the flow of its payments. ITAR-TASS has since reported that Izhorskiye Zavody in St. Petersburg had started producing equipment for the Bushehr nuclear power plant. The order was placed by Atomstroyeksport in December 1998, and the first advance payment has already been made. Nikolay Domichev, a spokesman for Izhorskiye Zavody, said that the equipment for the primary circuit of the reactor would be supplied to Iran in late 2001, and that the sanctions imposed by the United States on Russian institutions have had no impact on the project. In fact, a decision was made to speed up the work on the Iranian order. The reactor vessel, the steam generator vessel, the reactor vessel head, and the equipment inside the vessel will be assembled in St. Petersburg. Experts from Izhorskiye Zavody are expected to take part in the installation of the equipment on site. The senior managers of the facility believe that there is no reason for Iran to confine itself to one 1,000MW reactor in Bushehr. Intergovernmental protocols have been signed on intentions to deliver three VVER-610 reactor units to Iran.[79]

Iran seems to have obtained the training support it needs from Russia. In January 1999, the Iranian Atomic Energy Organization advertised for engineers to receive training in Russia for the Bushehr nuclear power plant. The advertisements statement that a total of 225 engineers were needed, with expertise in physics, nuclear physics, mechanical engineering, or computer science, that applicants must be Iranian nationals, and that successful candidates woould be sent to Russia after a short period of training in Iran. In February 1999, the Russian Ministry of Atomic Energy reported that 30 Iranian specialists were scheduled to arrive in Moscow in early February 1999 to receive training for operation of the Bushehr nuclear power plant. The Iranians were to be trained at a training center at the Novovoronezh nuclear power plant; and that the the training center had received assistance from Japan in upgrading its equipment. The terms of a Russian-Iranian contract signed in 1995 call for several hundred Iranians will be trained in Russia, and Minister of Atomic Energy Yevgeniy Adamov said that the Bushehr plant will be fully staffed by 2000-2001. One thousand Russians were reported to be working at the Bushehr site, and the first unit of the plant tobe 30 to 40 percent complete.[80]

Iran seems deeply committed to completing the project regardless of its problems in repaying foreign loans and the exact status of its oil revenues. [81]

## Longer-term Reactor Programs

The purchase of Russian support may also prove to be the first step in a far more ambitious Iranian effort. Iran has shown an interest in purchasing another VVER-1000 reactor for use at Bushehr. Various sources also indicate that Iran is seeking to purchase two V-213 VVER 440 power reactors and another large research reactor, or that it is seeking to purchase a total of five large 1,300 megawatt reactors.[82]

At least one speech by Reza Amrollahi indicated that Iran eventually expected to build up to 20 nuclear power plants, although he later stated that his views had been misinterpreted and that Iran also expected to get 5% of its electricity from nuclear power plants by the year 2000.[83] Georgi Kaurov, a spokesman for the Russian Atomic Energy Ministry confirmed in a public statement on March 6, 1998 that Russia was willing to sell such reactors in spite of US pressure not to do so.[84]

US experts believe that Iran is now seeking to buy four to five light water reactors from Russia, including two 1000 megawatt reactors and two 463 megawatt reactors (at a cost in excess of $5 billion) that can be used to produce substantial amounts of fissile material for nuclear weapons. They also believe that Iran has aggressively sought to buy highly enriched and/or fissile material from the former Soviet Union, as well as the services of Soviet nuclear weapons designers.[85]

These conclusions have been supported by recent developments in Iran. Shortly after President Khatami replaced Reza Amrollahi, the head of the Atomic Energy Organization of Iran, with Gholamreza Aghazadeh, Aghazadeh reaffirmed Iran's commitment to a massive nuclear power program. On October 3, 1997, Reza Amrollahi, the head of the Atomic Energy Organization of Iran indicated during a meeting with Hans Blix, the head of the International Atomic Energy Agency (IAEA), that Iran planned to eventually produce 20% of Iran's electric power needs from nuclear units. This meant adding a second 1,000 megawatt generating unit to its existing efforts to build a 1,000 megawatt unit in Bushehr. He indicated that Iran had approached Russia to buy two more 440 megawatt reactors and was seeking an eventual total of six, and that it was still seeking two 300 megawatt nuclear reactors from China.[86]

Russia has indicated on numerous recent occasions that it will continue nuclear cooperation with Iran, although it has repeatedly denied that it is giving Iran technology that can be used for nuclear weapons.

In November 1998, Russian Minister of Atomic Energy Yevgeniy Adamov confrimed during a visit to Iran that Iran had asked Russia to build up to three more 1,000MW reactors. He said that the contract on this project, if signed, would be worth $2-3 billion.[87] On Nomber 30 1998, First Deputy Minister of Atomic Energy Viktor Mikhailov discussed the history of cooperation with Iran in the nuclear industry and answered questions at a press conference on nuclear and missile contacts between Russia and Iran being held at the National Press Institut,. Mikhailov said he believed it was important to complete the construction of the Bushehr NPP, annd that cooperation with Iran was important for Russia both in terms of politics and economics. He said that in 1992-1997 Russia had designed a uranium mine for Iran with an annual output of 100 to 200MT, and that Iran was currently seeking Russian assistance in uranium

and isotope enrichment.[88]

On January 20, 1999, Adamov said at a a meeting with Yabloko party deputies that the United States had not produced any evidence of violations of international agreements by Russian nuclear enterprises over the past year and a half, and that the Russian special services exercised close daily supervision over organizations working with nuclear technology. Adamov reaffirmed that Russia does not want neighboring states to acquire nuclear weapons, and hoped that the current controversy over Iran would not adversely affect Minatom's constructive dialogue with the US Department of Energy.[89] In March 1999, Adamov again stated that Russia would continue close nuclear cooperation with Iran and support the construction of the reactors in Bushehr. [90]

In early January 2000, the Russian Minister of Defense, Igor Sergeyvev, met with the Secretary of the Iranian Security Council, Khasan Roukhani, and pledged Russian cooperation with Iran in developing its military and technical capabilities. Sergeyvev state that"Russia intendes to maintain the dynamics of its bilateral tires with Iran in the military, military-technical, scientific technical, and energy fields." The Russian Foreign Minister, Irgor Ivanov. Made a similar commitment during the same visit, and Vice Prime Minister, Ilya Klebanov, announced a possible Russian-Iranian deal that would sell Iran three additional nuclear reactors.[91] According to other reports, the Russian State Commission for Military-Industrial Affairs, which ischaired by Prime Minister and Acting President Vladimir Putin, decided to build three reactors for Iran's Bushehr nuclear power station on 14 January 2000 The Deputy Prime Minister Ilya Klebanov said that Russia's new contract with Iran did not involve the supply of military hardware and that that the agreement to build additional reactors would meet all international obligations.[92]

## Reactors and Proliferation

It not clear that Iran's reactor purchases are meant to be an integrated part of Iran's nuclear weapons effort, as distinguished from a way of acquiring the necessary nuclear technology. The reactor design Russia is selling Iran produces only very limited amounts of plutonium, and no country has as yet used a similar reactor design to acquire fissile material. Iran has also justified its reactor program by claiming that it needs to provide electric power from nuclear generators to reduce its use of exportable oil and gas. There are some experts who argue that Iran is seriously seeking to pursue this goal, that power reactors are an extremely inefficient way to obtain fissile material, and that Iran is more likely to support its weapons programs with specially designed smaller reactors, purchases of fissile material from the FSU, or other methods of enrichments.

The US intelligence community does not officially link Iran's efforts to acquire reactors to its effort to acquire fissile material, but it does express deep concern over Iran's ties to Russia. The Non-Proliferation Center of the Directorate of Central Intelligence summarized Iran's efforts to acquire nuclear weapons technology from Russian and China as follows in its February 2000 report: [93]

> ….China joined the Zangger Committee-which clarifies certain export obligations under the NPT-in October 1997 and participated in the Zangger Conversion Technology Holders meeting in February 1999. This was China's first opportunity to participate in a discussion of this type.
> China pledged in late 1997 not to engage in any new nuclear cooperation with Iran but said it would complete work associated with two remaining nuclear projects-a small research reactor and a zirconium production facility-in a relatively short period of time. The Intelligence Community will continue to monitor carefully Chinese nuclear cooperation with Iran. During the reporting period, firms in China provided missile-related items, raw materials, and/or assistance to several countries of proliferation concern-such as Iran. China also was a supplier of ACW to Iran through the first half of 1999.
> Prior to the reporting period, Chinese firms had supplied CW-related production equipment and technology to Iran. The US sanctions imposed in May 1997 on seven Chinese entities for knowingly and materially contributing to Iran's CW program remain in effect. In June 1998, China announced that it had expanded its chemical export controls to include 10 of the 20 Australia Group chemicals not listed on the CWC schedules. China has provided extensive support in the past to Pakistan's WMD and ballistic missile programs, and some ballistic missile assistance continues. In May 1996, Beijing promised to stop assistance to unsafeguarded nuclear facilities, but we cannot preclude ongoing contacts. China's involvement with Pakistan will continue to be monitored closely.
>
> … Russian entities during the reporting period continued to supply a variety of ballistic missile-related goods and technical know-how to Iran and were expanding missile-related assistance to Syria and India. For example, Iran's earlier success in gaining technology and materials from Russian companies accelerated Iranian development of the Shahab-3 MRBM, which was first flight-tested in July 1998. Russian entities during the first six months of 1999 have provided substantial missile-related technology, training, and expertise to Iran that almost certainly will continue to accelerate Iranian efforts to build new indigenous ballistic missile systems.
> During the first half of 1999, Russia also remained a key supplier for civilian nuclear programs in Iran. With respect to Iran's nuclear infrastructure, Russian assistance enhances Iran's ability to support a nuclear weapons development effort. By its very nature, even the transfer of civilian technology may be of use in Iran's nuclear weapons program. In addition, Russia supplied India with material for its civilian nuclear program during this reporting period.
> Russian entities remain a significant source of biotechnology and chemicals for Iran. Russia's world-leading expertise in biological and chemical weapons would make it an attractive target for Iranians seeking technical information and training on BW and CW agent production processes.

> Russia also was an important source of conventional weapons and spare parts for Iran, which is seeking to upgrade and replace its existing conventional weapons inventories.
> Following intense and continuing engagement with the US, Russian officials took some positive steps to enhance oversight of Russian entities and their interaction with countries of concern. Russia has reiterated previous commitments to observe certain limits on its nuclear cooperation with Iran, such as not providing militarily useful nuclear technology, although-as indicated above-Russia continues to provide Iran with nuclear technology that could be applied to Iran's weapons program. President Yel'tsin in July 1999 signed a federal export control law, which formally makes WMD-related transfers a violation of law and codifies several existing decrees-including catch-all controls-yet may lessen punishment for violators.
>
> Despite these decrees, the government's commitment, willingness, and ability to curb proliferation-related transfers remain uncertain. Moreover, economic conditions in Russia continued to deteriorate, putting more pressure on Russian entities to circumvent export controls. Despite some examples of restraint, Russian businesses continue to be major suppliers of WMD equipment, materials, and technology to Iran. Monitoring Russian proliferation behavior, therefore, will remain a very high priority.

Nevertheless, Iran's claims relating to its need for nuclear power present serious economic credibility problems that are the subject of debate within Iran as well as within the West. One Iranian newspaper, for example, referred to the efforts of the Atomic Energy Organization of Iran in September, 1997, by stating that, "the construction of a nuclear power plant in Iran is more like a joke."[94]

Reactors that cost billions of dollars in hard currency seem to make limited economic sense in a country with vast supplies of natural gas that can be used to generate electricity at 25% to 33% of the cost of nuclear electricity at market price conditions. This is particularly true since Iran faces a major problem in terms of spending hard currency, and will have to pay at least twice per installed kilowatt what it would have to pay for the capital cost of a gas-fired power plant. US intelligence studies have has found that Iran has little hope of ever breaking even on an investment in nuclear power relative to the consumption of domestic natural gas, and that it makes limited economic sense for Iran to concentrate all of the reactors in one area so far away from Iran's cities and industrial facilities in the north.[95]

The credibility of such claims are further undermined by the long history of problems with the nuclear weapons programs in other countries, by Iran's policy of underpricing oil and gas to the point where the increase in domestic consumption is cutting into its export capacity, and by Iran's acute hard currency problems. For example, President Rafsanjani undercut the argument that Iran needed nuclear power to allow gas to be exported by announcing that Iran had "endless" gas reserves and over 150 years of oil reserves in a speech to the Majlis on June 1, 1996. Rafsanjani announced the discovery of a new gas field of at least 9 trillion cubic feet and estimated Iran's oil reserves at 93 billion barrels.[96] US and European studies confirm these estimates and indicate that Iran's gas reserves are probably substantially larger.

