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Iraq's Nuclear Program: Acquiring a Nuclear Fuel Cycle

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A Research Paper

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A Research Paper

This paper was prepared by the Office of Near Eastern and South Asian Analysis. It was coordinated with the Directorate of Operations.

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Comments and queries are welcome and may be directed to the Chief, South Asia Division, NESA

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Iraq's Nuclear Program: Acquiring a Nuclear Fuel Cycle

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Key Judgments

Information available as of 18 January 1985 was used in this report.

Israel's destruction of Iraq's principal research reactor in 1981 and war-related economic difficulties have not dampened Iraq's interest in enhancing its nuclear capabilities, skills, and facilities. Iraq, however, is still at least a decade away from having nuclear facilities with the potential to support nuclear weapons development.

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Iraqi President Saddam Husayn has long advocated the development of an "Islamic bomb" that would give the Arab states strategic leverage over Israel.

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In our view, Saddam also believes that development of a nuclear weapons capability would advance Iraq's security interests in the region. A nuclear capability would further Baghdad's goal of becoming the preeminent Arab state in the Persian Gulf and might serve as a long-term deterrent to a vengeful Iran.

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Despite Baghdad's interest in pursuing nuclear research, Iraq will have to depend on extensive foreign assistance and technology to master virtually all aspects of the nuclear cycle. Fear of losing access to vital foreign technology should inhibit any desire to violate international safeguards.

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We anticipate that, when its war with Iran ends, Baghdad will accelerate its efforts to complete a nuclear fuel cycle. Until then, we expect Baghdad to try to exploit the "gray market" to acquire nuclear materials and technology. Since 1980, Iraq has concentrated on using European intermediaries to buy otherwise unavailable US technology and on breaking down orders for equipment into subcomponents not subject to export controls in the European vendor countries. Although results have been mixed, we expect Baghdad to continue using these methods.

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Defenses around the Tuwaitha nuclear center have been greatly strengthened since 1981, but Israeli or Iranian military action could still retard Iraqi nuclear goals. Another Israeli raid on Tuwaitha would embroil the United States in an Iraqi-led campaign to expel Israel from the International Atomic Energy Agency and damage US relations with moderate Arab states.

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Iraq's dogged pursuit of a nuclear fuel cycle will also impinge on US interests by:

- Demonstrating that the gray market can be used to evade US efforts to promote tighter international controls over nuclear trade.
- Circumventing US export controls and policies by employing West European intermediaries to obtain US-origin goods.

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Figure 1
Iraqi Nuclear Facility

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Iraq's Nuclear Program: Acquiring A Nuclear Fuel Cycle

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Despite its war with Iran, economic difficulties, and Israel's destruction in 1981 of its principal research reactor, Iraq has not lost interest in nuclear research. Baghdad continues to collaborate with foreign suppliers to expand its fuel cycle capabilities.

Although we lack firm evidence of Iraq's weapons goals or of its strategy to attain those goals, Iraq's 10-year search for foreign nuclear assistance provides many indicators of a long-term desire to acquire a complete nuclear cycle. On the basis of our analysis of Iraq's nuclear procurement strategy and on the steps taken by other would-be proliferant countries, we believe that Iraq's course points to a two-stage strategy for attaining fuel cycle capabilities that could be used to recover plutonium suitable for nuclear weapons from spent reactor fuel:

- In the short run, Iraq will probably try to gain as much experience in fuel-cycle-related technology as possible with currently available facilities. For example, Iraq could gain experience in handling irradiated fuel and conducting reprocessing-related research on a laboratory scale.

- In the longer term, we would expect Iraq to attempt to secure a reactor and perhaps a larger scale reprocessing facility more directly suitable for the production of plutonium for use in nuclear weapons than its present laboratory-scale facilities.

Iraqi President Saddam Husayn has long advocated the development of an "Islamic bomb" that would give the Arab states strategic leverage over Israel.

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In our view, Saddam also probably believes that development of a nuclear weapons capability would advance Iraq's security interests in the region. A nuclear capability would further Baghdad's goal of becoming the preeminent Arab state in the Persian Gulf and might serve as a long-term deterrent to a vengeful Iran.

