

Report:

AN ASSESSMENT OF IRAN'S NUCLEAR FACILITIES

by Greg J. Gerardi and Maryam Aharinejad

Greg J. Gerardi is a Senior Research Associate of the Center for Nonproliferation Studies (CNS) at the Monterey Institute of International Studies. Maryam Aharinejad was a Research Associate at CNS; she is currently an intern at the United Nations' Centre for Disarmament Affairs.

Much press has been given to the perceived threat posed by Iran's nuclear developments. In particular, Russia's agreement to complete Unit One of the nuclear complex at Bushehr, begun by the Germans in the late 1970s, and reports of China's assistance in the building of additional power reactors have strained relations between the United States and these two countries. The protocol for the completion of the Bushehr plant, signed by Russian nuclear energy minister Viktor Mikhailov and the President of the Atomic Energy Organization of Iran (AEOI) Reza Amrollahi on January 8, 1995, also calls on the two signatory organizations to draft and sign:

...within a six month period of time, a contract for the construction of a uranium [mine] shaft in Iran, after which negotiations will be conducted on the signing of a contract for the construction of a centrifuge plant for the enrichment of uranium according to conditions of contracts concluded by Russian organizations with firms of third countries.¹

The reactor deal, especially the clause for the provision of a centrifuge plant, is of particular concern to the United States, and was a major topic of the Clinton-Yeltsin summit in May 1995. Despite earlier claims by the Russians that there

was no contract for a centrifuge, Yeltsin later conceded this point of the deal stating that:

...the contract indeed has elements of both peaceful and military power engineering. Now we have agreed to separate them, and what bears on the military part, the possibility of creating, say, nuclear-weapons-grade fuel or other matters—the centrifuge, the building of mines—we decided to exclude these matters from the contract...²

U.S. concern about the transfer of any nuclear technology to Iran is based on the belief that Iran has a clandestine nuclear weapon development program. U.S. and Israeli intelligence assess Iran as being nuclear weapon capable in a five- to 10-year time frame.³ In order for a country to develop nuclear weapon capability *indigenously*, it must possess the requisite nuclear infrastructure to produce fissile material. This report assesses the extent of Iran's current and near-term nuclear infrastructure by compiling a list of its known and planned nuclear facilities and their capabilities. The information is based on an extensive search of available open sources. An attempt has been made to report only on those facilities whose existence can be substantiated by multiple reliable sources.

CONFIRMED SITES

Bushehr

Bushehr is the location of two partially-constructed German-built Siemens 1300 megawatt electric (MWe) power reactors that were more than half completed in 1979 at the time of the Islamic revolution. Work was resumed by Iran in 1984.⁴ Bushehr is also the site of the "Nuclear Energy College" where, by August 1992, 160 technicians had been trained.⁵ According to one unidentified German official, an Iraqi air raid in 1987 "destroyed the entire core area of both units."⁶ Subsequently, the quality of the reactor structure has suffered due to exposure to the extreme temperatures and the salty air near the coast. Sections of the inner steel containment were breached and will need to be repaired.⁷ The structure of the more damaged reactor has been sealed, and the containment dome covered in sheet metal, while motor shafts and rotary blades have been coated

with a tar-based paint to protect them from the corrosive salty air.⁸ Engineers from both Siemens and the German Technischer Überwachungsverein (TÜV), who examined the site after the bombing, estimated repair costs at \$2.9 to \$4.6 billion.⁹

On March 7, 1990, Iranian Finance Minister Mohsen Nourbakhsh and Soviet Minister for Railways Nikolay Konarev signed an economic cooperation protocol that included an outline agreement for completion of the Bushehr plant and construction of two VVER-440 reactors in Iran.¹⁰ The deal was to be partially paid for by deliveries of natural gas to begin in April 1990.¹¹ The site planned for the VVER-440 reactors was originally to be Gorgan, but this site was later determined to be unsuitable. It was then decided to build the plant at Bushehr instead. Also, the original 1990 agreement is believed to have faltered due to a shortage of funding on the Iranian side (see Gorgan below).