Some experts argue that Iran does not plan in economic terms and that Russia has priced its initial contracts so far below the normal world market price for such reactors that they might be economical, even for a nation with Iran's gas resources. Such experts also argue that Iran has little experience with the real-world life cycle cost of nuclear reactors, and may be reacting to price quotes that give it a false impression of the economics involved.

Russia is selling light water reactors which are less suited to producing plutonium than the heavy water reactors Iran sought initially. Russia has repeatedly denied that it will give Iran

any assistance in developing nuclear weapons, has repeatedly indicated that it will take back the plutonium-bearing spent fuel in the reactor, and has announced that Iran has signed a $30 million deal with Iran to provide fuel for the reactors and reprocess spent fuel in Russia. [97]

Nevertheless, these Russian denials need to be put in context. The US put intense pressure on Russia immediately after its deal with Iran when the US received strong indications that Russia had agreed to provide centrifuge and other enrichment technology as part of the deal. The US claimed that Victor Mikhaliov, the head of Russia's Atomic Energy Ministry, had proposed the sale of a centrifuge plant in April, 1995. The US also indicated that it had persuaded Russia not to sell Iran centrifuge technology as part of the reactor deal during the summit meeting between President's Clinton and Yeltsin in May, 1995. According to some reports, Russia was to reprocess the fuel at its Mayak plant near Chelyabinsk in the Urals, and could store it at an existing facility, at Krasnoyarsk-26 in southern Siberia. [98]

It was only after US pressure that Russia publicly stated that it never planned to sell centrifuge and advanced enrichment technology to Iran, and Iran denied that it had ever been interested in such technology. [99] For example, the statement of Mohammed Sadegh Ayatollahi, Iran's representative to the IAEA, stated that, "We've had contracts before for the Bushehr plant in which we agreed that the spent fuel would go back to the supplier. For our contract with the Russians and Chinese, it is the same." [100]

Iran may have given up little by making overt agreements not to reprocess Plutonium. Moving forward with the reactor deal means that Iran will end up with enough technology transfer to build reactors on its own. While the Russian reactor design is scarcely ideally suited to producing Plutonium, it is a large facility that can be used to produce plutonium if Iran changes its mind. Once the reactor is in operation, it is far from clear what the world would do about any Iranian violation of the IAEA. Plutonium reprocessing technology is not particularly challenging and no country that has so far attempted such reprocessing has failed. Iran can also go on with an overt reactor program while it pursues low-level or covert efforts to acquire Uranium enrichment capabilities.

There are still major uncertainties as to how many scientists and technicians from the Former Soviet Union may be supporting Iran. Few US intelligence experts seem to believe the recurrent press reports of a large presence of FSU technical experts in Iran. At the same time, US, British, French and Israeli experts do indicate that Iran has sought to buy nuclear technology on the black market in a number of FSU countries, and attempted to buy stocks of fissile material from one. There also are reports that some FSU nuclear scientists and technicians are working in Iran in areas that have nothing to do with its Russian-supported nuclear power program. There are also serious questions as to whether Russian scientists might work with Iranian experts to use the reactor at Busher to covertly produce Plutonium isotopes, if the reactor begins operation.[101]

Furthermore, private and state-owned Russian firms may not be fully honoring the agreements of the Russian government. The CIA indicates that Russia provided important transfers of nuclear technology to Iran in 1996. The Clinton Administration quietly complained to President Yeltsin about such transfers in July 1997. It expressed concern that Russia had broadened its technology transfers and might not be limiting its aid to Iran in setting up a plutonium reprocessing capability.[102]

These problems and uncertainties led Israel to claim in early 1997 that Russia was providing Iran with nuclear weapons technology. Israeli Prime Minister Benjamin Netanyahu raised the issue during a March 10-12 visit to Moscow. He received assurances from President Yeltsin that, “the nuclear cooperation (with Iran) was at a very rudimentary level and that (cooperation on) ballistic missiles, he said, was not taking place and will not take place.” Israel and Russia also reported to have reached an agreement to cooperate in countering the illegal traffic in such technology on March 12, 1997.[103]

Interestingly enough, Russian officials are privately ambiguous about the character of the Russian effort. Discussions with senior Russian officials from the MVD, Foreign Intelligence Service, and diplomatic service in June, 1998, indicated that the officials involved felt that the Russian reactor would have little direct value in helping Iran build a bomb. At the same time, Russian intelligence officers stated that Iran had sought other nuclear technology in Russia that seemed to by part of a nuclear weapons program, and that Russia had arrested Russian citizens involved in the transfer of such technology. They also stated that Russia had only dropped Iran from its public list of proliferators after the reactor sale, and that this was only done as the result of political direction.

## Proliferation and the Nuclear Non-Proliferation Treaty

Iran has firmly and repeatedly denied that it is seeking nuclear weapons. Some of these Iranian denials have been cited earlier, but there are many others. For example, Khamenei stated on July 13, 1992, that charges that Iran was proliferating were the result of "American and Zionist loudspeakers...obviously false....They know it is a lie....You are mistaken if you think that the Islamic Republic's strength lies in the obtaining or domestic manufacture of an atomic bomb....the power of faith will foil all the conspiracies and ploys of the enemy."

Reza Amrollahi, the former head of the Atomic Energy Organization of Iran has said that, "Our nuclear program is peaceful...My country has signed the NPT and has repeatedly expressed its willingness to honor it...Also, we are an active member of the IAEA."[104] The Iranian official news agency declared on January 8, 1995 that, “Iran simply does not have the ambition to become a nuclear weapons state. Iran does not, and will not, in light of its own interest, engage in a nuclear weapons program.”[105] President Rafsanjani answered a question relating to Iran’s desire to proliferation on the US program in an interview on the program “60 Minutes” in April 1997 in which he stated that, “Definitely not. I hate this weapon.”[106]

The problem with such statements is that they often seem to be contradicted by Iran’s purchase and acquisition programs, and are tied to the assumption that proliferation can be tracked by identifying key facilities and using the IAEA to inspect them.

## Iranian Nuclear Weapons Facilities

It is far easier to know that a nation is proliferating than it is to know specifically where it is proliferating. The location of several key declared Iranian nuclear facilities and known nuclear transshipment centers is well known. It is also clear that Iran has a large nuclear research program.[107] However, little credible data is available on the exact size and nature of Iran's nuclear weapons effort, the specific facilities involved, or the exact nature of Iran's imports of nuclear weapons related and dual-use technology.

Iran has demonstrated that it is capable of copying the sheltering and satellite deception techniques used by Iraq before the Gulf War, and a small, well-dispersed nuclear weapons program is very difficult to detect and characterize without on-site inspection and continuing monitoring.[108] Without such an effort, there is no way to publicly validate the existence of a low level Iranian nuclear weapons effort at given facilities, or to describe the current level of effort and its probable results. In fact, one reason that Iran's nuclear weapons program is so difficult to analyze is that Iran seems to be building its program so slowly. "Creeping proliferation" produces far fewer signs of activity than Iraq's massive investments.[109]

This allows a potential exporter to deny the existence of Iran's efforts. While British, French, German, Israeli, and US experts are convinced that an Iranian nuclear weapons effort exists, exporting nations like China and Russia have effectively rejected this claim when it has been convenient. For example, Yevgeny Primakov, Russia's most senior intelligence official, stated on March 23, 1995, "We have not found convincing evidence of the existence in the country of a coherent nuclear program." Lt. General Gennady Yevstafiyev declared on the same day, "We are keeping track of developments...But so far, we see no grounds for sharing the official US position..."

These Russian statements would be much more credible if they were not so different from ones that other Russian officials had made a year earlier. They contradicted statements made by Russians like Alexei Yablokov, an advisor to Yeltsin, who stated, "Thanks to Russia, Iran will be in a position to get the nuclear bomb in a few years.... By signing this contract, Russia is arming Iran." They do, however, illustrate the fact there is no international consensus regarding Iran's activities.[110]

## Scare Reports and Deliberate Misinformation

The situation has not been helped by scare reports and deliberate misinformation. For example, Israeli sources have claimed that Iran sought to buy the nuclear enrichment facilities that South Africa developed for its nuclear weapons program, although there is little evidence to support these reports.[111] Similarly the People's Mujahideen, a violent anti-regime group, has made a long series of detailed claims. At various times, the People's Mujahideen has reported that:

- Iran's facilities include a weapons site called Ma'allem Kelayah, near Qazvin on the Caspian. This is said to be an IRGC-run facility established in 1987, which has involved an Iranian investment of $300 million. Supposedly, the site was to house the 10 megawatt reactor Iran tried to buy from India.

- Two Soviet reactors were to be installed at a large site at Gorgan on the Caspian, under the direction of Russian physicists.

- The People's Republic of China provided uranium enrichment equipment and technicians for the site at Darkhouin, where Iran once planned to build a French reactor.

- A nuclear reactor was being constructed at Karaj; and that another nuclear weapons facility exists in the south central part of Iran, near the Iraqi border.

- The ammonia and urea plant that the British firm M. W. Kellog was building at Borujerd in Khorassan province, near the border with Turkestan, might be adapted to produce heavy water.

- The Amir Kabar Technical University, the Atomic Energy Organization of Iran (AEOI) (also known as the Organization for Atomic Energy of Iran or AEOI), Dor Argham Ltd., the Education and Research Institute, GAM Iranian Communications, Ghoods Research Center, Iran Argham Co., Iran Electronic Industries, Iranian Research Organization, Ministry of Sepah, Research and Development Group, Sezemane Sanaye Defa, the Sharif University of Technology, Taradis Iran Computer Company, and Zakaria Al-Razi Chemical Company are all participants in the Iranian nuclear weapons effort. [112]

Other sources based on opposition data have listed the Atomic Energy Organization of Iran, the Laser Research Center and Ibn-e Heysam Research and Laboratory Complex, the Bonab Atomic Energy Research Center (East Azerbaijan), the Imam Hussein University of the Revolutionary Guards, the Jabit bin al-Hayyan Laboratory, the Khoshomi uranium mine (Yazd), a possible site at Moallem Kalayeh, the Nuclear Research Center at Tehran University, the Nuclear Research Center for Agriculture and Medicine (Karaj), the Nuclear Research Center of Technology (Isfahan), the Saghand Uranium mine (Yazd), the Sharif University (Tehran) and its Physics Research Center. [113]

The problem with such lists of weapons facilities is that they have never been confirmed as accurate and end in discrediting more cautious and balanced reports. They also tend to include virtually all the major publicly-known research centers in Iran, and to ignore the fact that much of Iran's effort may take place in facilities that do not have a name relating to nuclear research or consist of purchasing efforts made through Iran's vast network of cutouts and purchasing officers abroad.

Iran's present purchasing network is the product of more than fifteen years of covert efforts to end-run Western and other foreign controls, and Iran has systematically lied about its activities ever since it set this network up following the beginning of the Iran hostage crisis. It is almost impossible to track all the various fronts and covers Iran uses, but the German Ministry of Economics has circulated a wide list of such Iranian fronts which are known to have imported or attempted to import controlled items. These fronts include the: [114]

- Bonyad e-Mostazafan;

- Defense Industries Organization (Sazemane Sanaye Defa);
- Pars Garma Company, the Sadadja Industrial Group (Sadadja Sanaye Daryaee);
- Iran Telecommunications Industry (Sanaye Mokhaberet Iran);
- Shahid Hemat Industrial Group, the State Purchasing Organization, Education Research Institute (ERI);
- Iran Aircraft Manufacturing Industries (IAI);
- Iran Fair Deal Company, Iran Group of Surveyors;
- Iran Helicopter Support and Renewal Industries (IHI);
- Iran Navy Technical Supply Center;
- Iran Tehran Kohakd Daftar Nezarat, Industrial Development Group;
- Ministry of Defense (Vezerate Defa).

