UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

Before Administrative Judges:

G. Paul Bollwerk, III, Chairman
Dr. Paul B. Abramson
Dr. Charles N. Kelber

In the Matter of	Docket No. 70-3103-ML
LOUISIANA ENERGY SERVICES, L.P.	ASLBP No. 04-826-01-ML
(National Enrichment Facility)	June 25, 2004

MEMORANDUM AND ORDER
(Material for the Record)

During the June 15, 2004 prehearing conference in this proceeding, petitioner New Mexico Environment Department (NMED) asked that a statement by Environment Secretary Ron Curry be placed in the record of this proceeding. See Tr. at 128. Additionally, petitioners Nuclear Information and Resource Service and Public Citizen (NIRS/PC) provided the Licensing Board and the other participants with copies of several items that they indicated were cited in their reply pleading. See Tr. at 218. Copies of Secretary Curry's statement (Attachment 1) and the NIRS/PC documents (Attachments 2-6) are attached to this memorandum and order, which should be incorporated into this proceeding.

Because the attached materials were provided to the Board and the participants at the prehearing conference, the Office of the Secretary need not serve the attached items upon the participants or the Board.

It is so ORDERED.

FOR THE ATOMIC SAFETY
AND LICENSING BOARD*

G. Paul Bollwerk, III
ADMINISTRATIVE JUDGE

Rockville, Maryland

June 25, 2004

* Copies of this memorandum and order, without the accompanying attachments, were sent this date by Internet e-mail transmission to counsel for (1) applicant Louisiana Energy Services, Inc.; (2) petitioners NMED, the Attorney General of New Mexico, and NIRS/PC; and (3) the NRC staff.

UNITED STATES OF AMERICA
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CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing LB MEMORANDUM AND ORDER (MATERIAL FOR THE RECORD) have been served upon the following persons by deposit in the U.S. mail, first class, or through NRC internal distribution.

Office of Commission Appellate
Adjudication
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Administrative Judge
G. Paul Bollwerk, III, Chair
Atomic Safety and Licensing Board Panel
Mail Stop - T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Administrative Judge
Paul B. Abramson
Atomic Safety and Licensing Board Panel
Mail Stop - T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Administrative Judge
Charles N. Kelber
Atomic Safety and Licensing Board Panel
Mail Stop - T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Lisa B. Clark, Esq.
Angela B. Coggins, Esq.
Office of the General Counsel
Mail Stop - O-15 D21
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Claybourne F. Clarke, Esq.
Assistant General Counsel
Tannis L. Fox, Esq.
Deputy General Counsel
Office of General Counsel
New Mexico Environment Department
1190 St. Francis Drive
Santa Fe, NM 87502-6110

Docket No. 70-3103-ML
LB MEMORANDUM AND ORDER
(MATERIAL FOR THE RECORD)

James R. Curtiss, Esq.
David A. Repka, Esq.
Martin J. O'Neill, Esq.
Winston & Strawn LLP
1400 L Street
Washington, DC 20005-3502

David M. Pato, Esq.
Stephen R. Farris, Esq.
Christopher D. Coppin, Esq.
Assistant Attorneys General
Glenn R. Smith, Esq.
Deputy Attorney General
Office of the New Mexico Attorney General
P.O. Box Drawer 1508
Santa Fe, NM 87504-1508

Lindsay A. Lovejoy, Jr.
618 Paseo de Peralta, Unit B
Santa Fe, NM 87501

Lisa A. Campagna, Esq.
Assistant General Counsel
Westinghouse Electric Company LLC
P.O. Box 355
Pittsburgh, PA 15230-0355

John W. Lawrence, Esq.
Louisiana Energy Services, L.P.
2600 Virginia Ave., NW, Suite 610
Washington, DC 20037

Adria T. Byrdsong
Office of the Secretary of the Commission

Dated at Rockville, Maryland,
this 25th day of June 2004

ATTACHMENT 1

State of New Mexico
ENVIRONMENT DEPARTMENT
Office of the Secretary
Harold Runnels Building
1190 St. Francis Drive, P.O. Box 26110
Santa Fe, New Mexico 87502-6110
Telephone (505) 827-2855
Fax (505) 827-2836

BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

June 14, 2004
Immediate Release

Contact: Jon Goldstein, NMED Communications Dir.
Phone: (505) 827-0314

Environment Secretary Ron Curry Statement to the Atomic Safety and Licensing Board

(Santa Fe, NM) —"I am pleased to be here and speak to you today on behalf of Governor Bill Richardson.

Governor Richardson recognizes the potential economic and other benefits of LES's proposed uranium enrichment facility. And, both Governor Richardson and I appreciate the level of cooperation LES management has shown the State thus far.

That said, the State of New Mexico intends to ensure that the LES facility is operated safely, and protects the citizens of New Mexico and our environment. As our filings with the Atomic Safety and Licensing Board have stated, we believe a more complete plan for the disposal of the depleted uranium that will be generated by the facility is needed.

Clarity on this point is essential. We do not want New Mexico to be put in the same position as other states that have accumulated large inventories of depleted uranium over a long period of time without a clear disposal pathway. We want to ensure that the health and safety of this community and its environment remains protected. In our view, this means that depleted uranium waste should be moved off-site and disposed of outside of New Mexico as quickly as possible.

It is for this reason that the New Mexico Environment Department, on behalf of the Governor, has petitioned to intervene in this matter. We intend to work with LES both inside and outside of this proceeding to establish a clearer schedule for storage and a firmer disposal pathway for this depleted uranium waste.

As the state in which LES proposes to locate, New Mexico has a unique and vital interest in participating in this proceeding. We believe, therefore, that the Board should allow NMED's intervention in order to ensure that the interests of the State of New Mexico are fully protected in this proceeding. Thank you."

For further information contact Jon Goldstein, Communications Director, NMED at (505) 827-0314.

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ATTACHMENT 2

A.Q. Khan, Urenco and the proliferation of nuclear weapons technology: - The symbiotic relation between nuclear energy and nuclear weapons

A report written by Joop Boer, Henk van der Keur, Karel Koster and Frank Slijper

Commissioned by GREENPEACE International

May 2004

ABOUT THE AUTHORS

Joop Boer (1945) is Chair of V.I.C. (Peace Information Centre) at Groningen. After studying biology and the environment he campaigned on nuclear energy and nuclear weapons proliferation issues for 25 years. He is the author of books on Dutch energy policy, nuclear waste issues and proliferation of uranium enrichment. From 1994 to 2001 he worked at WISE Amsterdam, an international anti-nuclear organisation, on nuclear energy issues. From 2001 he has run a small consultancy promoting solar energy as well as installing solar energy cells.