In February 1992, AEOI President Reza Amrollahi¹² told the International Atomic Energy Agency (IAEA)

Board of Governors that Iran would like to complete construction of the two 1300 Mwe power reactors at Bushehr—one of which is 80 percent complete, the other 65 to 70 percent complete—which could provide 10 to 20 percent of Iran's energy needs.¹³ In late 1994, Amrollahi stated that the Russians were assisting in the completion of Unit One of the Siemens plants¹⁴ by installing WER-1000 equipment, including primary circuitry and a pressure vessel, which—due to the greater size of its six horizontal WER-1000 steam generators compared to the German Siemens technology—will require the expansion of the existing reactor building.¹⁵ This reactor would be similar to Unit Four of the Russian Balakovskaya plant.¹⁶ A preliminary agreement calls for a new turbine to be provided by the firm Ukrainian Turboatom (Kharkov), which will fit in the existing structure, with the reactor to be provided by a Russian firm, either Izhorskiy Zavod or Atomash.¹⁷

Russian specialists began preliminary site studies in April 1994.¹⁸ On November 19, 1994, AEI Vice President Mehralizadeh¹⁹ said: "The completion work of Bushehr's atomic power plant has begun with ... the help of Russian experts."²⁰ In January 1995, Iran's Ambassador to the IAEA Mohammed Sadegh Ayatollahi²¹ is reported to have said that 85 percent of the construction was finished and over half of the equipment had been installed in Unit One.²² It is unclear whether the work the Russian experts were doing was limited to survey studies or was more substantive. Judging from the statement of AEI Vice President Mehralizadeh, the latter seems to be the case.

The Bushehr deal, signed by Amrollahi and Russian Nuclear Energy Minister Viktor Mikhailov on January 8, 1995, is worth \$800 million and calls for the completion of Unit One within four years.²³ Twenty million dollars is for the initial examination of the building structures, which is to be completed by the end of 1995, while \$780 million is for completion of the reactors.²⁴ Under the terms of the agreement, 3,000 Russian workers will assist in the construction of two light-water reactors,²⁵ and 500 Iranian technicians will be trained in Russia²⁶ at Moscow's Engineering and Physics Institute.²⁷ In February 1995, 150 Russian specialists were reported to be already working at the site.²⁸ According to the Bushehr plant's acting director Kazem Khabir, work on the plant will begin by June 1995, and will require the delivery of 7,000 tons of equipment.²⁹ The Russian company Zarubezhatomenergostroy will release an official feasibility study for the completion of the

Bushehr plant in September 1995.³⁰ Unit One should be operational 55 months after the publication of the feasibility study.³¹

Bonab

On September 11, 1994, AEI President Amrollahi announced that phase one of a nuclear energy research program at the "Bonab Atomic Energy Research Center" would begin in 1995, and that the center "will be used for agricultural purposes."³² In an interview with *Izvestiya* on February 15, 1995, an anonymous Russian diplomat was quoted as saying, "According to our information, the low-power reactors in Tehran and Tabriz are used by local universities for agriculture and medical research."³³ Bonab is approximately 80 kilometers south of Tabriz; thus this is most likely a reference to the site in Bonab.

Darkhovin [a.k.a. Karun and Ahvaz]

Darkhovin is a location on the Karun River south of the city of Ahvaz³⁴ where site preparation work was begun for two French-built power reactors.³⁵ In September 1992, AEI Deputy Director Haji Azim stated that contract negotiations were being conducted for the construction of two 300 Mwe nuclear reactors; the Chinese contracting authorities were reportedly the Qinshan Nuclear Power Company and the Shanghai Nuclear Research and Design Institute.³⁶ On October 1, 1992, it was reported that China would need 10 years to build the two reactors, and that it would have difficulty supplying both instrumentation and control and primary pumps for the reactors.³⁷ On February 21, 1993, China and Iran signed an agreement for the construction of two 300 Mwe Qinshan-type nuclear power reactors at the site.³⁸ China is also building two 300 Mwe reactors in Esteghlal, and there may be some confusion in the reporting concerning these two sites (see Esteghlal below).