There is no question that Iran has a large enough research and industrial base to hide a nuclear weapons effort of moderate size, and has a highly sophisticated purchasing network. The problem is to determine exactly what organizations and facilities are or are not "guilty."

## The NPT, IAEA Inspections, and Deniability

The Treaty on the Non-Proliferation of Nuclear Weapons (NNPT) and International Atomic Energy Agency (IAEA) provide a set of controls and an inspection capability that has significant value, but they can also legitimize the import of "peaceful" nuclear technology that can be used to develop a weapons program, and can be exploited to provide a cover for proliferation. As a signator to the NPT, Iran has had to permit the IAEA to inspect its nuclear facilities. Under the initial inspection regime, the scope of these inspections was limited.

Under Article V of the NPT, Iran was also entitled to import nuclear reactors and substantial amounts of nuclear technology, as long as they allow IAEA inspection of the reactors in their declared facilities. This transfer of "peaceful" nuclear technology is giving Iran a steadily improving nuclear technology base which, in turn, improves Iran's capability to build covert reactor facilities, centrifuge facilities, and/or chemical separation facilities.

While the IAEA can and did regularly inspect Iran's declared nuclear facilities after Iran accepted the terms of the NNPT, this did not necessarily provide a guarantee that Iran was not using nuclear technology to proliferate.. Before the 93+2 revisions to the NNPT, the IAEA only fully inspected declared Iranian facilities that had reactors or declared nuclear material. Visits to other Iranian facilities were limited and did not normally involve the kind of intrusive inspection that could differentiate between a legitimate nuclear facility, and one dedicated to a covert weapons program. As a result, the IAEA efforts to date can neither confirm nor deny the

existence of an Iranian nuclear weapons program. For example, the IAEA repeatedly certified that Iraq's three declared reactors were in compliance with the NNPT, but it was unable to inspect other facilities under the older NNPT inspection regime.

Even those Iranian facilities that are subject to IAEA inspection can present risks. As North Korea has demonstrated, a country can fully comply with the safeguards affecting reactor sales and then reject IAEA safeguards once the reactor or reactors are complete. It can then process the used reactor rods for plutonium, and a nation like Iran could refuel its reactors with locally made uranium rods. The types of light water reactors that Iran is buying are scarcely optimal designs for either plutonium irradiation or massive "cannibalization" of the reactor fuel, but Iran cannot buy other kinds of reactors. No one is selling the kind of research reactors with highly enriched uranium fuel that France offered to Iraq at the time of the inital Osiraq deal.[115]

Some sources have charged that Iran has use the IAEA to confuse or obfuscate its activities, and cite the fact that the IAEA has made special visits to Iranian facilities rather than full inspections. Other experts state, however, that the IAEA conducted these visits only after considerable background briefings from Western intelligence. It then made a limited pre-arranged visit to six of 10 suspected sites in February, 1992, and found no sign of weapons activity at any of these sites. It found that the uranium mining site at Saghand was at least five years away from production and had no uranium concentration plant. It also found the facility at Ma'allem Kelayah, which was said to be a nuclear weapons research center, to be little more than a motel-sized training and conference center. Further, it found that the People's Republic of China-supplied Calutron at Shiraz was found to be so small that it could only be used to produce isotopes for medical research.[116]

There have been other charges that the IAEA only conducted a "familiarization tour" during its 1992 visit, and that the IAEA was led to a decoy site, when it thought it was investigating a facility called Ma'allem Kelayah. IAEA spokesman David Kydd vehemently denied such reports that the IAEA was led to the wrong site, however, and US experts confirm his statements.[117]

Iran let a new team from the IAEA visit in October-November, 1993.[118] This IAEA team was also given detailed briefings by the US and other Western countries, and was allowed to visit suspected buildings at three main nuclear research complexes near Tehran, Isfahan, and Karaj. Like the previous IAEA mission, however, it was a visit, not a full or special inspection mission. The IAEA was not equipped or organized to find covert Iranian activities or examine all of the activities in the research facilities it was allowed to visit. Further, the IAEA team did not have adequate access to soil and particle samples in the facilities it was allowed to visit.[119]

Meaningful enforcement of the Nuclear Non-Proliferation Treaty will requires that all Iranian facilities to be subject to full IAEA challenge inspection under the revised terms of the NNPT, and the IAEA be supported by extensive national intelligence efforts to "target" suspected undeclared facilities. Even then, there could still be serious problems in determining what Iranian activities aree and are not part of a weapons effort.

Nuclear weapons research and development efforts are becoming steadily smaller in scale and easier to hide and disperse. Much of the data is now public. Computer simulation and pilot-

scale testing can now be substituted for the large-scale efforts of the past, and permit much smaller efforts than those of Israel, India, Pakistan, and South Africa. It would require continuing IAEA inspection of all mining, processing, and enrichment related research efforts, and the analysis of weapons system delivery programs to firmly determine whether Iran's programs proved it was acquiring nuclear weapons.

Iran can also compartmentalize its efforts so the researchers involved may not know the real purpose of the effort or to achieve "deniability." For example, Austrian scientists were discovered in 1997 to have spent a year working on a cyclotron at Iran's Karaj nuclear research center that some experts felt might be used as a prototype for processing uranium, and which other experts felt might be legitimate medical research. Only on-site inspection could hope to resolve such issues, provided that the ultimate intent of the program was clear from the physical evidence, its records, or interviews.[120]

Similarly, British customs officials seized 50 kilograms (110 pounds) of maraging steel in June, 1996. Maraging steel is a controlled export that can be used for some conventional weapons, including ballistic missiles, although its most likely use is the manufacture of centrifuges. The smuggler was identified as Ali Asghar Manzarpouri, a British citizen of Iranian origin living in Brighton. Manzarpouri was charged in a Brighton court on July 31, 1996. The Iranian effort to import maraging steel could not be linked to a specific end-user facility, and only intrusive challenge inspection could have hoped to identify the true end use of the material -- provided that sufficient intelligence existed to identify the precise facility in Iran.[121] These same problems arose much earlier when Iran bought extensive amounts of nuclear centrifuge technology from Germany -- although it denied doing so -- and other specialized equipment that could be used to design and manufacture nuclear weapons, and simulate nuclear tests.[122]

The question is how this situation can be changed in the future. The Governors of the IAEA took up a proposal in May 1997, that allows the IAEA to inspect any facility in an NPT country, whether it was declared or not. The proposal also allows routine environmental monitoring to detect the small amounts of isotopes that are likely to escape from any industrial scale plant or process, and use spectrometry to identify the isotopic ratio of a sample containing a billionth of a gram of material. This monitoring would probably detect any unusual ratio of U-235 to U-238, and the presence of any element involved in Plutonium processing in unusual amounts, as well as the products of nuclear fission like radioactive iodine and krypton isotopes. Small samples from the surface of walls and equipment, along with soil, water, air, and vegetation samples might reveal a great deal.[123] The IAEA does not currently carry out such an intrusive inspection regime in Iran, and still might not find a well-dispersed covert programs if it did.[124]

Furthermore, fully effective cooperation is dependent on the existence of some kind of secure forum for exchanging data that prevented the leakage of sensitive intelligence material. It has become clear to US intelligence professionals that there are severe limits on how much detail on Iran's efforts can be briefed to other states. Classified briefings to nations in the Gulf, some European countries, and Japan have led to extensive leaks, and because the foreign ministries of export-oriented countries tend to ignore the advice on their own national intelligence services.

Meaningful enforcement of a non-proliferation inspection effort also requires better international cooperation in reporting the export of dual-use technology, and arrangements that allowed the IAEA to directly interrogate countries as to the purpose of such exports and their end user, and to then inspect the resulting supplier facilities. Only a few countries really cooperate in pooling sensitive export data, and none allow foreign inspection of possible suppliers. Most countries also carefully compartmentalize their efforts to control nuclear proliferation so that only a few officials know the full details.

In summary, the IAEA effort to date, and Iranian denials, scarcely mean that Iran does not have a clandestine nuclear program. Many Western experts believe that the fact that Iran has clandestinely sought the material needed for a nuclear weapons effort for more than a decade and that the inability to target given facilities is simply a reflection of Iran's success in carrying out a covert program.

## Possible Dates for Iran's Acquisition of Nuclear Weapons

There is no way to estimate when Iran will get nuclear weapons or to be certain that Iran will push its nuclear programs forward to the point where it has actual weapons. As has been noted earlier, President Khatami replaced Reza Amrolahi -- the long-serving head of the Atomic Energy Organization of Iran -- in early September 1997. He replaced Amrolahi with Iran's former Oil Minister, Gholamreza Aghazadeh, who was also appointed a Vice President and a member of the Expediency Council. Such an appointment could mean that Khatami was emphasizing the effective management of Iran's nuclear power program, seeking new direction for its nuclear weapons effort, or simply be part of the normal process of bureaucratic rotation and change.[125]

If Iran does push forward with nuclear weapons, it seems unlikely that it will acquire them in the near-term, unless it can somehow buy fissile material from an outside source. As Lt. General Binford Peay, the commander of USCENTCOM, stated in June, 1997, "I would predict to you that it would be some time at the turn of the next century...I wouldn't want to put a date on it. I don't know if its 2010, 2007, 2003. I am just saying its coming closer. Your instincts tell you that that's the kind of speed they are moving at."[126]

Some sources have indicated that Iran may be able to build a weapon relatively quickly, but they have generally proved pessimistic. Robert Gates, then Director of Central Intelligence, testified to Congress in February 1992, that Iran was "building up its special weapons capability as part of a massive...effort to develop its military and defense capability."[127] In 1992 press reports by the US Central Intelligence Agency (CIA), National Intelligence Estimates (NIE) on this subject indicated that the CIA estimated Iran could have a nuclear weapon by the year 2000. Reports coming out of Israel in January 1995, also claimed that the US and Israel estimated Iran could have a nuclear weapon in five years. [128]

Other sources believe it may take Iran substantially longer to obtain nuclear weapons. US intelligence sources denied the reports coming out of Israel and estimated that it might take seven to fifteen years for Iran to acquire a nuclear weapon.[129] As has been mentioned earlier, John Holum testified to Congress in 1995 that Iran could have the bomb by 2003. In 1997, he testified that Iran could have the bomb by 2005-2007.[130] Although two years had passed in which

Iran might have made substantial progress, the US estimate of the earliest date at which Iran could make its own bomb slipped by two to four years.

Such estimates are inherently uncertain. US Secretary of Defense William Perry stated on January 9, 1995, "We believe that Iran is trying to develop a nuclear program. We believe it will be many, many years until they achieve such a capability. There are some things they might be able to do to short-cut that time."[131] In referring to "short cuts," Secretary Perry was concerned with the risk that Iran could obtain fissile material and weapons technology from the former Soviet Union or some other nation capable of producing fissile material.

This risk creates is perhaps the greatest single serious uncertainty regarding Iran's nuclear capabilities. Fore example, reports during 1992 and 1993 that Iran had hired large numbers of Soviet nuclear weapons scientists which proved to be unreliable.[132] At the same time, there is no doubt that the whereabouts of significant numbers of FSU scientists and technicians cannot be accounted for, that some have gone to Iran, and that a large technology transfer effort may have taken place.

Similarly, reports of Iran's real efforts to acquire nuclear materials and technology had led to exaggerated reports, Iran made a major effort to buy beryllium from a storage site in Khazakhstan in 1992 that then also stored some 600 kilograms of highly enriched uranium. In 1994, the secretly bought the fuel and flew it out of the country.[133] It is clear that it did so because of the fear it might fall into Iranian hands. At the same time, the US has never stated the exact nature of Iran's efforts to buy the material and far more dramatic reports that Iran had succeeded in buying weapons-grade material from the former Soviet Union, or nuclear armed missiles from Kazakhstan proved to be unsubstantiated.