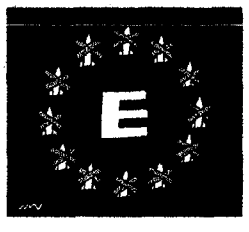
Ing. Henk van der Keur (1963) is a chemical engineer and a researcher on nuclear energy issues. He works at the Dutch Documentatie en Onderzoekscentrum Kernenergie (Documentation and Research Centre on Nucelar Energy), Laka Foundation. Since the early 1990s he has focused his work on the industrial use of depleted uranium. He has written numerous articles and papers on this waste product from the uranium enrichment industry. He is co-founder and staff member of the International Coalition to Ban Uranium Weapons (ICBUW).

Drs. Karel Koster (M.A) (1951) is a sociologist, specialising in the relationship between war, diplomacy and political change. He runs the Netherlands section of the Project on European Non-Nuclear Proliferation (PENN-Nl) in Utrecht; is a member of the executive of the Middle Powers Initiative (MPI) and European co-ordinator of the Parliamentarians Network on Nuclear Disarmament (PNND). He has specialised in nuclear weapons issues since 1996, with emphasis on political advocacy and co-ordination of anti-nuclear campaigning, nationally and internationally. He is the co-author of books and papers on NATO, Dutch security policy, the post Cold War order, the Gulf War and Turkey and developments in NATO nuclear weapons policy. He has also published various opinion pieces on nuclear arms issues in Dutch newspapers and periodicals.

Drs. Frank Slijper (M.A.) (1970) works at the Dutch Campagne tegen Wapenhandel (Campaign against Arms Trade) and has been a researcher and campaigner on arms trade issues for the last ten years. He graduated in 1993 as economist (international economic relations) on Dutch military procurement and the offset policies implemented to enhance the defence industry. He has written and published extensively on Dutch arms exports and policy ever since. For many years one of the focal points of his work has been the arms trade to India and Pakistan. Most recently he co-authored "Explosieve materie -Nederlandse wapenhandel blootgelegd" [Explosive material - Dutch arms trade revealed"], a unique handbook based on 16,000 pages of previously secret information, released through the Dutch Freedom of Information Act.

QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.

LAKA V.I.C.



PREFACE

Greenpeace International has commissioned this report to provide some insight into how one particular country, Pakistan, procured the technology to start its nuclear programme.

Through the history of the Khan network and its links to Urenco, the report highlights how easily civil nuclear technology can be acquired then put to military use. The report also shows how easily the international and domestic export controls system for civil nuclear technology can be circumvented to obtain the materials necessary to manufacture nuclear weapons.

As the authors of this report state:

"The role played by Urenco in the proliferation of nuclear technology as described in this paper illustrates clearly that the use of this technology for peaceful or military purposes cannot be separated. Furthermore, the existing international treaty obligations, which call for free access to nuclear technology for all member countries and for applying safeguards to nuclear materials, have in fact obfuscated an extremely important fact: the development of nuclear power as a source of energy makes it possible to create the basis of a nuclear weapons program."

Controlling who can have access to what types of nuclear technology through Article IV of the nuclear Non-Proliferation Treaty – as many are suggesting - is not the answer. The road to stopping countries acquiring the technology is not through saying some can have it and some can't. As past history has taught us, if countries cannot acquire this technology through legal means they will acquire it illegally, if they have political will, determination and enough money to pay for it.

If the international community is serious about tackling the threat of poliferation, there is an urgent need to agree and implement a comprehensive fissile material treaty that bans the production and possession of plutonium and highly enriched uranium.

Ultimately, only by ending the nuclear age will the threat of a nuclear breakout be curtailed.

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EXECUTIVE SUMMARY

The Khan Network

It is now well known that the 'father' of Pakistan's nuclear weapons programme, Abdul Qadeer (AQ) Khan, had his scientific roots in the Netherlands in the 1960's and 70's. At that time he had access to what was supposed to be highly secret uranium enrichment technology: the Urenco ultra centrifuge project. Thanks to security problems, as well as deliberate and unwitting help from former teachers and colleagues, he was able to build a global nuclear information network and business. From Pakistan, ultracentrifuge technology, knowledge and materials, were exported to Libya, Iran and North Korea. A mixture of legal and illegal transactions, involving businessmen from all over the world as well as individuals in the higher circles of the military and political elite in Pakistan allowed nuclear proliferation to proceed much faster than even those most familiar with the issue expected.

The Urenco Connection

Urenco, founded in 1970, is one of the world's leading uranium enrichment companies.[1] A Dutch/German/British consortium, Urenco uses the ultracentrifuge (UC) method to separate the useable fissionable uranium from the non-fissionable uranium. The advanced ultracentrifuge technology developed by Urenco uses significantly less electricity than gas diffusion,[2] which makes it much cheaper. Moreover, a UC enrichment plant can be built in modules, in contrast with gas diffusion plants which tend to be large football field sized facilities. Given the commercial advantages of the UC method of enrichment over gaseous diffusion methods, it is becoming the technology of choice around the world and eleven countries now have UC plants.[3]

After many years of denying accusations in that direction, the IAEA and Dutch authorities have recently confirmed that this very technology seems to have made its way to Iran, Libya and North Korea as well as Pakistan.[4] Moreover, it appears that until very recently Khan used the 'Dutch branch' of his international network of suppliers and middlemen for Pakistan's nuclear programme. And one Dutchman is now under investigation for having dealt with one of the other countries as well.[5]

The Risk of Proliferation

There are two steps in the civil nuclear chain which are most vulnerable with regard to nuclear proliferation: the export of technology for uranium enrichment and the reprocessing of spent nuclear fuel. The vulnerability of Urenco's security measures certainly goes a long way to explaining how interested states and non-state parties could obtain a nuclear arsenal via civil nuclear technology.

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[1] Boer, Joop; Uranium enrichment: No capacity growth in 20 years. WISE News Communique 499/500, Oct. 16, 1998. http://www.antenna.nl/wise/499-500/4932.html

[2] NEA/OECD, Trends in the Nuclear Fuel Cycle – Economic, Environmental and Social Aspects, OECD, 2001. p.10: http://www1.oecd.org/publications/e-book/6602011e.pdf

[3] Brazil, China, Germany, India, Iran, Israel, Japan, the Netherlands, Pakistan, Russia and the UK. In 2003, Louisiana Energy Services (LES) – a partnership of several major nuclear energy companies, including Urenco, Inc (a wholly owned subsidiary of Urenco Ltd) Westinghouse and US energy companies Duke Power, Entergy and Exelon – announced plans for a National Enrichment Facility (NEF) to be located near Eunice, New Mexico. The French enrichment company Eurodif announced in December 2003 it will acquire a fifty percent stake in Urenco's enrichment technology company and starting construction of a new UC plant at Tricastin in 2005.