Esfahan

Esfahan Nuclear Technology Center was built with Chinese assistance and opened in 1984 for the purpose of conducting research.³⁹ It is the location of a Chinese-supplied 27 kilowatt⁴⁰ "Miniature Neutron Source Reactor"⁴¹ arranged under a June

1990 agreement.⁴² In February 1992, this reactor was still under construction.⁴³ Preparations are currently underway "for putting the reactor into operation."⁴⁴ Esfahan is also the site of two subcritical facilities: one vertically-fueled with uranium pins with maximum neutron breeding rate of 0.9, the other a graphite-moderated and horizontally configured unit with a maximum neutron breeding rate of 0.8.⁴⁵ The site was built to resemble a city district with some of the facilities underground and others camouflaged.⁴⁶

Esfahan is also the location of a calutron supplied by China. In February 1992, an IAEA inspection team said this calutron did not have enrichment capability or facilities for the handling of radioactive material, and would be used for the production of stable zinc isotopes for medical purposes.⁴⁷ According to nuclear specialists David Albright and Mark Hibbs the "desk-top sized" calutron, with a one milliamp current, is for the production of isotopes, which are then irradiated in the reactor to convert them to useful radioactive materials.⁴⁸ A second reactor, inaugurated in June 1994, is used mainly for research, but it is not clear if this reactor is operational.⁴⁹ A site near Esfahan reportedly houses a "nuclear reactor starter device" received from China.⁵⁰ Since 1988, a majority of the 15 nuclear engineers from AEOI, who reportedly studied nuclear reactor design in China as part of a secret 1985 accord, came from the Esfahan nuclear research center.⁵¹

Esteghlal

As part of a \$1.2 billion agreement Iran reached with China in September 1992, the Chinese will assist in the construction of the twin Qinshan-type 300 MWe "Esteghlal" nuclear power plant near Bushehr, which is to be in operation by 2005.⁵² The site, where a full seismic study has already been conducted, was first dubbed "Esteghlal" by AEOI President Amrollahi in mid-September 1994.⁵³ On November 18, 1994, China's Ambassador to Iran Hua Liming announced that the plan to construct the plant had resumed and that specialists would be sent to Iran to assist in its construction.⁵⁴ In December 1994, Chinese nuclear scientists were reported to be in Iran to assist in the establishment of two nuclear reactors.⁵⁵

Gorgan

The "Gorgan Al Kabir Center" is the site where Iran reportedly spent \$80 million for 18 Russian nuclear technicians to conduct a geological survey and site preparations.⁵⁶ The presence of Russian nuclear technicians at Gorgan is supported by German intelligence head Bernd Schmidbauer's September 1994 statement that 14 nuclear scientists from the former Soviet Union had been present in Iran since early 1992.⁵⁷ The location was selected in 1990 for two planned V-213-type VVER-440 MWe power reactors to be purchased from the Soviet Union in exchange for natural gas.⁵⁸ According to Russian Deputy Atomic Energy Minister Yevgeniy Reshetnikov, no suitable site could be found at Gorgan, and it was decided to build the two 440 MWe reactors at Bushehr instead.⁵⁹

Karaj

The Karaj Agricultural and Medical Research Center⁶⁰ contains a Chinese calutron and a 30 MWe Belgian-supplied Ion Beam Applications (IBA) cyclotron.⁶¹ The calutron, housed in a gymnasium-sized building with a conventional ventilation system-making it "impossible" to work with radioactive substances-is intended for the production of radioisotopes for biological research.⁶² The calutron building was still under construction as of February 1995.⁶³ The cyclotron is for the acceleration and collision of sub-atomic particles in initiating nuclear transformations.⁶⁴ According to one report, "The construction of the cyclotron was completed in January 1995."⁶⁵ It is unclear if the report refers to construction of the facility housing the cyclotron or the cyclotron itself.