In 1996, John M. Deutch – then the Director of Central Intelligence, testified to Congress that: "We judge that Iran is actively pursuing an indigenous nuclear weapons capability. . . . Specifically, Iran is attempting to develop the capability to produce both plutonium and highly enriched uranium. In an attempt to shorten the timeline to a weapon, Iran has launched a parallel effort to purchase fissile material, mainly from sources in the former Soviet Union." He indicated that Iran's indigenous uranium-enrichment program seemed to be focused on the development of gas centrifuges, and that Iran's nuclear weapons program was still at least eight to ten years away from producing nuclear arms although this time could be shortened significantly with foreign assistance.[134]

A detailed Department of Defense report on proliferation was issued in 1997. It did not comment on the timing of Iran's nuclear efforts. It did, however, draw broad conclusions about the scale of the Iranian nuclear program and how it fit into Iran's overall efforts to acquire weapons of mass destruction. These conclusion still seem to broadly reflect the Department's views: [135]

> Iran's national objectives and strategies are shaped by its regional political aspirations, threat perceptions, and the need to preserve its Islamic government. Tehran strives to be a leader in the Islamic world and seeks to be the dominant power in the Gulf. The latter goal brings it into conflict with the United States. Tehran would like to diminish Washington's political and military influence in the region. Iran also remains hostile to the ongoing Middle East peace process and supports the use of terrorism as an element of policy. Within the framework of its national goals, Iran continues to give high priority to expanding its NBC weapons and missile programs. In addition, Iran's emphasis on pursuing independent production

capabilities for NBC weapons and missiles is driven by its experience during the 1980-1988 war with Iraq, during which it was unable to respond adequately to Iraqi chemical and missile attacks and suffered the effects of an international arms embargo.

Iran perceives that it is located in a volatile and dangerous region, virtually surrounded by potential military threats or unstable neighbors. These include the Iraqi government of Saddam Hussein, Israel, U.S. security agreements with the Gulf Cooperation Council (GCC) states and accompanying U.S. military presence in the Gulf, and instability in Afghanistan and the Central Asian states of the former Soviet Union.

Iran still views Baghdad as the primary regional threat to the Islamic Republic, even though Iraq suffered extensive damage during the Gulf War. Further, Iran is not convinced that Iraq's NBC programs will be adequately restrained or eliminated through continued UN sanctions or monitoring. Instead, the Iranians believe that they will face yet another challenge from their historical rival.

Tehran is concerned about strong U.S. ties with the GCC states because these states have received substantial amounts of modern Western conventional arms, which Tehran seeks but cannot acquire, and because U.S. security guarantees make these states less susceptible to Iranian pressure. While Tehran probably does not believe GCC nations have offensive designs against the Islamic Republic, it may be concerned that the United States will increase mistrust between Iran and the Arab states. It also likely fears that the sizable U.S. military presence in the region could lead to an attack against Iran. Iran may also be concerned by Israel's strategic projection capabilities and its potential to strike Iran in a variety of ways. For all these reasons, Tehran probably views NBC weapons and the ability to deliver them with missiles as decisive weapons for battlefield use, as deterrents, and as effective means for political intimidation of less powerful neighboring states.

In recent years, Iran's weak economy has limited the development of its NBC weapons and missile programs, although oil price increases in 1996 may have relieved the pressure at least temporarily. Tehran's international debt exceeds $30 billion, although Iran is meeting its debt repayment obligations. Iran also is facing a rapidly growing population which will exact greater future demands from its limited economy. Despite these internal problems, Iran assigns a high priority to attaining production self-sufficiency for NBC weapons and missiles. Therefore, funding for these efforts is likely to be a high priority for the next several years.

Tehran has attempted to portray U.S. containment efforts as unjust, in an attempt to convince European or Asian suppliers to relax export restrictions on key technologies. At the same time, foreign suppliers must consider the risk of sanctions or political embarrassment because of U.S.-led containment efforts.

Iran's nuclear program, focusing on electric power production, began during the 1970s under the Shah. Research and development efforts also were conducted on fissile material production, although these efforts were halted during the Iranian revolution and the Iran-Iraq war. However, the program has been restarted, possibly in reaction to the revelations about the scope of Iraq's nuclear weapons program.

Iran is trying to acquire fissile material to support development of nuclear weapons and has set up an elaborate system of military and civilian organizations to support its effort. Barring outright acquisition of a nuclear weapon from a foreign source, Iran could pursue several other avenues for weapon development. The shortest route, depending on weapon design, could be to purchase or steal fissile material. Also, Iran could attempt to produce highly enriched uranium if it acquired the appropriate facilities for the front-end of the nuclear fuel cycle. Finally, Iran could pursue development of an entire fuel cycle, which would allow for long-term production of plutonium, similar to the route North Korea followed.

Iran does not yet have the necessary infrastructure to support a nuclear weapons program, although is actively negotiating for purchase of technologies and whole facilities to support all of the above strategies. Iran claims it is trying to establish a complete nuclear fuel cycle to support a civilian energy program, but this same fuel cycle would be applicable to a nuclear weapons development program. Iran is seeking foreign sources for many elements of the nuclear fuel cycle. Chinese and Russian supply policies are key to whether Iran will successfully acquire the needed technology, expertise, and infrastructure to manufacture the fissile material for a weapon and the ability to fashion a usable device. Russian or Chinese supply of nuclear power reactors, allowed by the NPT, could enhance Iran's limited nuclear infrastructure and advance its nuclear weapons program.

Iran has had a chemical weapons production program since early in the Iran-Iraq war. It used chemical agents to respond to Iraqi chemical attacks on several occasions during that war. Since the early 1990s, it has put a high priority on its chemical weapons program because of its inability to respond in kind to Iraq's

chemical attacks and the discovery of substantial Iraqi efforts with advanced agents, such as the highly persistent nerve agent VX. Iran ratified the CWC, under which it will be obligated to eliminate its chemical program over a period of years. Nevertheless, it continues to upgrade and expand its chemical warfare production infrastructure and munitions arsenal.

Iran manufactures weapons for blister, blood, and choking agents; it is also believed to be conducting research on nerve agents. Iran has a stockpile of these weapons, including artillery shells and bombs, which could be used in another conflict in the region.

Although Iran is making a concerted effort to attain an independent production capability for all aspects of its chemical weapons program, it remains dependent on foreign sources for chemical warfare-related technologies. China is an important supplier of technologies and equipment for Iran's chemical warfare program. Therefore, Chinese supply policies will be key to whether Tehran attains its long-term goal of independent production for these weapons.

Iran's biological warfare program began during the Iran-Iraq war. The pace of the program probably has increased because of the 1995 revelations about the scale of Iraqi efforts prior to the Gulf War. The relative low cost of developing these weapons may be another motivating factor. Although this program is in the research and development stage, the Iranians have considerable expertise with pharmaceuticals, as well as the commercial and military infrastructure needed to produce basic biological warfare agents. Iran also can make some of the hardware needed to manufacture agents. Therefore, while only small quantities of usable agent may exist now, within 10 years, Iran's military forces may be able to deliver biological agents effectively. Iran has ratified the BWC.

Iran has an ambitious missile program, with SCUD B, SCUD C, and CSS-8 (a Chinese surface-to-surface missile derived from a surface-to-air missile) missiles in its inventory. Having first acquired SCUD missiles from Libya and North Korea for use during the Iran-Iraq war, the Iranians are now able to produce the missile themselves. This has been accomplished with considerable equipment and technical help from North Korea. Iran has made significant progress in the last few years toward its goal of becoming self-sufficient in ballistic missile production.

Iran produces the solid-propellant 150 kilometer range Nazeat 10 and 200 kilometer range Zelzal unguided rockets. Iran also is trying to produce a relatively short-range solid-propellant missile. For the longer term, Iran's goal is to establish the capability to produce medium range ballistic missiles to expand its regional influence. It is attempting to acquire production infrastructure to enable it to produce the missiles itself. Like many of Iran's other efforts, success with future missile capabilities will depend on key equipment and technologies from China, North Korea, and Russia.

Iran's missiles allow it to strike a wide variety of key economic and military targets in several neighboring countries, including Turkey, Saudi Arabia, and the other Gulf states. Possible targets include oil installations, airfields, and ports, as well as U.S. military deployment areas in the region. All of Iran's missiles are on mobile launchers, which enhance their survivability. Should Iran succeed in acquiring or developing a longer range missile like the North Korean No Dong, it could threaten an even broader area, including much of Israel.

Iran has purchased land-, sea, and air-launched short range cruise missiles from China; it also has a variety of foreign-made air-launched short range tactical missiles. Many of these systems are deployed as anti-ship weapons in or near the Gulf. Iran also has a variety of Western and Soviet-made fighter aircraft, artillery, and rockets available as potential means of delivery for NBC weapons.

In the future, as Iran becomes more self-sufficient at producing chemical or biological agents and ballistic missiles, there is a potential that it will become a supplier. For example, Iran might supply related equipment and technologies to other states trying to develop capabilities, such as Libya or Syria. There is precedent for such action; Iran supplied Libya with chemical agents in 1987.

Martin Indyck, the Assistant Secretary of State for Near East Affairs, testified to the Senate Foreign Relations Committee on July 28, 1998, that Iran's Shihab-3 and Shihab-4 programs were clearly linked to its efforts to acquire nuclear weapons. He made it clear that the missiles would give Iran the range to hit targets in Israel, Turkey, and Saudi Arabia. In regard to

Iran's nuclear program, Indyck stated that Iran had a "clandestine nuclear weapons program. People tend to say that a nuclear weapons capability is many years off. Our assessments vary. I would want to be a bit cautious about that because I believe there are large gaps in our knowledge of what is going on there because it's a clandestine program."[136]

There has been relatively little new formal testimony on the nature of US estimates of the timing of Iran's nuclear program, and the Director of the CIA did not address this subject in his testimony to Congress on the "world Wide Threat" on February 2, 2000. US intelligence has, however, continued to flag the Iranian nuclear threat as part of its broader assessments of Iran's efforts to proliferate. Since 1997, the Non-Proliferation Center of the office of the Director of Central Intelligence has issued a series of unclassified reports on Iran's efforts to acquire nuclear weapons technology. The latest version of the report was issued in February 2000, and focuses on developments in Iran since 1998,[137]

> Iran remains one of the most active countries seeking to acquire WMD and ACW technology from abroad. In doing so, Tehran is attempting to develop an indigenous capability to produce various types of weapons—nuclear, chemical, and biological—and their delivery systems. During the reporting period, Iran focused its efforts to acquire WMD- and ACW- related equipment, materials, and technology primarily on entities in Russia, China, North Korea and Western Europe.
>
> For the first half of 1999, entities in Russia and China continued to supply a considerable amount and a wide variety of ballistic missile-related goods and technology to Iran. Tehran is using these goods and technologies to support current production programs and to achieve its goal of becoming self-sufficient in the production of ballistic missiles. Iran already is producing Scud short-range ballistic missiles (SRBMs) and has built and publicly displayed prototypes for the Shahab-3 medium-range ballistic missile (MRBM), which had its initial flight test in July 1998 and probably has achieved "emergency operational capability"-i.e., Tehran could deploy a limited number of the Shahab-3 prototype missiles in an operational mode during a perceived crisis situation. In addition, Iran's Defense Minister last year publicly acknowledged the development of the Shahab-4, originally calling it a more capable ballistic missile than the Shahab-3, but later categorizing it as solely a space launch vehicle with no military applications. Iran's Defense Minister also has publicly mentioned plans for a "Shahab 5."
>
> For the reporting period, Tehran continued to seek considerable dual-use biotechnical equipment from entities in Russia and Western Europe, ostensibly for civilian uses. Iran began a biological warfare (BW) program during the Iran-Iraq war, and it may have some limited capability for BW deployment. Outside assistance is both important and difficult to prevent, given the dual-use nature of the materials, the equipment being sought, and the many legitimate end uses for these items.
>
> Iran, a Chemical Weapons Convention (CWC) party, already has manufactured and stockpiled chemical weapons, including blister, blood, and choking agents and the bombs and artillery shells for delivering them. During the first half of 1999, Tehran continued to seek production technology, expertise, and chemicals that could be used as precursor agents in its chemical warfare (CW) program from entities in Russia and China. It also acquired or attempted to acquire indirectly through intermediaries in other countries equipment and material that could be used to create a more advanced and self-sufficient CW infrastructure.
>
> Iran sought nuclear-related equipment, material, and technical expertise from a variety of sources, especially in Russia, during the first half of 1999. Work continues on the construction of a 1,000-megawatt nuclear power reactor in Bushehr, Iran, that will be subject to International Atomic Energy Agency (IAEA) safeguards. In addition, Russian entities continued to interact with Iranian research centers on various activities. These projects will help Iran augment its nuclear technology infrastructure, which in turn would be useful in supporting nuclear weapons research and development. The expertise and technology gained, along with the commercial channels and contacts established-even from cooperation that appears strictly civilian in nature-could be used to advance Iran's nuclear weapons research and developmental program.
>
> Russia has committed to observe certain limits on its nuclear cooperation with Iran. For example, President Yel'tsin has stated publicly that Russia will not provide militarily useful nuclear technology to Iran. Beginning in January 1998, the Russian Government took a number of steps to increase its oversight of entities involved in dealings with Iran and other states of proliferation concern. In 1999, it pushed a new