[4] "Beantwoording kamervragen van het lid Wilders (VVD) over het ontwerp van de ultracentrifuges in Iran", 20 january 2004, at www.minbuza.nl.

[5] Alberts and Knip, "OM onderzoekt partner Khan", NRC Handelsblad, 17 February 2004. The link with Libya was earlier made by Matt Kelley, "Pakistan, nuclear black market linked", AP, 11 February 2004.

The Future?

US President Bush is currently using the Khan disclosures as justification for prohibiting the further export of technology for uranium enrichment and reprocessing of spent nuclear fuel to countries which do not yet have this technology at a commerical level. This may yet be an important step in diminishing further global nuclear proliferation.[6] The nuclear weapons and advanced civil nuclear states however, already occupy a privileged position in the nuclear Non-Proliferation Treaty (NPT) regime compared to other states. This discrimination, simply increases the risk of proliferation, as it cannot prevent vertical proliferation[7] by the nuclear weapons states. The development of new nuclear weapons currently taking place in the US for example, increases the risk of a renewed nuclear arms race among the existing nuclear weapons states. The worldwide abolition of uranium enrichment and reprocessing of spent nuclear fuel, through a comprehensive fissile material treaty is the only real answer to diminishing the risk of nuclear proliferation.

And of course, such measures must be accompanied by the abolition of nuclear weapons.

[6] Bush sees nuke crackdown. CBS News, Feb.11, 2004. http://www.cbsnews.com/stories/2004/02/11/politics/main599704.shtml

[7] Vertical proliferation refers to nuclear proliferation within Nuclear Weapon States, ie production of more or new nuclear weapons by those states who already have them; compared with horizontal proliferation which refers to states who currently don't have nuclear weapons acquiring them.

INTRODUCTION

More than 50 years ago US President Dwight D. Eisenhower presented his "Atoms for Peace" speech before the UN General Assembly.[8] He called on the United States and the Soviet Union "to make joint contributions from their stockpiles of normal uranium and fissionable materials to an international Atomic Energy Agency" and then "devise methods whereby this fissionable material would be allocated to serve the peaceful pursuits of mankind." His speech was the starting shot for the world-wide development and spread of nuclear energy, the civilian by-product of the manufacture of nuclear weapons;.[9] this was really a campaign to make the nuclear idea acceptable.[10]

Because of the risks inherent in the spread of nuclear technology, knowledge and fissile material, a global nuclear watchdog, the International Atomic Energy Agency (IAEA) was esablished in 1957 and in 1970, the nuclear Non-Proliferation Treaty (NPT) entered into force.[11] Under the NPT, the IAEA was given the powers of safeguards and inspection for the non-nuclear weapons states. To facilitate the peaceful use of nuclear energy, US legislation was also amended to reduce nuclear secrecy, allowing nuclear technology, material and knowledge to be exported to friendly states, approved and authorised by what was then the Atomic Energy Commission, now the Nuclear Regulatory Commission.[12]

The history of the IAEA and the NPT demonstrates that the promotion of the peaceful use of nuclear energy is a myth. In fact it has accelerated nuclear proliferation for military purposes. The recent disclosures on the nuclear network emanating from Pakistan and the history of the British-Dutch-German uranium enrichment consortium Urenco support this.

This paper attempts to detail the extent of the proliferation of Urenco enrichment technology over three decades. Chapters I and II provide a detailed reconstruction of Khan's nuclear network which began with him illicitly acquiring detailed knowledge and documentation from Urenco. Chapter III describes the origin and history of Urenco and Chapter IV its share in world-wide nuclear proliferation. Finally in conclusion the authors present recommendations necessary, in their view, to reduce the threat posed by the proliferation of enrichment technology.

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[8] Atoms for Peace Address by Dwight D. Eisenhower President of the United States of America. Given to the 470th Plenary Meeting of the United Nations General Assembly on Tuesday, 8 December 1953.
http://www.ifpaenergyconference.com/pdf/speech.pdf

[9] Weiss, Leonard; Atoms for Peace. The Bulletin of the Atomic Scientists. November/December 2003, Vol. 59, No. 6, p.39.
http://www.thebulletin.org/issues/2003/nd03/nd03weiss.html

[10] Kollert, Roland; Latenten Proliferation

[11] http://www.fas.org/nuke/control/npt/back.htm

[12] Weiss; pp.40-41

CHAPTER I: KHAN'S DUTCH CONNECTION

Making a career

Born in the Indian town of Bhopal in 1936, AQ Khan and his family moved to Pakistan in 1952 and in 1961 Khan started his scientific tour through Europe in West-Berlin, studying at the *Technische Universität*. He continued at the *Technische Hogeschool* (now *Universiteit*) Delft in the Netherlands from 1963, where his mentor was the internationally renowned physicist prof. dr. W.G. Burgers. Khan received his MSc degree in metallurgical engineering there in 1967. Later he stated: "I got the best engineer's study in Delft, one of the best universities in the world".[13] Under the wings of prof. dr. Martin J. Brabers (himself a former pupil of Burgers) he received a Ph.D. in metallurgy from the Catholic University of Leuven (Belgium) in 1971 with a study on the elasticity of metal alloys.[14] Brabers and Khan co-edited "Topics in Physical Metallurgy", published in August 1972.