Mo'allem Kalayeh [a.k.a. Ghazvin/Qazvin]

Mo'allem Kalayeh is the reported location of uranium enrichment gas centrifuges being installed by Chinese and Pakistani experts.⁶⁶ The site was visited by a four-man team of IAEA inspectors in the second week of February 1992⁶⁷ and found to be a training and recreation facility for AEOI staff.⁶⁸ According to Russian Deputy Atomic Energy Minister Yevgeniy Reshetnikov, a Russian inspection of the site arrived at the same conclusion.⁶⁹ Construction work at the facility continues.⁷⁰

Tehran

The Tehran [Amirabad]⁷¹ Nuclear Research Center⁷² (TNRC) at Tehran University is the location of a U.S.-supplied five megawatts thermal (Mwt) research reactor that began operations in 1967.⁷³ Under safeguards, the reactor has operated only sporadically, limited to six to eight hours per week at one to two Mwt, according to IAEA Deputy Director General Maurizio Zifferero,⁷⁴ due to problems with fuel supply.⁷⁵ On May 5, 1987, a \$5.5 million agreement was signed between Investigaciones Aplicadas (INMAP) of Argentina and the AEOL for replacement of the reactor core. The new core operates on 20 percent enriched uranium rather than the 93 percent enriched fuel required by the U.S. supplied core.⁷⁶ In late September 1988, the IAEA approved a contract for the delivery of 115.8 kilograms of 20 percent enriched uranium from Argentina to Iran.⁷⁷ In April 1989, work on the replacement of the five Mwt reactor core was still in progress.⁷⁸ The current status of the reactor core is unknown.

According to a former engineer from the program, a plutonium extraction laboratory exists at TNRC,⁷⁹ but other reports indicate that this facility produces non-weapons-grade radioisotopes.⁸⁰ According to a March 1988 press report, Iran was trying to rebuild the plutonium extraction laboratory.⁸¹ In 1992, a uranium ore concentration facility located at the University of Tehran was described as being "incapacitated."⁸² It appears that the facility is currently not in operation.⁸³

On October 13, 1992, TNRC inaugurated the "Ibn-e Heysam" [a.k.a. Abn Hisem] research laboratory facility attached to the AEOL Laser Research Center—which includes a semiconductor branch.⁸⁴ However, the laboratory "is said to have no lasers" useful for uranium separation.⁸⁵

Yazd

In 1985, AEOL announced the discovery of an estimated 5,000 tons of high-grade uranium ore in Yazd province.⁸⁶ In 1987, the Khomeini government announced a plan to establish a uranium production plant for the processing of uranium ore into concentrate.⁸⁷ Reza Amrollahi, head of the AEOL, announced in March 1989 that the Saghand mine in Yazd province contains 3,000 tons of uranium ore and 4,000 tons of molybde-

num. He also stated that an investment of \$4 million over a three-year period would prepare the mines for production and exploitation and that uranium was also present in lesser quantities in Esfahan, Azerbaijan, Khorasan, and Sistan-va-Baluchestan provinces.⁸⁸ A research unit at the local university conducts site studies of the deposit, and site preparation for exploitation continues.⁸⁹

CONCLUSION

Based on the information presented in this report, Iran does not currently possess the requisite nuclear infrastructure for the indigenous production of fissile material in the amounts necessary for the production of nuclear weapons. The Islamic government of Iran, however, has embarked on an ambitious nuclear energy development program, though not quite as ambitious as that of the Shah's planned 23 nuclear power stations. AEOL President Reza Amrollahi recently revealed that Iran hopes to build approximately 10 nuclear reactors over a 20-year period to supply 20 percent of Iran's energy needs.⁹⁰ If everything goes according to the AEOL's plan, Unit One of the Bushehr plant should be operational in late 1999 to early 2000, and Unit Two should follow within a year or two thereafter. Units Three and Four, the V-213-type WER-440 Mwe reactors originally planned for Gorgan, would probably come on line about the same time as the two Chinese-built Qinshan-type 300 Mwe reactors at Esteghlal in 2005 or shortly thereafter. This would account for six power reactors. If Iran actually intends to build 10 nuclear power reactors, then it could well take 20 years before they are all in operation.