> export control law through the Duma. Russian firms, however, faced economic pressures to circumvent these controls and did so in some cases. The Russian Government, moreover, failed in some cases regarding Iran to enforce its export controls. Following repeated warnings, the US Government in January 1999 imposed administrative measures against Russian entities that had engaged in nuclear- and missile-related cooperation with Iran. The measures imposed on these and other Russian entities (which were identified in 1998) remain in effect.
> China pledged in October 1997 not to engage in any new nuclear cooperation with Iran but said it would complete cooperation on two ongoing nuclear projects, a small research reactor and a zirconium production facility at Esfahan that Iran will use to produce cladding for reactor fuel. The pledge appears to be holding. As a party to the Nuclear Nonproliferation Treaty (NPT), Iran is required to apply IAEA safeguards to nuclear fuel, but safeguards are not required for the zirconium plant or its products.
>
> Iran is attempting to establish a complete nuclear fuel cycle for its civilian energy program. In that guise, it seeks to obtain whole facilities, such as a uranium conversion facility, that, in fact, could be used in any number of ways in support of efforts to produce fissile material needed for a nuclear weapon. Despite international efforts to curtail the flow of critical technologies and equipment, Tehran continues to seek fissile material and technology for weapons development and has set up an elaborate system of military and civilian organizations to support its effort.

Unofficial or leaked estimates, however, have appeared to grow more pessimistic. The New York Times and Washington Post published reports in January 2000 that the CIA now estimated that it could not characterize the timing of the Iranian nuclear weapons program, and that Iran might already have a bomb. These reports, however, seem to have dealt with an intelligence report that focused on the inherent uncertainties in estimating Iranian capabilities, rather than to have been the result of any radical change in an estimate of how rapidly Iran could produce a weapon.[138]

Further background leaks following the New York Times report indicated that the CIA had concluded that Iran was capable of completing the design and manufacture of all aspects of a nuclear weapon except the acquisition of fissile material – a accomplishment that Iraq had also mastered by 1990. While the details of the report were never leaked, it seems likely that it concluded that Iran could now design medium sized plutonium and uranium weapons, and manufacture the high explosive lens, neutron initiators, high speed capacitors, and other components of the weapon. It could conduct not fissile simulations of the explosive behavior of such designs using modern test equipment in ways similar to the Iraqi and Pakistani nuclear programs, and could rapidly assemble a weapon from these components if it could obtain illegal fissile material. It seems likely that the report concluded that Iran now had the technology for processing highly enriched Plutonium simply because no country that has ever seriously attempted such processing has failed, but that Iran would need fissile or borderline fissile uranium to make a bomb. As a result, the key uncertainty was whether the US could monitor all potential sources of fissile material with enough accuracy to ensure that Iran did not have a weapon and the answer was no.,

Although any such conclusions are speculative, it also seems likely that the US intelligence community has concluded that it is not possible to perfectly identify the level of Iranian nuclear weapons efforts, the specific organizations involved, the location and nature of all facilities, the foreign purchasing offices, and Iran's technical success. US intelligence certainly knows far more than it makes public, but Iran has been carrying out a covert program since the Shah without one known case of a major defector or public example of a reliable breakthrough in Humint. It also learned during the Iran-Iraq War that it needed to ensure its

facilities were not centralized and vulnerable, and had to conceal its activities as much as possible from any kind of intelligence surveillance. The strengthening of the NPT inspection regime, and Iran's search for a more moderate effort, has almost certainly reinforced these efforts to conceal its programs.[139]

CIA Deputy Director for Intelligence, John McLaughlin, made the following broad comments on the uncertainties in estimating the nature of efforts to proliferate in an interview in January 2000.[140]

> ``I would say the problem of proliferation of weapons of mass destruction is becoming more complex and difficult, …We're starting to see more evidence of what I might call kind of secondary proliferation. That is more evidence of sharing of information and data among countries that are striving to obtain weapons…As the systems mature in the obvious countries like North Korea and Iran, they themselves have the potential to start becoming sources of proliferation as distinct from aspirants. And that begins to complicate the whole picture …In the intelligence business (denial and deception) is an art form unto itself, it is how do you deny information to the other side and how do you deceive the other side?… Countries that are building such weapons are learning more and more about how to do that, making our job harder,…So if there is an issue that is to me personally worrying, it's the increasing complexity of the proliferation challenge…To some degree we're dealing with problems that are fuelled by hundreds of years of history. At the same time this past is colliding with the future, because you have these same people now using laptop computers and commercial encryption...You're not going to find that information on their Web sites. You're going to have to go out and get it somewhere clandestinely, either through human collection or through technical means,"

At present, most experts feel that Iran has all the basic technology to build a bomb, but lacks any rapid route to getting fissile uranium and plutonium unless it can steal or buy it from another country. They also believe that Iran is increasingly worried about preemptive strikes by Israel or the US. As a result, Iran deliberately has lowered the profile of its activities and only conducts a low-to-moderate level weapons design and development effort.[141] No serious expert has claimed that a major weapons grade production effort has yet been detected. As a result, many feel that Iran is at least to five to seven years away from acquiring a nuclear device using its own enriched material, and be six to nine years away from acquiring the ability to design a nuclear weapon that can be fitted in the warhead of a long-range missile system.

The "wild card" in all these estimates is that the deadlines would change so radically if Iran could buy fissile material from another nation or source -- such as the 500 kilograms of fissile material the US airlifted out of Kazakhstan in 1994. This was enough material to make up to 25 nuclear weapons, and the US acted primarily because Iran was actively seeking to buy such material.[142] If Iran could obtain weapons grade material, a number of experts believe that it could probably develop a gun or simple implosion nuclear weapon in nine to 36 months.

The risk of such a transfer of fissile material is significant. US experts believe that all of the weapons and fissile material remaining in the former Soviet Union are now stored in Russian facilities. The security of these facilities is still erratic, however, and there is a black market in nuclear material. While the radioactive material sold on the black market by the CIS and Central European citizens to date has consisted largely of plutonium 240, low grade enriched uranium, or isotopes of material which have little value in a nuclear weapons program, this is no guarantee for the future. There are also no guarantees that Iran will not be able to purchase major transfers of nuclear weapons components and nuclear ballistic missile warhead technology.

# Iran's Nuclear Warfighting Doctrine and Capabilities

It is possible to speculate at vast length on what Iran would do with nuclear weapons. However, it is impossible to determine how aggressively Iran would exploit such a capability in terms of threatening or intimidating its neighbors, or putting pressure on the West. Trying to guess at Iran's nuclear warfighting doctrine and actions is as speculative as guesses about how it would use biological weapons. It is quite possible that Iran has not yet looked far enough beyond its nuclear weapons acquisition efforts to work out detailed plans for possession. There is no way to know if Iran would choose a relatively stable model of deterrence or aggressively exploit its possession politically. It is equally difficult to guess whether Iran would develop an aggressive doctrine for use, consider developing a launch on warning/launch under attack capability, or reserve the use of such a weapon as a last resort.[143]

What is clear is that if Iran acquired a working nuclear device, this would suddenly and radically change perceptions of the military balance in the region. Iran is likely to acquire such weapons at about the same time it acquires MRBMs and this would be a volatile combination. Iran could destroy any hardened target, area target, or city within the range of its delivery systems. Iran's Southern Gulf neighbors are extremely vulnerable to attacks on a few cities, and even one successful nuclear attack might force a fundamental restructuring of their politics and/or economy. They are effectively "one bomb" countries.

Iranian nuclear capabilities would raise major mid-term and long-term challenges to the Southern Gulf states and to the West in terms of deterrence, defense, retaliation, and arms control. It would almost certainly accelerate efforts to deploy theater missile defenses -- although such systems seem more likely to be "confidence builders" than leak proof. It would almost certainly lead the US to consider counter-proliferation strikes on Iran, and to work with its Southern Gulf allies in developing an adequate deterrent. Given the US rejection of biological and chemical weapons, this raises the possibility of creating a major US theater nuclear deterrent, although such a deterrent could be sea and air based and deployed outside the Gulf.

If the US failed to provide such a deterrent, it seems likely that the Southern Gulf states would be forced to accommodate Iran or seek weapons of mass destruction of their own. Further, such Iranian possession would almost certainly trigger a major new Iraqi effort to acquire such weapons, and make any efforts at arms control meaningless for some years to come.

It is also impossible to dismiss the possibility that Iran or Iraq would chose to develop and use a "radiological weapon." Such a weapon could take three forms -- all of which would interact with its potential use of chemical and biological weapons.

- *The first would be a "dirty weapon"* using fissile material with contaminated or low enrichment levels that would have limited heat and blast effects, but still produce yields of 3 to 5 kilotons, and which would effectively poison a city if detonated near the ground. Such a device would reduce some of the manufacturing and design problems inherent in creating clean or efficient nuclear weapons.

- *The second would be to use a weapon that had not been tested, which was felt to be unreliable, or which was on an inaccurate missile* and detonate it near the ground so

that radiation effects compensate for a failure to reach design efficiency or accuracy of the delivery system.

- *The third would be to use radioactive material in micro-powder or liquid form as a terror or unconventional weapon*. It would be very difficult to get substantial lethality from the use of radioactive material, and such a weapon would be less efficient than biological weapons in terms of weight and lethality. It would, however, have the capacity to contaminate a key area and to create panic.

While the US and Russia have rejected radiological weapons because they have the ability to precisely control the yield from their nuclear weapons, such options might be attractive to Iran or Iraq. As is the case with chemical and biological weapons, even the prospect of Iran's acquiring any such nuclear weapons has increased its ability to intimidate its neighbors.

As for warfighting capability, the actual yield and effects of any Iranian nuclear weapon are probably not key issues. Any working nuclear device Iran is likely to develop will be sufficient to destroy any hardened target, area target, or city in the Middle East. Nuclear weapons do, however, differ sharply in their effect as they grow in size. It is not possible to quantify these effects in terms of fallout, and the data on prompt radiation are controversial in terms of their lethal effect.

Iran's nuclear programs will also be heavily interactive with its biological and chemical programs and its efforts to improve its delivery capabilities. By the time Iran has significant nuclear capability, it also should have significant missile, cruise missile, and long-range strike aircraft capability -- although it may not have cruise missiles capable of carrying a nuclear weapon. It should have rebuilt much of its conventional capabilities to the point where it has significant warfighting capabilities, and it will pose a major threat to other nations in the region -- possibly as far away as Israel.

---

[1] Washington Post, April 17, 1995, p. A-12; New York Times, May 2, 1995, p. A-6.

[2] Rodney W. Jones and Mark G. McDonough with Toby Dalton and Gregory Koblentz Tracking Nuclear Proliferation: A Guide in Maps and Charts, 1998, Carnegie Endowment for International Peace, 1999, "Iran".

[3] Washington Post, April 17, 1995, p. A-12; New York Times, May 2, 1995, p. A-6.

[4] Washington Times, February 24, 1997, p. A-1; Sunday Telegraph, February 23, 1997, p. 1.

[5] Associated Press, May 5, 1997, 01:26.