In May 1972 Khan started work at FDO[15], a subsidiary of VMF[16] in Amsterdam, highly recommended by the engineer A. Langstraat, an old friend from his time in Delft.[17] Security clearance for this sensitive job, from the Dutch Internal Security Service BVD (now the AIVD), was necessary because FDO was a major subcontractor for ultra centrifuge (UC) related work at Urenco's subsidiary UCN[18] in Almelo. Khan got the clearance without problems. VMF-Werkspoor was the place where in 1954 Jacob Kistemaker, the Dutch father of the UC-technology, built his first centrifuges for enriching uranium.[19]

Though Khan was supposed to work with material that was ultimately labelled "confidential", he soon found himself amidst all kinds of secret information, both at FDO, FMA[20] and UCN. He was even allowed to take home complete dossiers from FDO[21]. He visited UCN for the first time on 8 and 9 May 1972 and in 1974 spent 16 days in the "brainbox" (a temporary building) in Almelo, translating secret German reports on new developments in ultracentrifuge technology into Dutch.[22] Although at one stage he was seen taking notes in Urdu, his explanation that he was writing a personal letter was accepted.[23] According to the governmental report on the Khan case there was "an open atmosphere" within the group of technicians in the brainbox. Also during these days, he was free to enter the (classified) UC-plant itself, as the canteen and sanitary facilities were there. Nobody seemed to be bothered, as everybody had good faith in Khan.[24]

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[13] Harm Ede Botje and Ko Colijn, "De vader van de islamitische bom verklaart zich nader", Vrij Nederland, 18 July 1998. As for the rest of this article, all translations from Dutch-language sources are the author's.
[14] See e.g. David McMullin, "TU Delft's Dr. Strangelove", Delta, vol.34, nr. 26, 2002, at www.delta.tudelft.nl. Also Jan Pijper and Hugo Schneider, "Wat Khan kon, kon Khan nooit alleen"", de Volkskrant, 14 March 1981.
[15] Fysisch Dynamisch Onderzoekslaboratorium, or Physical Dynamic Research laboratory, founded as in-house laboratory in 1971.
[16] Werkspoor and Stork merged in 1954 into VMF (Verenigde Machinefabrieken), which in 1992 became Stork again. Throughout the literature VMF is also often called VMF-Werkspoor and VMF-Stork, sometimes referring to their former name.
[17] Pijper and Schneider, de Volkskrant, 14 March 1981. Though the government report on Khan claims that it was a normal application procedure, the vacancy was not advertised ("Onderzoek, zaak-Khan", Tweede Kamer, vergaderjaar 1979-1980, 16082, nrs. 1-2, p.17).
[18] Ultra-Centrifuge Nederland, which was set up in 1969..
[19] Henk Tolsma, "Nieuwe Helden", Technisch Weekblad, 16 January 2004.
[20] Fijn Mechanische Afdeling, another VMF department that produced and assembled engine parts for the Dutch ultracentrifuges.
[21] "De zaak-Khan", Tweede Kamer, 1979-1980, 16082, nrs 1-2, p.18.
[22] "De zaak-Khan", Tweede Kamer, 1979-1980, 16082, nrs 1-2, p.18; Frits Veerman and Jacques Ros, "Atoomspionage", Center Boek, Weesp, 1988, p.39.
[23] "De zaak-Khan", Tweede Kamer, 1979-1980, 16082, nrs 1-2, p.18.
[24] "De zaak-Khan", Tweede Kamer, 1979-1980, 16082, nrs 1-2, p.19.

Khan continued to work at FDO until late 1975, using the opportunities to expand his knowledge of the network of Urenco subcontractors and other companies. Suspicion arose in his last year in the Netherlands, after a number of incidents attracted the attention of the authorities,[25] and he was 'promoted' in October 1975 to a different function in the company to keep him away from uranium enrichment work. No formal investigation was launched as there seemed to be no hard evidence for any wrong-doing, despite signals to the contrary from a whistleblower.

Khan, his wife Hendrina[26] and daughters Dina and Aysha left for Islamabad for holidays on 15 December 1975. A case of yellow fever kept him there for at least two months according to a letter that his wife wrote to friends.[27] Some time later Khan himself sent his resignation letter to FDO, where his job formally ended on 1 March 1976.

In those three and a half years at FDO Khan collected and copied the most important documents needed to enable his country to build its own centrifuges for uranium enrichment - essential for 'Project 706', the creation of Pakistan's nuclear capability. His home country highly appreciated his Dutch work and AQ Khan became the main architect of Pakistan's nuclear weapons programme.

Building a European network

In July 1975, S.A. Butt - a physicist-turned-diplomat - was posted at the Pakistani embassy in Brussels, Belgium, in charge of buying the necessary tools, parts and materials (mostly special steel and aluminium) in Europe.[28] Later he was joined by Ikram ul-Haq Khan (no relation), with whom he worked at Watchberg-Pech, near Bonn in Germany. A.Q. Khan himself returned to Belgium in 1976 for negotiations with Belgo Nuclear for purchasing so-called glove boxes, that protect against radiation.[29] Export controls were easily bypassed, as trusted, mostly western intermediaries placed the orders. Though the CIA (and other intelligence services) were supposedly aware of Pakistan's purchases, all went smoothly until 1978, when it became apparent that the British subsidiary of Emerson Electric sold to Pakistan 'high-frequency inverters', with the same specifications as those used by British Nuclear Fuel Ltd. to enrich uranium. Before long an investigation was launched and elsewhere in Europe alarm bells started ringing.[30]

The Pakistan pipeline

Even before Khan left the Netherlands, companies were approached with lists of components needed for Pakistan's UC-project. One company that was particularly eager to make a profit was Van Doorne's Transmissie (VDT) in Tilburg. In the late 70's VDT worked on a deal to supply 6,500 maraging steel tubes for the centrifuges, ordered by S.A. Butt.[31] During what may have been his first trip back to the Netherlands after his return to Pakistan, Khan visited VDT in

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[25] One of them is an order that a Dutch company received from the Pakistani embassy in Brussels for special foil, which existence could almost certainly only be known through Khan. A deal never materialised. See also "De zaak-Khan", Tweede Kamer, 1979-1980, 16082, nrs 1-2, p.19-20.

[26] Henny Donkers by birth, according to one source she is the daughter of a Dutch diplomat who worked many years in Africa and because of that she has a British, South African and Dutch passport (Groene Amsterdammer, 21 February 2004).

[27] Frits Veerman and Jacques Ros, "Atoomspionage", Center Boek, Weesp, 1988, p. 41.

[28] Though the Dutch connection is emphasized here, a host of European companies were more than eager to supply whatever Pakistan's wish list contained. To mention a few, Swiss companies Vakkuum Apparate Technik (now again in the spotlight as Urs Tanner, the son of the then director Friedrich Tanner, turns out to have been working for the Malaysian company SCOPE, which built parts for Libya's ultra-centrifuge programme) and Cora Engineering; Albrecht Migule's CES Kalthoff GmbH in Germany; Team Industries (Leonberg, Germany) served as suppliers for the Pakistani nuclear programme at least during the late 1970's.

[29] Pijper and Schneider, de Volkskrant, 14 March 1981.

[30] Veerman and Ros, p. 45-6.

[31] Butt's involvement is mentioned by Jaco Alberts and Karel Knip, "De vriend van een atoomspion", NRC Handelsblad, 21 February 2004.