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Developing the Nuclear Program: The Search for Aid

The Early Days: A Frustrated Bid for the Direct Route to Plutonium

Iraq acquired a small research reactor and isotope-production facility from the Soviet Union in the late 1960s, but its major effort to obtain foreign nuclear aid began after several dramatic events in 1974:

- The Indian nuclear explosion in May.
- The announcement in June by the Shah, a traditional rival, that Iran planned to build several power reactors.
- The quadrupling of oil prices in 1973-74, which permitted Iraq to finance expensive development projects.

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France: The First Patron

France has helped Iraq master reactor operation and design. Since the Israeli raid in June 1981, however, France has progressively tightened safeguards.

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According to Embassy reporting, the bilateral agreement, signed in 1976, that called for French contractors to build a reactor and laboratory complex at Tuwaitha was a compromise reached after Paris rejected Iraqi requests for the same type of reactor used in the French nuclear weapons program and a reprocessing plant to extract plutonium from its spent fuel.

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the Mitterrand government will probably negotiate a bilateral agreement with Baghdad, a requirement for implementing the commercial contract. Pending such an agreement, we believe that Paris is allowing CERBAG to make limited preparations for the reconstruction project.

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French companies are probably already doing limited work at the reactor site. the outer wall of an experiment hall surrounding the remains of the Tammuz 1 reactor and an underground experimental chamber adjoining the reactor pool are being rebuilt.

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We believe the restrictions that France has placed on its assistance will prevent the production of weapons-grade plutonium from the reactor unless Iraq violates safeguards and French limitations on reactor operations. French officials told US representatives in July 1983 that they would provide fuel containing only low-enriched uranium (which is not suitable for use in nuclear weapons) and match fuel deliveries to a reactor operating schedule that would make undetected plutonium production more difficult. Furthermore, France said in 1983 that it would require the spent fuel to be returned to France. The French also said that they were studying the possibility of reprocessing Tammuz fuel in France. Nonetheless, Iraqi involvement in a rebuilt Tammuz facility would be of value in enhancing their understanding of reactor engineering and materials testing.

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Italy: Fuel Cycle Facilities on the Installment Plan

Italy has provided training and technology in nuclear fuel fabrication, reprocessing, and radioisotope production. The Italian-Iraqi nuclear relationship is long-standing, extensive, not well regulated by Italian authorities, and tainted by Iraqi bribery of Italian officials. Cooperation dates back to the mid-1970s when Italy agreed to build a major laboratory complex at Tuwaitha. Italy also agreed to provide training and aid in designing the facilities if its industrial firms received construction contracts.

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The Laboratory Complex. SNIA-Techint, an Italian contractor, turned over to Iraq in February 1983 completed laboratories for nuclear fuel fabrication, materials testing, chemical engineering research, and the production of isotopes.

Iraq will probably try to gain as much experience as possible from these facilities, including handling irradiated fuel and conducting reprocessing-related research on a laboratory scale. Such research can be done legitimately as long as the safeguards arrangements associated with the equipment are observed. We cannot confirm that the Italian laboratories currently give Iraq the capability to reprocess spent fuel to recover plutonium, but Baghdad has taken steps, with the help of SNIA-Techint, that could lead to such a reprocessing capability:

- the labs were similar to the EUREX reprocessing facility in Italy.
- In mid-1982, Italian officials who visited Tuwaitha were surprised to find that the equipment in the labs, although incomplete, was comparable to that in the most advanced reprocessing laboratories in Western Europe.
- Iraq has already acquired or installed equipment for handling the highly radioactive materials encountered in reprocessing spent fuel. These include a remote maintenance capability for hot cells where radioactive materials could be handled; sealed glove boxes suitable for handling plutonium; and a highly sophisticated chopping machine used to cut up spent-fuel elements in the first stage of reprocessing.