[6] Reuters, January 16, 1998, 0551.

[7] Reuters, January 16, 1998, 0551.

[8] Reuters, January 16, 1998, 0551.

[9] Congressional Research Service, Issue Briefs 92076, 92056, and 93033; Washington Times, December 19, 1994, p. A-18.

[10] Associated Press, May 5, 1997, 01:26.

[11] United Press, August 14, 1996, 1041. These statements are typical of the comments of Iranian officials and media found in a review of the FBIS-NES during 1995-1997. For example, see FBIS-NES-97-233, August 21, 1997, and Tehran Jomhuri-ye Eslmai, August 21, 1997.

[12] IRNA, August 17, 1997, 2041; BBC Summary of World Broadcasts, August 19, 1997.

[13] IRNA, August 17, 1997, 2041; BBC Summary of World Broadcasts, August 19, 1997, August 28, 1997, September 12, 1997; Agence France Presse, August 16, 1997, 15:22; London Times, August 16, 1997; SAPA, September 11, 1997, 0946; Xinhua, September 11, 1997, 0911305.

[14] David Kyd, a spokesman of the IAEA, stated on August 19, 1997 that the IAEA had no evidence that Iran was trying to obtain nuclear weapons components from South Africa. See IRNA, August 17, 1997 (FBIS-TAC-97-229, August 17, 1997), 2041; BBC Summary of World Broadcasts, August 19, 1997, August 28, 1997, September 12, 1997; Agence France Presse, August 16, 1997, 15:22; London Times, August 16, 1997; SAPA, September 11, 1997, 0946; Xinhua, September 11, 1997, 0911305; ,

[15] Washington Post, October 5, 1997, p. C-4.

[16] See Eric Arnett, "Iran, threat perception and military confidence-building measures, www. sipri,se/projects/technology/Iran-CBM.html, accessed April 17, 1997; the introduction and Chapters 10-13 of Eric Arnett, Editor, Military Capacity and the Risk of War: China, India, Pakistan, and India, Stockholm, Stockholm Institute of Peace Research Institute, March, 1997; Jane's Defense Weekly, April 16, 1997, p. 16.

[17] According to one report by Zalmay Khalizad in Survival, Pakistan was deeply involved in this $10 billion effort, as was China. US experts do not confirm these reports. Washington Post, May 17, 1995, p. A-23.

[18] Associated Press, May 5, 1997, 01:26.

[19] For a detailed history and list of suppliers see the author's Weapons of Mass Destruction in the Middle East, London, Brassey's, 1991, and After the Storm: The Changing Military Balance in the Middle East, Boulder, Westview, 1993.

[20] Working papers by Leonard Spector, Daniel Poneman, Nuclear Power in the Developing World, London, Allen and Unwin, 1982, Chapter 5; "Iran's Nuclear Weapons Program," Mednews, Vol. 5,17/18, June 8, 1992, pp. 1-7.

[21] Some reports indicate that one reactor at Bushehr was 80% complete.

[22] Much of this analysis is based on research by Leonard Spector of the Carnegie Endowment.

[23] The lasers were exported by a firm headed by Dr. Jeffrey Earkens, who had worked on classified laser enrichment technology. They seem to have been exported filled with gases that did not produce the optimal wave length for nuclear enrichment, but could be refilled with the gases necessary to produce the required wave length.

[24] Los Angeles Times, August 22, 1979; Leonard Spector, Going Nuclear, Cambridge, Ballinger, 1987, pp. 47-53' Shyam Bhatia, Nuclear Rivals in the Middle East, London, Routledge, 1988, p. 85; JPRS-NTD, December 23, 1989.

[25] Observer, May 17, 1987.

[26] Yellow cake is not subject to IAEA inspection. Kenneth R. Timmerman, Weapons of Mass Destruction: The Cases of Iran, Syria, and Libya, Simon Wiesenthal Center, Los Angeles, August, 1992, pp. 28-45.

[27] See Atomic Energy Organization of Iran, The Performance of the Atomic Energy Organization of Iran, Tehran, AEOI, August 1997; Tehran Salam, August 21, 1997, and August 27, 1997; FBIS/NES, September 5, 1997, 09031007000318; September 8, 1997, NC0809092597

[28] Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

[29] Working papers by Leonard Spector and Washington Post, April 12, 1987.

[30] The agreement made under the Shah was have given Iran about 250-300 metric tons of Uranium enriched to 3%. During 1980-1990, Iran refused to accept the material or pay for it. When Iran did ask for the material in 1991, France used the fact that Iran's option to obtain enriched material for its investment had expired to deny Iran shipment of the material guaranteed under the original terms of the Iranian investment. Washington Times, November 15, 1991, p. F-4; David Albright and Mark Hibbs, "Spotlight Shifts to Iran," Bulletin of the Atomic Scientists, March, 1992, pp. 9-12.

[31] Washington Post, April 12, 1987, p. D-1; James Bruce, "Iraq and Iran: Running the Nuclear Technology Race," Jane's Defense Weekly, December 5, 1988, p. 1307; working papers by Leonard Spector; JPRS-TND, October 6, 1989, p. 19.

[32] El Independent, Madrid, February 5 and 6, 1990; FBIS-Middle East, December 1, 1988; Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

[33] Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

[34] El Independent, Madrid, February 5 and 6, 1990; FBIS-Middle East, December 1, 1988.

[35] El Independent, Madrid, February 5 and 6, 1990; FBIS-Middle East, December 1, 1988.

[36] Uranium dioxide is normally subject to IAEA safeguards and inspection, but Argentine compliance is uncertain. Argentina sold at least three metric tons to Algeria in January, 1986. Nucleonics Week, May 7, 1987, p. 6

[37] Working papers by Leonard Spector; Observer, June 12, 1988; Office of the Secretary of Defense, Proliferation: Threat and Response, Washington, Department of Defense, April, 1996, pp. 12-16; US News and World Report, February 12, 1990; FBIS-NES, March 23, 1990, p. 57; FBIS-EAS, December 9, 1989, December 11, 1989; Defense and Foreign Affairs, November 20, 1989, p. 2; New York Times, May 8, 1989, June 27, 1989.

[38] Nucleonics Week, May 2, 1991; Robert Shuey and Shirley A Kan, Chinese Missile and Nuclear Proliferation, Congressional Research Service, IB92056, October 4, 1994, pp. 6-7; Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

[39] Washington Times, April 22, 1987, page 6; Economist, "Foreign Report", April 2, 1987, p. 7; "Iran's Nuclear Weapons Program," Mednews, Vol. 5,17/18, June 8, 1992, pp. 1-7.

[40] Many of the details on these aspects of the Iranian effort are drawn from working papers provided by Leonard Spector of the Carnegie Endowment, and Warren Donnelly of the Congressional Research Service. Also see Nucleonics Week, November 19, 1987, p. 1; November 26, 1987, p. 5; March 3, 1988, p. 7; July 28, 1988, p. 15

[41] For further background on recent developments, see Director of Central Intelligence, "The Acquisition of Technology Relating to Weapon s of Mass Destruction and Advanced Conventional Munitions," Washington, CIA, June, 1997; Leonard Spector, Mark G. McDonough and Evan Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995; Treaty on the Non-Proliferation of Nuclear Weapons: Problems for its Prolongation, Moscow, Russian Foreign Intelligence Service, 1995; Greg Gerardi and Maryam Ahrinijad, "An Assessment of Iran's Nuclear Facilities," Nonproliferation Review, Spring-Summer, 1995, pp. 209-215; David A. Schwarzbach, "Iran's Nuclear Puzzle," Scientific American, June 1997, pp. 62-65; David A. Schwarzbach, Iran's Nuclear Program: Energy or Weapons, Natural Resources Defense Council, Nuclear Weapons data book series, 1995; Shahram Chubin, "Does Iran Want Nuclear Weapons?, Survival, Vol. 37, No. 1, Spring 1995, pp. 86-104.

[42] There is a broad consensus among Western intelligence experts and governments that quiet discussions with potential supplier nations and corporations, and criminal prosecution of violators in the West, works better that open efforts to embarrass given suppliers. Suppliers are more cooperative and have less fear of media attacks that have often been launched against companies who have not actually made the reported transfers. More important, it is possible to keep the nature of such tracking efforts secret, and avoid providing a model of what to buy to other proliferators. As a result, most Iranian purchasing efforts do not become public. Western governments and intelligence organizations do occasionally deliberately embarrass uncooperative governments and companies with "leaks," but these are usually deliberately vague enough to preserve security. Similarly, briefings to outside governments and experts are usually very carefully limited. Intelligence experts have found that even classified briefings to friendly governments almost inevitably leak in detail to the media or hostile sources.

[43] The US had supplied 11 pounds of 93% enriched uranium in the mid-1970s, but this was largely depleted and could not keep the reactor running continuously. Base upon work by Leonard Spector; Nucleonics Week, May 14 ,1989, p. 2; Observer, March 6, 1988.

[44] Reuters, February 7, 1992, AM Cycle, and Rio Negro, February 7, 1992; Washington Post, November 17, 1992, pp. A-1 to A-30.

[45] Nuclear Engineering International, March, 1990, p. 3.

[46] Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

[47] Robert Shuey and Shirley A. Kan, Chinese Nuclear and Missile Proliferation, Congressional Research Service, IB92056, October 4, 1994; Washington Times, October 16, 1991, November 6, 1991, p. F-4, November 1, 1991, p. 7; Los Angeles Times, October 31, 1991, p. B-4, March 17, 1992, p. 1; David Albright and Mark Hibbs, "Spotlight Shifts to Iran," Bulletin of the Atomic Scientists, March, 1992, pp. 9-12; Washington Post, October 31, 1991, p. 1, January 12, 1992, p. C-7, February 2, 1992, p. A-1, September 12, 1992, p. A-13, June 26, 1991, October 30, 1991; "Iran's Nuclear Weapons Program," Mednews, Vol. 5,17/18, June 8, 1992, pp. 1-7; New York Times, September 11, 1992, p. A-6, May 27, 1993; Nucleonics Week, May 2, 1991, September 24, 1992, October 1, 1992; Los Angeles Times, January 18, 1993, p. A-1, March 17, 1992, p. A-1; Jane's Intelligence Review, Special Report No. 6, May, 1995, p. 14.

[48] Robert Shuey and Shirley A Kan, Chinese Missile and Nuclear Proliferation, Congressional Research Service, IB92056, October 4, 1994, pp. 6-7; Washington Post, April 17, 1995, p. A-1, April 18, 1995, p. A-13.

[49] New York Times, May 16, 1995, p. A-1; United Press August 14, 1996, 1041; Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; Washington Times, May 17, 1995, p. A-15.

[50] Office of the Secretary of Defense, Proliferation: Threat and Response, Washington, Department of Defense, April, 1996, pp. 12-16; Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; Washington Times, May 17, 1995, p. A-15.

[51] See Atomic Energy Organization of Iran, The Performance of the Atomic Energy Organization of Iran, Tehran, AEOI, August 1997; Tehran Salam, August 21, 1997, and August 27, 1997; FBIS/NES, September 5, 1997, 09031007000318; September 8, 1997, NC0809092597; Kenneth Katzman, "Iran: Arms and Technology Acquisitions," Library of Congress, CRS-97-474F, October 1, 1997; Kenneth Katzman, "Iran: Military Relations With

China," Library of Congress, CRS-967-572F, June 26, 1996; Shirley A. Kan, "Chinese Proliferation of Weapons of Mass Destruction, Background and Analysis," Library of Congress, CRS-96-767F, September 13, 1996.

[52] Washington Post, November 17, 1992, p. A-1, April 18, 1995, p. A-13; Wall Street Journal, May 11. 1993, p. 14; Robert Shuey and Shirley A Kan, Chinese Missile and Nuclear Proliferation, Congressional Research Service, IB92056, October 4, 1994, pp. 6-7; Nucleonics Week, September 24, 1992, October 1, 1992; New York Times, May 27, 1993; The Middle East, July/August, 1994, pp. 9-10.