1977.[32] Within the company the order was commonly known as the 'Pakistan pipeline'. The tubes were exported between 2 November 1976 and 10 September 1979. On this later date a shipment of 300 tubes was stopped at Schiphol Airport.[33] Though the Ministry of Economic Affairs was well aware of the deal and had even warned VDT several times not to deliver, VDT simply went ahead and was stopped only years later. At first the company claimed that the materials were for agricultural purposes. But in court it turned out that in 1977 it had admitted to officials that it knew the order was for Khan as orders had come from the Pakistani embassy in Bonn, Germany. However, director Hamstra Pik successfully claimed that no licence was needed for the exports.[34] Though the Dutch parliamentary commission on the Khan affair concluded that the tubes were "essential for the set-up of a U.C.project"[35], Dutch law was on VDT's side. As the tubes were not "specifically developed" for use in gas centrifuges, no export licence was needed, revealing a major loophole in the export law. The case was particularly embarrassing for the Dutch authorities as they had a large share in VDT and had spent millions of dollars to subsidise what was supposed to be the company's main business, the development of variable transmission systems for cars.

A gift from heaven

FDO also appeared in court as a consequence of the government's investigation into the Khan case. It was revealed that in 1977 it allowed the sale to Pakistan of specially designed measuring instruments, originally made for Urenco. When Urenco dropped the order, Pakistan's interest came like "a gift from heaven".[36] In 1983 FDO's director and sales manager were indicted for not having obtained an export licence. A year later both were acquitted - the court rejected the argument that because the embedded restricted devices needed a licence, the complete machine needed one too.

C.M. Kuys, FDO sales manager from 1976-1977, travelled to Pakistan in 1977 for the deal, worth 45,000 euro and stayed at Khan's house. To a Dutch journalist he stated in early 2004 that he had also visited Khan in 1976, in cooperation with the Dutch security service BVD, to make clear that he "should not bother us any more", asking former colleagues for help with sensitive information.[37] The reason that he made a sales visit to Khan the next year was because "that measuring equipment was innocent, we could deliver that to him." Soon though it became apparent that it did have something to do with "the affair".

Offset policy: Dutch components for Pakistan's nuclear delivery systems

Often overlooked are the legal, government-sanctioned sales of numerous components by Dutch companies[38] for the 40 Pakistani F-16s that were ordered in 1980, the year of the Khan report. Though Norway (a partner in the F-16 project) raised objections to the sale, the Dutch government gave the go-ahead, despite the common knowledge that F-16s are capable of nuclear tasks[39] and that Pakistan was moving ahead on the road towards nuclearisation. A new batch of 71 fighter-planes was ordered in 1989, but cancelled in October 1990, when the US government

[32] Pijper and Schneider, de Volkskrant, 14 March 1981.
[33] Ko Colijn en Paul Rusman, chapter 8.1 in "Het Nederlandse wapenexportbeleid 1963-1988", Nijgh & Van Ditmar Universitair, The Hague, 1989. Clemens Graafsma, "Van Doorne leverde omstreden materiaal", de Volkskrant, 12 September 1980.
[34] "Vrijspraak voor Van Doorne's Transmissie", de Volkskrant, 7 September 1984.
[35] Quoted in Colijn and Rusman, p. 407.
[36] Leonard S. Spector, "The new nuclear nations" (Vintage Books/Random House, New York, 1985), p.24.
[37] GPD (Harald Doornbos), "Stork deed ook na vermoeden van atoomspionage nog zaken met Khan", Haarlems Dagblad, 5 February 2004.
[38] E.g. Fokker (now Stork Aerospace), HSA (now Thales Nederland), Daf SP (now SP Aerospace & Vehicle Systems).
[39] As they are for the NATO nuclear task, by the Dutch Air Force at Volkel AB in the Netherlands.

decided that an arms embargo to Pakistan was needed, in response to its progress towards a nuclear bomb.[40] Also their F-16s were allegedly modified with the means of carrying and delivering a nuclear weapon.[41] Only weeks before the American embargo the Dutch government claimed that "the relation between Pakistani F-16 planes and nuclear weapons is not correct".[42] Today Pakistani authorities are again in talks with the Americans to renegotiate a batch of F-16s, new or second-hand, and to refurbish the current Pakistani F-16s, now the US has lifted its sanctions.[43] Even though its missile programme has progressed much over the last years and dependency on aircraft as nuclear delivery systems has diminished, additional F-16s could still prove to be an important tool in Pakistan's nuclear inventory.

A Dutch inquiry

Only at the end of March 1979, after a German television programme[44] revealed that Pakistan - through Khan - had access to Urenco UC technology, did the Dutch launch an investigation into the matter. Because new reports in early June of that year revealed that centrifuges identical to the Dutch ones were already working in Pakistan, the authorities "intensified" their investigation[45].

From the beginning, the Dutch authorities downplayed questions and accusations with regard to the value of the knowledge Khan had gained, and concerning the many failures on the security side. First it was said to be all rumours, then it was said that if any knowledge had been compromised, it would have been "only an insignificant part of the ultra-centrifuge technology"[46]. Some months later it was acknowledged that "serious doubts exist on Khan's innocence"[47]. Finally in the 1980 official report 'Onderzoek zaak-Khan' the government concluded "that it is likely that Pakistan through Khan has been able to acquire sensitive knowledge concerning the enrichment technology" but that the "real contribution of Khan to a Pakistani UC-project regarding the input of knowledge is hard to measure".[48]

The general picture the government tried to uphold throughout was one of a regrettable accident, due to laxity by a couple of people. Some extra safeguards were installed to prevent a recurrence in the future, and cases against Khan and two guilty companies were prepared.[49] Though the government came under fire several times for its handling of the case, there were no further political consequences.

It was another four years before Khan was finally tried and prosecuted. The case against him was not very strong: all that could be used against Khan were two letters from him - written after his

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[40] Intelligence information reaching US authorities indicated that Pakistan was actively working on a nuclear bomb. It supposedly had received a design for a bomb from China, had tested a nuclear trigger, and was actively producing weapons-grade uranium. See http://www.f16falcon.com/facts/f16_17.html.

[41] http://www.f16falcon.com/facts/f16_17.html

[42] Quoted in Ko Colijn and Paul Rusman, "Pakistaanse atoombom onder F-16's van Fokker?", Vrij Nederland, 2 June 1990.