The Iraqis have also obtained additional laboratories, technology, and equipment from the Italians that would, in our judgment, assist them in making test fuel elements and samples for irradiation in their research reactor. In late 1981, the Iraq Atomic Energy Commission (IAEC) asked SNIA-Techint to supply laboratories for refining uranium ore, making uranium hexafluoride (which is the chemical form for the enrichment of uranium), fabricating reactor fuel and fuel-element parts, and making natural uranium metal, a preferred material for irradiating in a reactor to make plutonium.

The CIRENE Reactor. Iraq showed a strong interest in purchasing a CIRENE reactor, a heavy-water-moderated reactor suitable for plutonium production that is under development by Italy. Although Italian officials told US representatives in late 1981 that the vendor had completed a feasibility study on plant construction for the IAEC, the vendor did not want to resume talks for fear of Israeli reprisals. The US Embassy in Rome, moreover, has reported that the CIRENE currently exists only as an uncompleted prototype.

Training

training that Italy provided for approximately 100 Iraqis between 1979 and 1980 further support our contention that Baghdad is interested in acquiring the technology to reprocess spent nuclear fuel. Our analysis of the training program shows that it was directed toward nuclear fuel fabrication, production of reactor parts, reprocessing, and the testing of materials used in building and operating nuclear fuel cycle facilities

Table 1
Foreign Training of Iraqi Nationals in Sensitive Technologies [a]

	Italy [b]					France [c]	
	Reprocessing	Nuclear Fuel Fabrication	Materials Testing	Isotope Production	Maintenance	Reactor Operations	Nuclear Science
Total	**16**	**32**	**25**	**6**	**21**	**250**	**64**
Managers	5	3	5	None	[d]	[d]	[d]
Supervisory scientists and engineers	1	1	6	None	None	[d]	[d]
Scientists and engineers	4	9	11	2	1	[d]	[d]
Technicians	6	15	3	3	18	[d]	[d]
Equipment operators and skilled workers	None	4	None	1	2	[d]	[d]

[a] Grand total (all fields)—414.
[b] Italy (subtotal—all fields)—100.
[c] France (subtotal—all fields)—314.
[d] Level unknown.

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(table 1). We believe that the trainees took part in EUREX operations and reviewed the operating manual of the EUREX reprocessing plant similarities between this facility and the laboratories at Tuwaitha Center.

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The Soviet Union: Limited Technical Aid

The USSR, Iraq's oldest nuclear partner, has thus far played a limited role in Iraq's nuclear development, confining its activities to fueling and maintaining the IRT-5000 research reactor that it supplied in the 1960s. Soviet assistance has not contributed to Iraq's fuel cycle objectives. In early 1984, the Soviets had refueled the reactor in conjunction with completion of its refurbishment by a Belgian firm.

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In March 1984, however, Iraq and the USSR signed a contract for a feasibility study for construction of a power reactor in Iraq. A Japanese company estimates that it would take the Soviets two years to select a site and another two years to prepare it for construction. It is unlikely that Baghdad will conclude a contract for construction of a power reactor before the Iraq-Iran war ends, but in our opinion the USSR would like to get such an agreement soon for its commercial benefits and to strengthen political ties. If the Soviets eventually build a power plant, it is not likely to pose a serious proliferation threat, because they have traditionally required tight IAEA safeguards on their exported reactors, including the return of spent nuclear fuel to the USSR.

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Other Suppliers

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our analysis of Iraq's imports of nuclear products show that Austria, Switzerland, Japan, the Netherlands, and West Germany have been important suppliers of laboratory equipment, technology, training, and components for the French and Italian facilities at Tuwaitha Center. Firms in these countries have supplied lasers and other equipment that may be related to uranium-enrichment research as well as computers and reactor control equipment (table 2).

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US Embassies have reported that Iraq bought large quantities of ore and natural uranium in the late 1970s and early 1980s from Brazil, Portugal, Spain, and Niger.

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25X1 Iraqi agents negotiated joint ventures in uranium mining during the same period with Tunisia and Morocco. Iraq may have acquired some processed uranium dioxide from Brazil in 1981 and 1983.