Commenting on the prospective sale of a gas centrifuge plant to Iran, Russian First Deputy Minister for Atomic Energy Vitaliy Konovalov noted that "... such a factory would be profitable only if the country had at least 10-15 nuclear power plants."⁹¹ Given the AEOL's stated plans, the perceived requirement for such equipment is apparent. It can be assumed that Iran will continue to pursue the acquisition of enrichment and fuel fabrication equipment in the future. Such equipment would allow Iran to exploit its reserves of natural uranium and thus secure a reliable source of fissile material unaffected by external political factors. While such acquisitions would not be in violation of the Non-Proliferation Treaty (NPT), they would be a major source of concern in the West. When and if the nuclear facili-

ties Iran currently has planned are completed, they could pose a concealed proliferation threat. Iran's future nuclear infrastructure would provide adequate cover for the acquisition of sensitive nuclear fuel cycle capabilities. It could also present a potential training ground for a nuclear weapon program. Moreover, the acquisition or development of an indigenous enrichment and fuel fabrication capability could enable Iran to produce its own weapons-grade fissile material. At this point in time, however, the future of Iran's nuclear facilities is uncertain. Further information will provide additional clues to Iran's ultimate intentions, whether peaceful or not.

¹ Natural Resources Defense Council, News Release, "Russia-Iran Protocol Provides Evidence of Discussions, But No Firm Agreement, On Sale Of Centrifuge Plant For Uranium Enrichment," May 10, 1995.

² Dmitriy Gornostayev, "A Second Irangate? Clinton Apparently Decided To Play It in Russia," *Nezavisimaya Gazeta*, May 12, 1995, p. 2; in FBIS-SOV-95-092 (12 May 1995, on-line).

³ Chris Hedges, "Iran May Be Able to Build an Atomic Bomb in 5 Years U.S. and Israeli Officials Fear," *The New York Times*, January 5, 1995, p. A5.

⁴ Leonard S. Spector, *Nuclear Ambitions* (Boulder: Westview Press, 1990), p. 204.

⁵ Voice of the Islamic Republic of Iran (Tehran), August 13, 1992; in JPRS-TND-92-030 (27 August 1992), pp. 13-15.

⁶ Mark Hibbs, "Bonn Will Decline Teheran Bid to Resuscitate Bushehr Project," *Nucleonics Week*, May 2, 1991, pp. 17-18.

⁷ "Russian-German Hybrid for Bushehr?," *Nuclear Engineering International* 39 (November 1994), p. 10. It should be noted that it is unclear how much, if any, equipment was present inside the reactor dome in 1987, or if the facility was strictly an empty shell. The damage referred to may simply be that of the steel casing of the containment dome.

⁸ Elaine Sciolino, "Iran's Nuclear Goals Lie in Half-Built Plant," *The New York Times*, May 19, 1995, pp. A1, A4.

⁹ Hibbs, "Bonn Will Decline Teheran Bid to Resuscitate Bushehr Project," *loc. cit.*, pp. 17-18.

¹⁰ "Iran May Get Reactors From The Soviet Union," *Nuclear News*, April 1990, p. 19; "...and Iran," *Nuclear Engineering International* 35 (May 1990), p. 7.

¹¹ *Ibid.*

¹² Reza Amrollahi is Chairman of AEOI and, since 1994, the assistant for nuclear affairs to President Rafsanjani *Al-Sharq Al-Awsat*, February 12, 1994, pp. 1, 4; in JPRS-TND-94-006 (16 March 1994), pp. 56-57. He studied nuclear physics at the University of Texas with follow-on training at a nuclear research center in Mol, Belgium (Claude van England, "Iran Defends Its Pursuit of Nuclear Technology," *Christian Science Monitor*, February 18, 1993, p. 7). He headed a delegation negotiating with an unknown Spanish company for nuclear technology. He is concurrently First Vice President of the Islamic Republic of Iran and President of the AEOI *Antara* (Jakarta), September 6, 1990; in JPRS-TND-90-071 (15 October 1990), p. 2). According to one European official, "While Amrollahi has reiterated at the IAEA that the Iranian nuclear program is exclusively dedicated to peaceful use, there are indications that Amrollahi is not fully in control of AEOI" (Mark Hibbs, "Bonn Will Decline Tehran Bid to Resuscitate Bushehr Project," *Nucleonics Week*, May 2, 1991, pp. 17-18).

¹³ "Iran May Get Reactors From The Soviet Union," *loc. cit.*, p. 67.

¹⁴ Mark Hibbs, "Iran May Withdraw From NPT Over Western Trade Barriers," *Nucleonics Week*, September 29, 1994, pp. 1, 8-9.