[53] Washington Post, November 17, 1992, p. A-1, April 18, 1995, p. A-13; Wall Street Journal, May 11. 1993, p. 14; Robert Shuey and Shirley A Kan, Chinese Missile and Nuclear Proliferation, Congressional Research Service, IB92056, October 4, 1994, pp. 6-7; Nucleonics Week, September 24, 1992, October 1, 1992; New York Times, May 27, 1993; The Middle East, July/August, 1994, pp. 9-10.

[54] New York Times, February 23, 1995, May 16, 1995, p. A-1, May 18, 1995, p. A-11; Washington Post, April 18, 1995, p. A-13, May 8, 1995, p. A-22, May 18, 1995, p. A-22; Nucleonics Week, February 13, 1992, p. 12, October 14, 1993, p. 9, December 16, 1993, p. 11, September 22, 1994, p. 1, October 6, 1994, p. 11; Washington Post, February 14, 1992, February 12, 1995; Nuclear Fuel, March 14, 1994, p. 9, March 28, 1994, p. 10; Nuclear Engineering, April 1992, p. 67, November, 1994, pp. 4, 10, United Press, November 21, 1994, Reuters, November 20, 1994.

[55] Washington Times, April 18, 1996, p. A-7.

[56] Washington Times, October 14, 1997, p. A-1; October 15, 1997, p. A-3; Washington Post, October 25, 1997, p. A-1; October 30, 1997, p. A-15; New York Times, on-line news service, October 31, 1997.

[57] Christian Science Monitor, December 19, 1996, p. 1; Associated Press, May 5, 1997, 01:26; Director of Central Intelligence, "The Acquisition of Technology Relating to Weapon s of Mass Destruction and Advanced Conventional Munitions," Washington, CIA, June, 1997; Leonard Spector, Mark G. McDonough and Evan Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, p. 123; Treaty on the Non-Proliferation of Nuclear Weapons: Problems for its Prolongation, Moscow, Russian Foreign Intelligence Service, 1995, pp. 56-59; Greg Gerardi and Maryam Ahrinijad, "An Assessment of Iran's Nuclear Facilities," Nonproliferation Review, Spring-Summer, 1995, pp. 209-215.

[58] Associated Press, August 24, 1997, 2216.

[59] Washington Times, October 22, 1997, p. A-12.

[60] Washington Times, October 14, 1997, p. A-1; October 15, 1997, p. A-3; Washington Post, October 30, 1997, p. A-15; New York Times, on-line news service, October 31, 1997; Reuters, March 15, 1998, 1312, March 26, 1998, 0743; Washington Post, March 13, 1998, p. A-1.

[61] Washington Post, March 13, 1998, p. A-1

[62] New York Times, February 23, 1995, May 18, 1995, p. A-11; Washington Post, April 18, 1995, p. A-13, May 8, 1995, p. A-22, May 18, 1995, p. A-22; Nucleonics Week, February 13, 1992, p. 12, October 14, 1993, p. 9, December 16, 1993, p. 11, September 22, 1994, p. 1, October 6, 1994, p. 11; Washington Post, February 14, 1992, February 12, 1995; Nuclear Fuel, March 14, 1994, p. 9, March 28, 1994, p. 10; Nuclear Engineering, April 1992, p. 67, November, 1994, pp. 4, 10, United press, November 21, 1994, Reuters, November 20, 1994.

[63] Executive News Service, September 23, 1993, 1730, September 28, 1995, 1647; Washington Times, September 25, 1995, p. A-1; Washington Post, September 28, 1995, p. A-22; New York Times, September 30, 1995, p. A-4.

[64] Reuters, March 15, 1998, 1312.

[65] For a comprehensive summary of Russian nuclear exports to Iran, see Fred Wehling, "Russian Nuclear and Missile Exports to Iran," The Nonproliferation Review/Winter 1999. The report is accessible through the web page of the Monterrey Institute at Monterey Institute, www.cns.miis.edu.

[66] See Atomic Energy Organization of Iran, The Performance of the Atomic Energy Organization of Iran, Tehran, AEOI, August 1997; Tehran Salam, August 21, 1997, and August 27, 1997; FBIS/NES, September 5, 1997, 09031007000318; September 8, 1997, NC0809092597

[67] Chalk Times, January 11, 1995, p. 1; New York Times, January 5, 1995, p. A-10.

[68] New York Times, January 8, 1995, p. A-8, February 23, 1995, p. A-8; Washington Post, January 7, 1995, p. A-17, February 11, 1995, p. A-11, March 3, 1995, p. A-32, April 17, 1995, p. A-13; Washington Times, February 21, 1995, p. A-13; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.

[69] New York Times, February 23, 1995, May 18, 1995, p. A-11; Washington Post, May 8, 1995, p. A-22; Nucleonics Week, February 13, 1992, p. 12, October 14, 1993, p. 9, December 16, 1993, p. 11, September 22, 1994, p. 1, October 6, 1994, p. 11; Washington Post, February 14, 1992, February 12, 1995; Nuclear Fuel, March 14, 1994, p. 9, March

28, 1994, p. 10; Nuclear Engineering, April 1992, p. 67, November, 1994, pp. 4, 10, United Press, November 21, 1994, Reuters, November 20, 1994; Los Angeles Times, March 10, 1995, p. A-3.

[70] New York Times, February 23, 1995, May 18, 1995, p. A-11; Washington Post, May 8, 1995, p. A-22; Nucleonics Week, February 13, 1992, p. 12, October 14, 1993, p. 9, December 16, 1993, p. 11, September 22, 1994, p. 1, October 6, 1994, p. 11; Washington Post, February 14, 1992, February 12, 1995; Nuclear Fuel, March 14, 1994, p. 9, March 28, 1994, p. 10; Nuclear Engineering, April 1992, p. 67, November, 1994, pp. 4, 10, United Press, November 21, 1994, Reuters, November 20, 1994; Los Angeles Times, March 10, 1995, p. A-3 Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.

[71] Reuters, November 6, 996, 0909; ECU Country Reports, Iran, August 2, 1996; ECU Views Wire, January 17, 1997, January 20, 1997; Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; Washington Post, March 3, 1995, p. A-32; Journal of Commerce, January 8, 1997, p. 6B; Times-Picayune, February 8, 1997, p. B-6; Financial Times, March 14, 1997, p. 4.

[72] New York Times, February 23, 1995, May 18, 1995, p. A-11; Washington Post, May 8, 1995, p. A-22; Nucleonics Week, February 13, 1992, p. 12, October 14, 1993, p. 9, December 16, 1993, p. 11, September 22, 1994, p. 1, October 6, 1994, p. 11; Washington Post, February 14, 1992, February 12, 1995; Nuclear Fuel, March 14, 1994, p. 9, March 28, 1994, p. 10; Nuclear Engineering, April 1992, p. 67, November, 1994, pp. 4, 10, United Press, November 21, 1994, Reuters, November 20, 1994; Los Angeles Times, March 10, 1995, p. A-3.

[73] FBIS-SOV, July 21, 1995, p. 1.

[74] FBIS-SOV, June 29, 1995, pp. 5-7; Washington Times, May 5, 1997, p. A-13..

[75] Reuters, July 3, 1997, 0640.

[76] Based on reporting in a working paper by the Monterrey Institute. See ITAR-TASS world service broadcast, 18 March 1996, in "Russian Nuclear Aid to Iran 'Not Confined' to Bushehr," FBIS-TAC-95-005.]{entered 8/14/98 FW

[77] Washington Post, April 17, 1995, p. A-12, May 17, 1995, p. A-23; New York Times, May 19, 1995, p. A-1, May 22, 1995, p. A-1; Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123.

[78] Reuters, March 6, 1998, 1452 and March 11, 1998, 0947; Washington Post, March 7, 1998, p. A-15

[79] Based on reporting in a working paper by the Monterrey Institute. See Sergey Alekhin, "Izhorskiye Zavody: We Shall Build Reactor for Iran," *Rossiyskaya gazeta*, 13 February 1999, p.3; in "Petersburg Plant To Supply Equipment for Bushehr," FBIS Document FTS19990215000317.] {Entered 3/11/99 CF

[80] Based on reporting in a working paper by the Monterrey Institute. See "Iranians to Learn How to Operate Nuclear Power Plant in Russia," Interfax, No.3, 1 February 1999.]{entered 3/11/99 FW; Agence France Presse, 29 January 1999, in "Iran Recruits Engineers for Nuclear Training in Russia," *Russia Today*, 29 January 1999, http://www.russiatoday.com.]{entered 2/22/99 FW

[81] ITAR-TASS, FBIS-SOV-98-050; Reuters, March 6, 1998, 1242; New York Times, March 7, 1998, p. A-3; Washington Times, March 7, 1998, p. A-6.

[82] New York Times, February 23, 1995, May 18, 1995, p. A-11; Washington Post, May 8, 1995, p. A-22; Nucleonics Week, February 13, 1992, p. 12, October 14, 1993, p. 9, December 16, 1993, p. 11, September 22, 1994, p. 1, October 6, 1994, p. 11; Washington Post, February 14, 1992, February 12, 1995; Nuclear Fuel, March 14, 1994, p. 9, March 28, 1994, p. 10; Nuclear Engineering, April 1992, p. 67, November, 1994, pp. 4, 10, United Press, November 21, 1994, Reuters, November 20, 1994; Los Angeles Times, March 10, 1995, p. A-3.

[83] Reuters, November 6, 996, 0909; ECU Country Reports, Iran, August 2, 1996; ECU Views Wire, January 17, 1997, January 20, 1997

[84] New York Times, March 7, 1998, p. A-3; Washington Times, March 7, 1998, p. A-6.

[85] Chalk Times, January 11, 1995, p. 1; New York Times, January 5, 1995, p. A-10.

[86] Middle East Economic Digest, October 17, 1997, p. 10.

[87] Based on reporting in a working paper by the Monterrey Institute. See Aleksandr Koretskiy, "Rossiya sdelayet Iran velikoy atomnoy derzhavnoy," *Segodnya*, online edition, http://www.ipres.ru/news/sg, No.263, 25 November 1998.
[2] Andrew Jack, Stephen Fidler, "Moscow asked to bid for contract," *Financial Times*, 26 November 1998; in Lexis-Nexis Academic Universe, http://web.lexis-nexis.com/universe.{entered 2/22/99 FW}

[88] Quoted in a working paper by the Monterrey Institute. See "Press Conference with First Deputy Minister of Nuclear Energy Viktor Mikhailov, PIR Center Officials Regarding Russia-Iran," Kremlin International News broadcast, 1 December 1998; in Lexis-Nexis Academic Universe, http://web.lexis-nexis.com.]{entered 2/22/99 FW

[89] Quoted in a working paper by the Monterrey Institute. See "SShA ne predstavili informatsii o narushenii Rossiey mezhdunarodnykh dogovorov—Minatom," Interfax, No.1, 20 January 1999.]{entered 3/22/99 FW.

[90] Associated Press, January 14, 2000, 1306; Reuters, January 14, 2000, 0859; New York Times, January 17, 2000, p. A-1.

[91] New York Times, January 17, 2000, p. A-1.

[92] Quoted in a working paper by the Monterrey Institute. See Ekho Moskvy, 14 January 2000, in BBC Summary of World Broadcasts, 17 January 2000; in "Russia to Build Three Reactors for Iran Instead of One," Lexis-Nexis Academic Universe, http://web.lexis-nexis.com/universe, and "Russian official: Iran may order three additional nuclear reactors," Associated Press, 14 January 1999.{entered 1/21/00 FW}

[93] Non-Proliferation Center, Director of Central Intelligence, Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions 1 January Through 30 June 1999.

[94] Not always politely. See Atomic Energy Organization of Iran, The Performance of the Atomic Energy Organization of Iran, Tehran, AEOI, August 1997; Tehran Salam, August 21, 1997, and August 27, 1997; FBIS/NES, September 5, 1997, 09031007000318; September 8, 1997, NC0809092597

[95] For further details, see David A. Schwarzbach, "Iran's Nuclear Puzzle," Scientific American, June 1997, pp. 62-65; David A. Schwarzbach, Iran's Nuclear Program: Energy or Weapons, Natural Resources Defense Council, Nuclear Weapons data book series, 1995.

[96] Associated Press, June 2, 1996.