[43] The possibility of refurbishment was mentioned most recently in March 2004 when Pakistan's major non-NATO ally (MNNA) status was announced.(Gopal Ratnam and Vivek Raghuvanshi, "Subcontinental Tightrope - U.S. Nod To Pakistan Angers India", Defense News, 29 March 29 2004). In October 2003 Belgium was said to be a possible source of surplus F-16s for Pakistan ("Pakistan may get 60 helicopters from the US", The Press Trust of India, 4 October 2003; See also: "Pakistan to get $341 mil. worth of U.S. armaments: official", Japan Economic Newswire, 30 September 2003).

[44] ZDF, 28 March 1979; see: "De zaak-Khan", Tweede Kamer, 1979-1980, 16082, nrs 1-2, p.9.

[45] "De zaak-Khan", Tweede Kamer, 1979-1980, 16082, nrs 1-2, p.9.

[46] Economic Affairs minister Van Aardenne, as quoted in Veerman and Ros, p. 47.

[47] Van Aardenne, Wiegel (Interior minister) and Van der Klauw (Foreign Affairs), as quoted in Veerman and Ros, p. 47.

[48] "De zaak-Khan", Tweede Kamer, 1979-1980, 16082, nrs 1-2, p. 1-2.

[49] For example, 126 Dutch subcontractors of UCN are notified 24 July 1979 of the existing legislation. Ibid. p.32.

return to Pakistan - to his former colleague Veerman, in which he had asked for 'classified'[50] information about 'bottom-bearings' and 'pivots', critical UC-parts. For the illegal copying of secret documents with UC-technology and relevant details of its suppliers he could not be prosecuted, because proof was lacking. If he had been caught it could only have been for espionage, not for illegally exporting materials. At that time no export licence was needed for the transfer of technology.[51] After an initial sentence - *in absentia* - of 4 years imprisonment, Khan was acquitted 28 March 1985 by an appeals court due to a 'technicality', as the summons had not been delivered properly.

Though he was declared *persona non grata*, Khan continued to visit the Netherlands for years, both for business and family affairs, by way of the Belgian border, which was quite porous. He was only caught once, in December 1988, when he was put on a plane back to Pakistan. On at least three later occasions he was even officially allowed to enter the country, on "humanitarian grounds".[52]

Tem years later, and within days of Pakistan crossing the nuclear threshold - 28th May 1998 - Dutch Foreign minister Hans van Mierlo announced an embargo on arms exports to the country, as he had against India a few days earlier in response to its nuclear tests. When A.Q. Khan's Dutch background re-emerged in the media, Urenco spokesman Willem van der Elst claimed that "many of those stories were very, very exaggerated. As far as we know he has never been able to get hold of any information".[53] That claim became more ludicrous every day.

The Dutch authorities themselves have now admitted that Urenco technology apparently has made its way via Pakistan to countries that some governments have labelled 'countries of concern', or even part of an 'axis of evil'.[54] In a written statement - that was mentioned in relation to Khan's public confession of having leaked nuclear technology on 4 February 2004 - Khan himself is said to have confessed to selling nuclear technology to Iran, Libya and North Korea.[55]

What role for the Pakistani government?

One of the most implausible aspects of the Khan story ar the claims that Khan was leading a multi-million dollar nuclear trading business on his own.[56] Given his high position within the Pakistani establishment and his close contacts with presidents and prime ministers since the mid-seventies, it is highly unlikely that they did not know about his activities. Moreover, as most stories on the North Korean-Pakistani nuclear relations confirm, the barter trade of missile technology for uranium enrichment technology directly benefited Pakistan's nuclear missile

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[50] According to former lawyer Frank Bakker, Khan would have walked free anyway, as his lawyer, the late Mario den Drijver, had succesfully proven that at least for the pivot, blueprints were publicly available (Ed Croonenberg, "Nucleair gidsland", HP De Tijd, 20 February 2004).

[51] A direct consequence of Khan's case is the creation of an additional category for the transfer of technology for which a licence is needed. Excluded though is technology that is already available in open sources.

[52] The mother of Khan's wife re-married a former transport worker, who Khan was allowed to visit on humanitarian grounds, because of his critical condition. "Atoomspion Khan kreeg toestemming voor ziekenbezoek", de Volkskrant, 11 July 1992; Hans van Zon, "Dr. Abdul Qadeer Khan heeft nergens spijt van", Algemeen Dagblad, 27 June 1998.

[53] "Rol spion overdreven", Trouw, 29 May 1998.

[54] "Beantwoording kamervragen van het lid Wilders (VVD) over het ontwerp van de ultracentrifuges in Iran", 20 January 2004 and "Kamerbrief inzake bij de regering aanwezige kennis over de betrokkenheid van Urenco Nederland BV bij de ontwikkeling van nucleaire wapens in een aantal landen waaronder Pakistan", 5 April 2004, both at www.minbuza.nl.

[55] See e.g.: "Pakistani nuclear hero admits selling secrets", AP, 4 February 2004.

[56] According to the Bush administration Khan's business with Libya alone netted $100 million. David E. Sanger and William J. Broad, "Pakistani's Nuclear Earnings: $100 Million", The New York Times, 15 March 2004.

programme.[57] That Khan had set up such deals without permission from the authorities is simply beyond imagination. Most analysts therefore agree that Khan's confession and the subsequent pardon was directly linked to the knowledge that starting a court case would not only automatically create a perfect case for a coup, but also certainly implicate president Musharraf and many others. With top Al Qaeda leaders supposedly hiding in the remote border region with Afghanistan, and Pakistan's willingness to assist the US military in their hunt just across the border, Pakistan is too important in the war against terrorism to sacrifice. In fact it is so important that despite the allegations on Pakistan's role in proliferating nuclear technology, on 18 March 2004, when US Secretary of State Collin Powell visited Musharraf, it was announced that Pakistan would get the status of "major non-NATO ally".[58] As in the past, short-term foreign policy aims effectively undermined attempts to stop the proliferation of nuclear technology.

If recent rumours prove to be true, the case may come full circle, taking a bizarre step back to the Netherlands. According to the British paper The Daily Telegraph, in 2003, AQ Khan sent his daughter Dina abroad with "potentially incriminating documents" and a tape-recorded statement.[59] Khan is said to claim that all the chiefs of army staff since 1977, including general Musharraf, knew of his actions. Khan's pardon is said to be directly linked to his possession of these documents. Ziauddin Sardar writes in the New Statesman that he knows where they are: Khan sent his daughter to the Netherlands in December 2003, with "truckloads of incriminating documents".[60] He says that confidential contacts with people within the Pakistani military are his source.[61] If true, Khan has given the Dutch government another major headache.