¹⁵ Mark Hibbs, "Minatom Says It Can Complete One Siemens PWR In Iran In Five Years," *Nucleonics Week*, September 29, 1994, pp. 3-4; "Russian-German Hybrid For Bushehr?," *Nuclear Engineering International* 39 (November 1994), p. 10.

¹⁶ Andrey Kolesnikov "Viewpoint: Is Russia Losing a Nuclear War?," *Moskovskiy Novosti*, March 14, 1995, p. 12; in FBIS-SOV-95-053 (20 March 1995), p. 13.

¹⁷ "Russia Determined to Complete Iran Nuclear Plant," *Interfax* (Moscow), May 4, 1995; in FBIS-SOV-95-086 (4 May 1995), p. 5.

¹⁸ "Agreement Signed On Bushehr," *Nuclear Engineering International* 40 (March 1995), pp. 4-5.

¹⁹ Reuter, "Iran Says Russians Begin Work On Nuclear Plant," November 20, 1994. "Agreement Signed on Bushehr," *Nuclear Engineering International* 40 (March 1995), pp. 4-5.

²⁰ *Ibid.*

²¹ Ayatollahi is also a Deputy Director of the AEOI. Voice of the Islamic Republic of Iran (Tehran), 13 August 1992, *loc. cit.*

²² Senthil Ratnasabapathy, "'No Evidence' Of Iranian Nuclear Bomb Plan Says IAEA," *IPS Daily Journal*, January 11, 1995, p. 3.

²³ Reuter, "Russia Signs Deal for Iranian Nuclear Plant," January 8, 1995; "Iran, Russia Agree On \$800 Million Nuclear Plant," *The Washington Post*, January 9, 1995, p. A18; "Iran's Nuke Plant Deal with Russia Raises Fears," *The Washington Times*, January 10, 1995, p. A13.

²⁴ Kolesnikov, *loc. cit.*

²⁵ Charles W. Holmes, "Iran Nuclear Plant Gets Russian Boost," *The Washington Times*, February 12, 1995, pp. A1, A9; "Russen bauen bereits iranisches Atomkraftwerk," *Süddeutsche Zeitung*, February 16, 1995.

²⁶ "Agreement Signed On Bushehr," *loc. cit.*

²⁷ Lally Weymouth, "Riches to Rouges," *The Washington Post*, April 20, 1995.

²⁸ Aleksandr Platkovsky, *Izvestiya*, January 13, 1995, p. 3; in *Current Digest of the Post-Soviet Press*, February 8, 1995, p. 30; Fred Hiatt, "U.S. Efforts to Block Iran Reactor Sale Cause Anger in Moscow," *Washington Post Foreign Service*, March 2, 1995.

²⁹ "Iran, Russia Agree On \$800 Million Nuclear Plant Deal," *The Washington Post*, January 9, 1995, p. A18; "In Russia," *Post-Soviet Nuclear & Defense Monitor* 2 (January 16, 1995), p. 12; "Agreement Signed on Bushehr," *loc. cit.*, pp. 4-5.

³⁰ "Russia is Determined to Complete Iran Nuclear Plant," *Interfax* (Moscow), May 4, 1995; in FBIS-SOV-95-086 (4 May 1995), p. 5.

³¹ Gennadiy Yezhov and Andrey Serov, *Itar-Tass* (Moscow), May 11, 1995; in FBIS-SOV-95-091 (11 May 1995, on-line).

³² Reuter, September 11, 1994; in Executive News Service, September 11, 1994.

³³ Konstantin Eggert, "Smolensk Square Surprised at the Reaction," *Izvestiya*, February 15, 1995, p. 3; in FBIS-SOV-95-031 (15 February 1995), p. 9.

³⁴ AFP (Paris), November 25, 1992; in JPRS-TND-92-045 (December 7, 1992), p. 16.

³⁵ Spector, *op. cit.*, p. 204.

³⁶ "A Bomb for the Ayatollahs?," *The Middle East* (October 1992), p. 23.

³⁷ Mark Hibbs and Margaret L. Ryan, "Official Says China Developing Ability to Supply Entire PWRs," *Nucleonics Week*, October 1, 1992, pp. 4-5.

³⁸ *Arms Control Reporter* (March 1993), p. 435.B.153.