[97] Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; Washington Post, March 3, 1995, p. A-32, April 4, 1995, p. A-19, May 4, 1995, p. A-17, May 5, 1995, p. A-29; Washington Times, February 21, 1995, p. A-13, August 8, 1995, p. A-9; Iran Business Monitor, Volume IV, Number 6, June, 1995, p. 1; Newsweek, May 15, 1995, p. 36; New York Times, May 5, 1995, p. A- 8; Executive News Service, October 6, 1995, 1640; October 10, 1995, 1522, October 12, 1995, 1045.

[98] Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; Office of the Secretary of Defense, Proliferation: Threat and Response, Washington, Department of Defense, April, 1996, pp. 12-16; Washington Post, March 3, 1995, p. A-32, April 4, 1995, p. A-19, May 4, 1995, p. A-17, May 5, 1995, p. A-29; Washington Times, February 21, 1995, p. A-13, August 8, 1995, p. A-9; Iran Business Monitor, Volume IV, Number 6, June, 1995, p. 1; Newsweek, May 15, 1995, p. 36; New York Times, May 5, 1995, p. A- 8; Executive News Service, October 6, 1995, 1640; October 10, 1995, 1522, October 12, 1995, 1045; Journal of Commerce, January 8, 1997, p. 6B; Times-Picayune, February 8, 1997, p. B-6; Financial Times, March 14, 1997, p. 4.

[99] Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; Washington Post, March 3, 1995, p. A-32, April 4, 1995, p. A-19, May 4, 1995, p. A-17, May 5, 1995, p. A-29; Washington Times, February 21, 1995, p. A-13; Iran Business Monitor, Volume IV, Number 6, June, 1995, p. 1; Newsweek, May 15, 1995, p. 36; New York Times, May 5, 1995, p. 8; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.

[100] Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; Office of the Secretary of Defense, Proliferation: Threat and Response, Washington, Department of Defense, April, 1996, pp. 12-16; Washington Post, March 3, 1995, p. A-32, April 4, 1995, p. A-19, May 4, 1995, p. A-17, May 5, 1995, p. A-29; Washington Times, February 21, 1995, p. A-13, August 8, 1995, p. A-9; Iran Business Monitor, Volume IV, Number 6, June, 1995, p. 1; Newsweek, May 15, 1995, p. 36; New York Times, May 5, 1995, p. A- 8; Executive News Service, October 6, 1995, 1640; October 10, 1995, 1522, October 12, 1995, 1045; Journal of Commerce, January 8, 1997, p. 6B; Times-Picayune, February 8, 1997, p. B-6; Financial Times, March 14, 1997, p. 4.

[101] For typical press reporting on such issues, see International Defense Review, 2/1997, pp. 21-23, and Washington Times, September 23, 1997, p. A-13; Extensive separate analysis has been done by the CSIS.
[102] Washington Post, July 3, 1997, p. A-7; Director of Central Intelligence, "The Acquisition of Technology Relating to Weapon s of Mass Destruction and Advanced Conventional Munitions," Washington, CIA, June, 1997; Reuters, July 3, 1997, 0640.
[103] Jane's Defense Weekly, March 19, 1997, p. 3.
[104] Washington Post, November 17, 1992, p. A-30. Wall Street Journal, May 11, 1993, p. A-14; Christian Science Monitor, February 18, 1993, p. 7.
[105] Chalk Times, January 9, 1995, p. 6; New York Times, January 5, 1995, p. A-10, January 8, 1995, p. A-8, January 10, 199, p. A-3; Washington Times, December 19, 1994, p. A-18, January 6, 1995, p. A-15; Washington Post, January 7, 1995, p. A-17, .
[106] Washington Times, May 5, 1997, p. A-13.

[107] For a detailed unclassified summary of the Iranian nuclear program, see Andrew Koch and Jeanette Wolf, "Iran's Nuclear Facilities, a Profile, available at the web page of the Monterey Institute, www.cns.miis.edu.
[108] Leonard S. Spector, Mark G. McDonough, and Evan S. Medeiros, Tracking Nuclear Proliferation, Washington, Carnegie Endowment, 1995, pp. 119-123; New York Times, April 3, 1995, p. A-1.
[109] For a range of typical reporting on Iran, see Nucleonics Week, February 13, 1992, p. 12, March 26, 1992, p. 7, May 28, 1992, p. 3, August 6, 1992, p. 13, August 20, 1992, p. 7, September 24, 1992, p. 2; Nuclear Fuel, July 6, 1992, p. 17, December 7, 1992, p. 5; Nuclear News, April, 1992, p. 67; Los Angeles Times, January 29, 1992, p. A-4, March 21, 1992, p. A-1; Washington Post, October 18, 1992, p. C-5.
[110] Office of the Secretary of Defense, Proliferation: Threat and Response, Washington, Department of Defense, April, 1996, pp. 12-16; Washington Post, March 24, 1995, p. A-28, April 29, 1995, p. A-8, May 5, 1995, p. A-29; New York Times, April 3, 1995, p. A-1, April 29, 1995, p. A-6; Philadelphia Inquirer, May 3, 1995, p. A-3; _, February 27, 1995, p. 27; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.
[111] Associated Press, December 24, 1997, 1305.
[112] Washington Times, November 15, 1991, p. F-4; Washington Post, February 7, 1992, p. A-18, February 15, 1992, p. A-29; Associated Press PM Cycle, February 6, 1992; "Iran's Nuclear Weapons Program," Mednews, Vol. 5,17/18, June 8, 1992, pp. 1-7.
[113] Gerald White, The Risk Report, Volume 1, Number 7, September, 1995.
[114] Gerald White, The Risk Report, Volume 1, Number 7, September, 1995.
[115] It may also be possible to cheat an IAEA inspection. At least one effort was detected in Iraq to create reactor design which concealed an irradiation chamber in the reactor for producing plutonium. Israel permitted US inspection of its facilities in Dimona in one point in its nuclear weapons program where it provided a false control panel and records simulating a different operational cycle, and smaller reactor capacity, than was actually the case. The technology now available to the IAEA makes it unlikely that such efforts could succeed, but such success is at least possible.
[116] Robert Shuey and Shirley A Kan, Chinese Missile and Nuclear Proliferation, Congressional Research Service, IB92056, October 4, 1994, pp. 6-7; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.
[117] Patrick Clawson, Iran's Challenge to the West, How, When, and Why, Washington, The Washington Institute Policy Papers, Number Thirty Three, 1993, pp. 60-61; Financial Times, February 6, 1992; Washington Post, February 15, 1992, pp. A-29-A-30, November 17, 1992, p. A-30; Los Angeles Times, March 17, 1992, p. 1; Associated Press, AM Cycle, February 12, 1992; Agence France Presse, February 12, 1992. Christian Science Monitor, February 18, 1993, p. 7; Wall Street Journal, May 11, 1993, p. A-14; Middle East Economic Digest, March 17, 1995, p. 7.
[118] The major uncertainty in such matters is whether Iran not has a significant centrifuge effort in a secret or underground locations. A few experts feel there is some risk that Iran might also have a secret reactor to produce Plutonium, but this seems unlikely. Washington Post, November 20, 1993, p. A-13.
[119] The major uncertainty in such matters is whether Iran not has a significant centrifuge effort in a secret or underground locations. A few experts feel there is some risk that Iran might also have a secret reactor to produce Plutonium, but this seems unlikely. Washington Post, November 20, 1993, p. A-13.
[120] Sunday Telegraph, February 24, 1997, p. 1; Washington Times, February 24, 1997, p. A-1.

[121] United Press, August 14, 1996, 1041; Sunday Telegraph, August 12, 1996.
[122] For more background, see the author's Weapons of Mass Destruction in the Middle East, Brassey's, London, 1992 and Iran and Iraq: The Threat From the Northern Gulf, Boulder, Westview, 1994. Also see Office of the Secretary of Defense, Proliferation: Threat and Response, Washington, Department of Defense, April, 1996, pp. 12-16; US News, November 14, 1994, pp. 87-88; and New York Times, December 27, 1994, p. A-17.
[123] David A. Schwarzbach, "Iran's Nuclear Puzzle," Scientific American, June, 1997, p. 62.
[124] White House "Fact Sheet," May 14, 1997; Washington Post, May 15, 1997, p. A-24. Also see the discussion of monitoring and country activity in Director of Central Intelligence, "The Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, July-December, 1996," Washington, CIA, June 1997, and Shai Feldman, Nuclear Weapons and Arms Control in the Middle East, Cambridge, MIT Press, 1997.
[125] Reuters, September 3, 1997, 0150.
[126] Speech at the annual USCENTCOM conference, June 26, 1997.
[127] Los Angeles Times, March 17, 1992, p. 1.
[128] New York Times, November 30, 1992, pp. A-1 and A-6, January 5, 1995, p. A-10; Washington Times, January 6, 1995, p. A-15.
[129] New York Times, January 10, 1995, p. A-3; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.
[130] Associated Press, May 5, 1997, 01:26.
[131] Chalk Times, January 10, 1995, p. 31; Washington Times, January 19, 1995, p. A-18.
[132] Although the possibility is a real one. Financial Times, January 30, 1992, p. 4; Agence France Presse, January 26, 1992; Sunday Times, January 26, 1992; Der Spiegel, July 20, 1992, p. 117; Patrick Clawson, Iran's Challenge to the West, How, When, and Why, Washington, The Washington Institute Policy Papers, Number Thirty Three, 1993, pp. 63-65; United States News and World Report, November 14, 1994, p. 88; Jane's Intelligence Review, "Iran's Weapons of Mass Destruction," Special Report Number 6, May, 1995, pp., 4-14; Gerald White, The Risk Report, Volume 1, Number 7, September, 1995; Jane's Intelligence Review, October, 1995, p. 452.
[133] New York Times, January 17, 2000, p. A-8.
[134] Rodney W. Jones and Mark G. McDonough with Toby Dalton and Gregory Koblentz Tracking Nuclear Proliferation: A Guide in Maps and Charts, 1998, Carnegie Endowment for International Peace, 1999.
[135] http://www.defenselink.mil/pubs/prolif97/graphics.html
[136] Washington Times, July 29, 1998, p. A-12.
[137] Non-Proligeration Center, Director of Central Intelligence,Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions 1 January Through 30 June 1999. This report is issued in response to a Congressionally directed action in Section 721 of the FY 97 Intelligence Authorization Act, which requires: "(a) Not later than 6 months after the date of the enactment of this Act, and every 6 months thereafter, the Director of Central Intelligence shall submit to Congress a report on
(1) the acquisition by foreign countries during the preceding 6 months of dual-use and other technology useful for the development or production of weapons of mass destruction (including nuclear weapons, chemical weapons, and biological weapons) and advanced conventional munitions; and (2) trends in the acquisition of such technology by such countries." At the DCI's request, the DCI Nonproliferation Center (NPC) drafts this report and coordinates it throughout the Intelligence Community. As directed by Section 721, subsection (b) of the Act, it is unclassified. As such, the report does not present the details of the Intelligence Community's assessments of weapons of mass destruction and advanced conventional munitions programs that are available in other classified reports and briefings for the Congress.
[138] New York Times, January 17, 2000, p. A-1 and A-8; Bloomberg New, January 17, 2000, 08:28; Reuters, January 17, 2000, 13:53; Associated Press, January 18, 2000, 0211.
[139] Reuters, January 24, 2000, 18:55; January 26, 2000, 11:21.
[140] Reuters, January 24, 2000, 18:32.
[141] Washington Times, May 17, 1995, p. A-15; Office of the Secretary of Defense, Proliferation: Threat and Response, Washington, Department of Defense, April, 1996, pp. 12-16.
[142] New York Times, May 14, 1995; Washington Post, November 5, 1997, p. A-1..
[143] For interesting insights into possible scenarios and their implications, see Anthony H. Cordesman, "Terrorism and the Threat From Weapons of Mass Destruction in the Middle East: The Problem of Paradigm Shift," Washington, CSIS, October 17, 1996; Brad Roberts, Terrorism with Chemical and Biological Weapons, Calibrating Risks and

Responses, Alexandria, Chemical and Biological Weapons Control Institute, 1997; Shai Feldman, Nuclear Weapons and Arms Control in the Middle East, Cambridge, MIT Press, 1997.