Official silence again

The recent questions on Khan and Urenco have caused serious unease in The Hague. But rather than revealing the answers in public, the government appears to be trying to maintain as much secrecy about the case as possible. For as long as no court case takes place it is only investigative journalism that provides new insights. Most disappointing in this respect is the long-expected letter from the government on the recent Urenco revelations. Announced in January 2004, it was finally sent to parliament in early April. The one-page letter "on the available knowledge with the government on the involvement of Urenco Nederland BV with the development of nuclear weapons in a number of countries, among which Pakistan", goes no further than stating that Urenco itself has never been involved as such in the development of nuclear weapons by these countries. That Khan stole information on the "earliest Urenco-technology" is nevertheless regretted. Then the letter concludes that 24 years later there is nothing to add to the Khan report, concerning the Khan affair and Urenco. The finding of "centrifuges of the old Urenco-design" in Libya and Iran only reinforces the "serious suspicion" that A.Q. Khan has stolen these blueprints.[62] In that respect, too, not much has changed since the 1980 report "De zaak-Khan".

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[57] A 20-member North Korean delegation was even present at Pakistan's nuclear tests. See for example: Paul Watson and Mubashir Zaidi, "Death of N. Korean Woman Offers Clues to Pakistani Nuclear Deals", Los Angeles Times, 1 March 2004.
[58] "US To Designate Pakistan A Major Non-NATO Ally", AFP, 18 March 2004, at www.spacedaily.com.
[59] Massoud Ansari and Victoria Schofield, "Father of the Islamic bomb barters papers for his future", Telegraph, Internet-edition, 15 February 2004.
[60] Ziauddin Sardar, ""Traitor" will get a rich retirement", New Statesman, 9 February 2004.
[61] Aart Brouwer, "Waar zijn de Khan-papers?", Groene Amsterdammer, 21 February 2004.
[62] "Kamerbrief inzake bij de regering aanwezige kennis over de betrokkenheid van Urenco Nederland BV bij de ontwikkeling van nucleaire wapens in een aantal landen waaronder Pakistan", 5 April 2004, at www.minbuza.nl.

CHAPTER II: KHAN'S SUPPORT NETWORK

Khan befriended several top Dutch scientists during his time in the Neherlands as well as colleagues and former co-students, who later visited either Khan or his nuclear connections. Though Khan's charming, friendly personality is often quoted as a reason why he could win people to work with him, he obviously had more to offer, including free trips to Pakistan, paid for by the Pakistani government. One of these colleagues, Henk Slebos, may well have earned most of his income over the last decades with business deals from Khan.

A moral duty

In the first years after Khan's departure for Pakistan in 1975 at least three prominent Dutch scientists are said to have visited Pakistan: Brabers, Burgers and Barendregt[63]. The only one who has never denied this is Brabers, Khan's professor in Leuven. He is quoted as having said that it was his "moral duty" to help former students whenever asked, but has also said: "I don't help them to make an atomic bomb."[64] Brabers admits to having been in Islamabad "several times" in the years 1976-1977. In those years he also met Munir Ahmad Khan, then chairman of the Pakistan Atomic Energy Commission (PAEC) and the country's representative at the IAEA. Munir Khan was AQ Khan's boss for a short while in 1976, until 'AQ' founded the Engineering Research Laboratories (ERL, later KRL).[65] According to Brabers he never wanted money, but he did get tickets for free or half-price, as a guest of the Pakistani government.[66]

After President Bhutto openly started the quest for Pakistan's nuclear bomb in 1974, restrictions were placed on Pakistani students at Dutch universities and laboratories. Concerns about these developments were not shared by everybody. As Brabers commented in 1981: "[P]ersonally I don't really care. Knowledge is not secret and UC-technology is nothing exotic. You can find it all back in the professional literature."[67]

In the early nineties Brabers was rector of the Gulam Ishaq Khan Institute of Engineering, Science and Technology, set up by AQ Khan in Topi, North West Frontier Province. The institute was on a June 1998 US government list of Pakistani entities which were said to be involved in nuclear or missile activities and therefore denied US items controlled for non-proliferation reasons. And as recently as last year he was a member of the international scientific committee of the 8th International Symposium on Advanced Materials (ISAM), held in September 2003 in Islamabad. ISAM is the most important international meeting of Khan Research Laboratories (KRL) (see below).

Before working at Leuven University, Brabers had worked at the atomic research centre in southern Norway where Dutch and Norwegian scientists worked together. Brabers' boss in Norway was another respected scientist, the mathematician and physicist dr. T. Barendregt. From 1959 Brabers and Barendregt also worked together in Mol, Belgium, where Barendregt became director of Eurochemie, the then European project to reprocess spent nuclear fuel. In the early '80's Brabers worked one day a week at the nuclear energy laboratory SCK, also in Mol.[68]

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[63] Pijper and Schneider, de Volkskrant, 14 March 1981.
[64] Pijper and Schneider, de Volkskrant, 14 March 1981.
[65] http://nuclearweaponarchive.org/Pakistan/AQKhan.html
[66] Pijper and Schneider, de Volkskrant, 14 March 1981.
[67] Pijper and Schneider, de Volkskrant, 14 March 1981.
[68] Pijper and Schneider, de Volkskrant, 14 March 1981.

Barendregt was director of the Dutch engineering company Comprimo between 1976 and 1 October 1980.[69] Comprimo and Interatom, subsidiary of the German Siemens concern were together responsible for the design and supervision of the first two uranium enrichment factories in Almelo.[70] Barendregt's son confirmed to journalists in 1981 that his father had been to Pakistan "several times" in the period 1975-1977.[71] His father denied this to the same journalists, but admits to having been in Pakistan in 1974, to work on a deal for a fertilizer plant despite a Comprimo spokesperson stating that the company had not done any fertiliser related work for 25 years. Barendregt also denied that he had ever met A.Q. Khan, but Brabers claimed that he met Munir Ahmad Khan in late 1976 to get orders for Comprimo. After retiring in 1980 Barendregt became advisor of Nuclebras in Brazil.

The third scientist, professor Burgers, from Delft, has always denied having ever been in Pakistan, let alone having visited Khan there. Nevertheless, both professor Brabers and a Dutch friend of Mrs Khan claim that he was there there for six weeks in early 1977.[72] According to this Volkskrant article, Mrs Khan's friend has a letter from her, in which she complains of having to take care of the invalid Burgers. In the same article Burgers wife says that this letter must be a falsification.