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Working the Nuclear Marketplace: Iraq's Procurement Strategy

Our analysis shows that Iraq has used a combination of tactics to promote its long-term objective of closing the nuclear fuel cycle. Judging from our review of past procurement actions, Iraq adopted a new strategy in the mid-1970s after it had failed to acquire sensi-

25X1 tive facilities directly. it resorted, with mixed success, to bribery of nuclear officials in Italy, threats against Italian contractor companies, attempts to buy uranium and nuclear-related equipment through front companies controlled by Iraqi intelligence, and direct contacts by Iraqi intelligence officers with potential sellers.

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Exploiting the Black and Gray Markets

25X1 Our analysis shows that Iraq is actively involved in what we define as the "gray market" (those transactions that do not violate the letter of supplier state export controls but appear to violate the intent) to secure nuclear materi-

25X1 als and technology Gray market transactions are much easier to facilitate than those on the open market because sales can be arranged on a component-by-component or subsystem-by-subsystem basis that would be strictly regulated or not allowed at all if sold on a total system basis.

25X1 Iraq has been most successful when it has used European firms as intermediaries to evade US or other supplier state export controls. Firms in Italy, France, Austria, Switzerland, Lichtenstein, and West Germany have ordered nuclear-related equipment from the United States that has been transshipped to Iraq. Among the items that Iraq has acquired in this manner are computerized reactor control equipment for Tammuz 1 (1982), a multichannel analyzer (1982), and remote manipulators for handling highly radioactive materials (April 1981).

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One example illustrates how the "European connection" works for Iraq. In May 1982, the US Embassy in Switzerland reported that the Iraqi Atomic Energy Commission placed an order with the Swiss subsidiary of a US firm for computer reactor control equipment 25X1 that we believe was intended for use in rebuilding 25X1 Tammuz 1. The United States had denied permission for the parent company to export the equipment. 25X1

the Iraqis issued a letter of credit to the Swiss 25X1 subsidiary for the equipment.

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Iraqi attempts to organize clandestine procurement operations through 25X1 front organizations or intelligence operations have had only modest results and have often been spectacularly unsuccessful. For example:

- The IAEC used the Arab Mining Company (ARMICO), normally a joint stock company owned by several Arab countries with headquarters in Jordan, to negotiate uranium mining and purchase agreements in North and Central Africa in the late 1970s and early 1980s. Former IAEC Vice Chairman and Minister of Education Abd al-Razzaq Qasim al-Hashimi has been identified in the Iraqi press as ARMICO Chairman. Even while he was serving as IAEC Vice Chairman, Hashimi traveled to Brazil in 1981 in his ARMICO role to discuss nuclear cooperation with the Brazilian Government. In our view, the ARMICO connection may have allowed Iraq to disclaim a direct role in some 25X1 negotiations. 25X1 we believe the IAEC's main achievement through the ARMICO cover is a joint venture with Morocco for extracting uranium from phosphates, which began operation in 1983.