³⁹ International Atomic Energy Agency, Press Release 92/11 of 14 February 1992, INFCIRC/406, Annex 2; "IAEA Inspection Team Finds Nothing Suspicious," *Nuclear News* (April 1992), p. 67; "Dimona et al.," *The Economist*, March 14, 1992, p. 46.

⁴⁰ David Albright and Mark Hibbs, "Spotlight Shifts To Iran," *The Bulletin of the Atomic Scientists* (March 1992), pp. 9-11.

⁴¹ Mark Hibbs, "U.S. Warned Not To Try Using IAEA To Isolate or Destabilize Iran," *Nucleonics Week*, October 8, 1992, pp. 9-10.

⁴² R. Jeffrey Smith, "Officials Say Iran Is Seeking Nuclear Weapons Capability," *The Washington Post*, October 30, 1991, pp. A1, A20; Elaine Sciolino, "Intelligence Report Indicates Iran Has Been Seeking Nuclear Arms," *The*

New York Times, October 31, 1991, p. A9.

⁴³ Shirley A. Kan, *Chinese Missile and Nuclear Proliferation: Issues for Congress* (Washington, D.C.: Congressional Research Service), August 24, 1992, p. 8.

⁴⁴ Foreign Intelligence Service of the Russian Federation, *Nuclear Non-Proliferation Treaty: Extension Problems* (Moscow 1995), (hereafter FIS Report).

⁴⁵ Hibbs, U.S. Warned Not To Try Using IAEA To Isolate or Destabilize Iran," *loc. cit.*, pp. 9-10.

⁴⁶ *Het Belang Van Limburg* (Hasselt), February 12, 1992, pp. 1, 4; in JPRS-TND-92-005 (3 March 1992), pp. 39-40.

⁴⁷ Michael Z. Wise, "Atomic Team Reports on Iran Probe," *The Washington Post*, February 15, 1992, pp. A29-A30.

⁴⁸ Albright and Hibbs, *loc. cit.*

⁴⁹ Chris Hedges, "Iran May Be Able To Build An Atomic Bomb In 5 Years, U.S. and Israeli Officials Fear," *The New York Times*, January 5, 1995, p. A5.

⁵⁰ Arnold Beichman, "A Modern Genghis With Risky Dreams?," *The Washington Times*, August 13, 1992, p. G3.

⁵¹ Mark Hibbs, "Bonn Will Decline Teheran Bid to Resuscitate Bushehr Project," *loc. cit.*, pp. 17-18.

⁵² "Russian-German Hybrid for Bushehr?" *Nuclear Engineering International* 39 (November 1994), p. 10; United Press International, "China Goes Ahead With Nuclear Plants in Iran," 11/21/94; in Executive News Service, November 21, 1994; Mark Hibbs, "Iran May Withdraw from NPT over Western Trade Barriers," *loc. cit.*, pp. 1, 8, 9; "Agreement Signed On Bushehr," *loc. cit.*, pp. 4-5.

⁵³ Mark Hibbs, "Minatom Says It Can Complete One Siemens PWR In Iran In Five Years," *Nucleonics Week*, February 29, 1994, pp. 3-4.

⁵⁴ United Press International, "China Goes Ahead With Nuclear Plants in Iran," *loc. cit.*

⁵⁵ "Reactor Tourists," *Far East Economic Review*, December 1, 1994.

⁵⁶ "China Sells Reactor to Iran," *Mednews*, September 14, 1992, p. 2.

⁵⁷ Heinz Vielain, *Welt am Sonntag* (Hamburg), August 21, 1994, pp. 1-2; in JPRS-TND-94-017 (8 September 1994), pp. 43-44.

⁵⁸ *Het Belang Van Limburg* (Hasselt), February 12, 1992, pp. 1, 4; in JPRS-TND-92-005, (3 March 1992), pp. 39-40; Mark Hibbs, "IAEA Explores Iran's Intentions, Minus Evidence of Weapons Drive," *Nucleonics Week*, February 13, 1992, pp. 12-13; "Agreement Signed on Bushehr," *loc. cit.*

⁵⁹ Kolesnikov, *loc. cit.*

⁶⁰ International Atomic Energy Agency, Press Release 92/11 of 14 February 1992, *loc. cit.*

⁶¹ *Het Belang Van Limburg* (Hasselt), February 12, 1992, *loc. cit.* FIS Report, *op. cit.*

⁶² Mark Hibbs, "U.S. Warned Not To Try Using IAEA To Isolate or Destabilize Iran," *loc. cit.*; FIS Report, *op. cit.*; Claude van England, "Iran Defends Its Pursuit of Nuclear Technology," *Christian Science Monitor*, February 18, 1993, p. 7.