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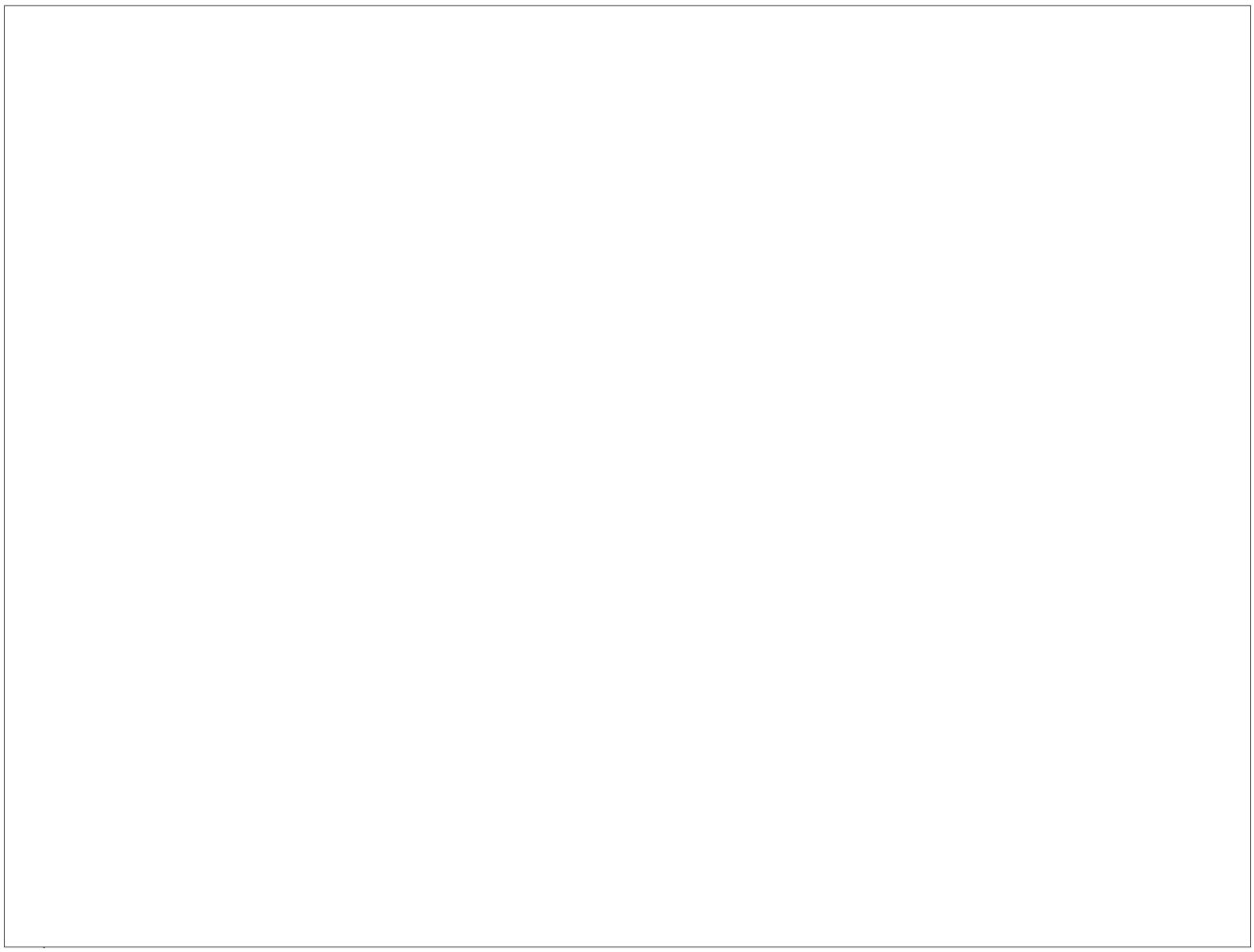

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European suppliers, for instance, have been subjected to economic pressures:

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- in 1981 that Iraq agreed to supply 60 percent of Portugal's oil needs in return for uranium ore.

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Economic Leverage: Diminished, but Not Forgotten

Iraq has a history of promising oil deliveries, arms purchases, and other economic incentives in exchange for transfers of nuclear technology and materials.

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Baghdad's leverage, however, has not entirely disappeared. Prospects for completion of pipeline projects that would boost Iraq's oil export capacity point to a renewal of Western interest in securing a long-term trade position in Iraq. Any significant increase in Iraq's oil export capacity would improve the chances of a resumption of at least some stalled economic development projects. Moreover, potential nuclear partners such as France and Italy are well aware of the Ba'thist regime's history of rewarding friends that stick by it in times of stress. Such energy-deficient industrial states would be attracted by the long-term outlook for Iraqi oil exports; reserves are large, and

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Baghdad could sustain petroleum production of at least 4 million b/d well into the next century.

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We believe that the IAEC, before 1981, attempted to use its purported interest in buying a power reactor to induce foreign vendors to make other technology transfers. French and Italian Government and industry representatives believed in the late 1970s, when the agreements for the construction of the Tuwaitha Center were being signed, that offering research facilities at small profit margins or even below cost would give them advantages in bidding on a potentially profitable power reactor project that Iraq advertised from 1975 to 1981.

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the Italians decided in 1979 to offer the CIRENE reactor to stay in the competition.

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the US Embassy in Paris reported in May 1984 that France believed that the Soviet Union was expanding its commercial role in Iraq at Paris's expense, particularly in arms sales.