⁶³ FIS Report, *op. cit.*

⁶⁴ van England, *loc. cit.*

⁶⁵ FIS Report, *op. cit.*

⁶⁶ Mark Hibbs, "Bonn Rules Out Work on Bushehr; Iran will get Gas-Fired Plant," *Nucleonics Week*, July 4, 1991, pp. 7-8; Albright and Hibbs, "Dimona et al," *loc. cit.*; Alon Pinkas, "Thinking the Unthinkable about Iran," *The Jerusalem Post*, April 23, 1992.

⁶⁷ Michael Z. Wise, "Atomic Team Reports on Iran Probe," *The Washington Post*, February 15, 1992, pp. A29-A30; "IAEA Inspection Team Finds Nothing Suspicious," *Nuclear News* (April 1992), p. 67.

⁶⁸ Hibbs, "Bonn Rules Out Work on Bushehr; Iran will get Gas-Fired Plant," *loc. cit.*

⁶⁹ Kolesnikov, *loc. cit.*

⁷⁰ FIS Report, *op. cit.*

⁷¹ Beichman, *loc. cit.*

⁷² International Atomic Energy Agency Press Release 92/11 of 14 February 1992, *loc. cit.*

⁷³ Spector, *op. cit.*, p. 218; Frank Barnaby, *The Invisible Bomb: The Nuclear*

Arms Race in the Middle East (London: I. B. Tauris & Co., Ltd., 1989), p. 124.

⁷⁴ Gamini Seneviratne, "IAEA Approves Argentine Fuel for Teheran Research Reactor," *Nuclear Fuel*, October 3, 1988, p. 13.

⁷⁵ Hibbs, "U.S. Warned Not To Try Using IAEA To Isolate or Destabilize Iran," *loc. cit.*

⁷⁶ "Argentina Strikes a Deal with Iran," *Nuclear Engineering International* 32 (July 1987), pp. 4-5; "Argentina Confirms Deal for Work on Bushehr," *Nuclear News* (July 1987), p. 54.

⁷⁷ Gamini Seneviratne, *loc. cit.*, p. 13; Mark Hibbs, "Sensitive Iran Reactor Deal May Hinge on MFN for China," *Nucleonics Week*, October 1, 1992, pp. 5-6; van England, *loc. cit.*

⁷⁸ *Clarín* (Buenos Aires), April 4, 1989, p. 12; in JPRS-TND-89-010 (23 May 1989), pp. 10-11.

⁷⁹ Spector, *op. cit.* p. 206.

⁸⁰ FIS Report, *op. cit.*

⁸¹ Spector, *op. cit.*, p. 207.

⁸² Mark Hibbs, "U.S. Warned Not To Try Using IAEA To Isolate or Destabilize Iran," *loc. cit.* pp. 9-10; FIS Report, *op. cit.*

⁸³ FIS Report, *op. cit.*

⁸⁴ IRIB Television First Program (Tehran), October 13, 1992; in FBIS-NES-92-201 (16 October 1992), p. 40.

⁸⁵ *Ibid.*

⁸⁶ Spector, *op. cit.* p. 218; *Nuclear News* (March 1985), pp. 117-118; Barnaby, *op. cit.*, p. 126.

⁸⁷ Spector, *op. cit.*, p. 206.

⁸⁸ "Iran Plans Exploitation of Uranium Deposits," *Nuclear Engineering International* (March 1989), p. 6.

⁸⁹ FIS Report, *op. cit.*

⁹⁰ Elaine Sciolino, "Iran Announces Plan to Build 10 Nuclear Reactors," *The Sunday Herald*, May 14, 1995, pp. 1A, 8A.

⁹¹ Interfax (Moscow), May 18, 1995; in FBIS-SOV-95-096 (18 May 1995, on-line).