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Pressure on Vendor Firms and Governments

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Baghdad has exerted pressure on some of the firms selling nuclear services and equipment to Iraq to act as agents or brokers for obtaining nuclear-related training, technology, and equipment from third parties. In other instances, the Iraqis have used bribes or threats to secure cooperation from the vendors or their governments. We believe that these relationships have assisted Iraq in establishing what appears to be an extensive procurement network run directly by the IAEC.

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The sharp drop in Iraqi oil exports—from over 3 million barrels per day (b/d) in 1979 to about 900,000 b/d now—following the start of the Iraq-Iran war greatly reduced Baghdad's economic leverage with its nuclear suppliers. Iraq's influence has been further reduced by the slack world oil market.

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[redacted]

25X1 [redacted] Iraq delayed payments to SNIA-Techint in 1982 and, on one occasion, withheld exit visas for SNIA personnel working in Iraq. [redacted] the company agreed to complete the laboratories and to provide additional training partly as a result of such coercion. [redacted]

According to [redacted] the US Embassy in Rome, Iraq has used bribery to facilitate its relationship with the Italian Atomic Energy Commission:

[redacted]

- In 1979, US Embassy officials in Rome learned that IAEC personnel had given expensive gifts to their Italian counterparts.
- In 1983, [redacted] Italian officials investigating alleged corruption in their nuclear program believed that the Iraqis had bribed several officials, possibly to facilitate the transfer of sensitive technology related to reprocessing. [redacted]

Outlook

We expect Iraq to continue pursuing a two-tiered objective—fuel cycle technology and creation of an experienced work force in the short term, and acquisition of larger fuel cycle facilities ultimately capable of producing plutonium suitable for nuclear weapons in the long term. We believe that Iraq is at least a decade away from accomplishing this long-term objective. Israeli or Iranian military action could retard it even further. [redacted]

Baghdad's dependence on foreign assistance will continue to make its foreign procurement strategy a key element in accomplishing both the long- and short-term goals. We expect that this same dependency will also force the Iraqis to continue to observe international safeguards. [redacted]

In the short run, we believe Baghdad will focus its efforts in the following areas of its nuclear program:

- Training its nuclear work force at the Tuwaitha Center as well as in Western Europe. The work force is not capable of operating sophisticated fuel cycle facilities without outside assistance.
- Rebuilding the Tammuz 1 reactor as soon as possible, even if this means submitting to French demands for enhanced international safeguards and controls over the operation of the reactor.
- Developing reprocessing-related technology by acquiring and using additional components and equipment for the Italian laboratory complex for limited "hot" work. These activities would be conducted within the provisions of Iraq's safeguards agreement with the IAEA, but the experience would help close the gap in Iraq's knowledge of the fuel cycle. [redacted]

Implications for the United States

Iraq's persistent search for foreign nuclear assistance poses a challenge to US nonproliferation and foreign policy interests:

- The indirect transfer of US and other equipment and technology to Iraq through European intermediaries could become a contentious issue in US relations with Iraq and nations that tolerate this trade. Iraq may respond to tougher control measures by channeling more of its purchases into gray market operations.
- Other potential proliferants could become convinced that Iraq's success in acquiring nearly all of the facilities it needs for laboratory-scale reprocessing clearly demonstrates that the international gray market can be used to evade national export controls in the major supplier states. This development would complicate US efforts to promote tighter supervision of such trade.

- The spread of sensitive information through training programs poses a serious challenge to US efforts to control the spread of sensitive nuclear technologies.

- We speculate that Israel or Iran at some time might regard the emerging reprocessing capabilities at the Tuwaitha Center as an intolerable security threat. Reconstruction of the Tammuz 1 reactor would, in our judgment, tempt either Israel or Iran to attack Iraq's nuclear facilities. If Israel were to attack the Tuwaitha Center again, other Arab or Muslim countries probably would accuse the United States of complicity, as they did in 1981. We expect that such an attack would damage US relations with moderate Arab states and give new life to the stalled Iraqi campaign to expel Israel from the IAEA.

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