Many years later, the Dutch seem to have become more sensitive to foreigners working at or visiting scientific institutions and related companies. In the summer of 2003, the security and intelligence service AIVD released a report in which it warned of possible infiltration by people from "countries of concern", most notably Iran, Libya, Syria, North Korea, Pakistan and India.[73]

Operation butter factory

The name of Henk Slebos has been mentioned many times during the last months in press reports on Khan's nuclear network. His name surfaced shortly after a Pakistani government spokesman stated at a press conference, that a Dutch businessman called "Hank" or "Hank S." was involved.[74]

Henk Slebos has known AQ Khan for more than forty years, since they both studied metallurgy in Delft in 1963. After his studies Slebos worked for five years for the Royal Navy, as 'troubleshooter' involved in buying components for submarines. Through his job he was in touch with the specialised welding firm Explosive Metal Works Holland (EMWH) - a Urenco subcontractor - where he became Commercial Director around 1974.

In 1976 Slebos flew to Pakistan for the first time. The Dutch daily NRC quotes him as saying on tape: "I delivered him (...) the whole lot, the whole range from electronics to the construction materials, all kinds of things that were not forbidden to deal in."[75] And according to the court that

[69] Then a joint company of RSV (the then shipyard conglomerate, which went bankrupt a couple of years later), VMF (Stork), Shell and SHV (a former coal company owned by one of the richest Dutch families - de Fentener van Vlissingen).
[70] And probably the third, see: "Comprimo werkt aan UCN-project", de Volkskrant, 15 June 1978.
[71] Pijper and Schneider, de Volkskrant, 14 March 1981.
[72] Pijper and Schneider, de Volkskrant, 14 March 1981.
[73] "Proliferatie van massavernietigingswapens - Risico's voor bedrijven en wetenschappelijke instellingen", AIVD, July 2003.
[74] David Rohde and David E. Sanger, "Key Pakistani Is Said To Admit Atom Transfers", New York Times, 2 February 2004.
[75] Albert and Knip, NRC Handelsblad, 21 February 2004.

sentenced him in 1985, he admitted to Dutch export control authorities that he was well aware of the nuclear destination of his export activities, (see also below).[76]

Slebos - who started his own business Slebos Research BV in 1978 - is mentioned in different cases from the late 1970's onwards, though some claims are hard to verify. He is said to have been involved in the VDT (Pakistan Pipeline) deal as a middleman.[77] And according to German broadcasting corporation ZDF, Slebos met the head of the Special Works Organisation, Amid Ali Said, in the Netherlands in 1980.[78]

By accident[79], Slebos was caught illegally exporting a US-made Tektronix oscilloscope on 23 October 1983 and was sentenced to one year imprisonment in July 1985. During the trial it turned out that Slebos had been warned by the Dutch government export control department (ECD) in 1980, for three suspicious transactions.[80] For unknown reasons he never served his prison term.[81] According to another German broadcaster, in 1985 and 1986 Slebos received around 340,000 Euro's from the Pakistani embassy in Bonn in his German Commerzbank account. In that same TV programme he was said to be involved in a deal for Khan with German steel company Arbed Saarstaal. Interviewed by the Germans, Slebos explained that financial problems were the reason for his activities. He is quoted as having codenamed his business with Pakistan "Operation Butter factory".[82]

On 24 December 1988 Khan was caught in a car, near his wife's family home in Bergen op Zoom, apparently as a result of security service monitoring on Slebos, who was travelling with him.[83] Khan was put on a plane back to Pakistan. According to the WDR (German broadcasting corporation) journalists, the two had also met in the Netherlands in July of that year. [84] On both trips Khan is said to have been looking for European suppliers of measuring equipment to register nuclear test explosions.[85]

A decade later Slebos' name resurfaced in the media. Some weeks after Pakistan's nuclear tests, in May 1998, journalists of the weekly Vrij Nederland discovered that three Slebos packages were being held at Schiphol airport, and two more in Austria and Belgium.[86] Besides Slebos Research, Bodmerhof BV, another Slebos company, was also involved. Though the goods normally would not need an export licence, a special 'catch-all' provision was applied, because of their suspected Pakistani destination.[87] Asked about the case in an interview, Khan stated: "I

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[76] Alberts and Knip, NRC Handelsblad, 21 February 2004.
[77] See Pijper and Schneider, de Volkskrant, 14 March 1981.
[78] ZDF, 17 February 1981, as quoted in Pijper and Schneider, de Volkskrant, 14 March 1981. The Special Works Organisation was set up under the Defence ministry by prime minister Zulfikar Ali Bhutto in the mid-seventies, to control nuclear activities. Former Finance minster Ghulam Ishaq Khan was appointed as its first coordinator.
[79] Because of a work-to rule action by the unions, personnel at the airport were checking every single package.
[80] "Vriend Khan hoort 15 maanden eisen", Reformatorisch Dagblad, 19 June 1985.
[81] College van Beroep voor het Bedrijfsleven, "LJN-nummer: A00900 Zaaknr: AWB 02/595", 29 October 2003.
[82] WDR (Westdeutsche Rundfunk) programme as quoted in: Theo Jongendijk and Walter Samuels, "Nederlander verdacht van hoofdrol in Pakistaans atoom-spionageschandaal", Telegraaf, 11 January 1989.
[83] "BVD volgt zakenvriend van atoomspion Kahn", NRC Handelsblad, 11 January 1989.
[84] Jongendijk and Samuels, Telegraaf, 11 January 1989.
[85] Jongendijk and Samuels, Telegraaf, 11 January 1989.
[86] Ko Colijn and Paul Rusman, "Khan bestelt nog steeds uitrusting in Nederland", Vrij Nederland, 6 June 1998.
[87] If there is suspicion that certain non-strategic goods may be used in relation with weapons of mass destruction this special provision is used. From its coming into force in 1996 it has been used about twenty times in total (see "Beantwoording vragen van het lid Karimi over het (nucleaire) smokkelwerk van Khan en Nederlandse connecties", 9 March 2004, at www.minbuza.nl).

know Slebos as a righteous Dutch citizen, who takes all precautions to obey laws and rules. Before he delivers something to Pakistan, he always checks everything again and again".[88]

The legal battle continued until late 2003. Slebos sold part of the equipment - an LMF[89] made compressor, type V 17 5518 L, 40-K - to a company called V-I in Schiedam, which unsuccessfully applied for an export licence to Pakistan in May 1999. V-I did not accept that decision and went to court in 2000. The firm claimed that the compressor was meant for an ordinary company, the People's Steel Mill in Karachi, despite Slebos having previously given the Institute for Industrial Automation (part of Khan's KRL) as the final destination. Intelligence and export control authorities, however, claimed that the compressor was "very suitable for use with the Ghauri missiles, as used in the Pakistani missile programme"[90]. In October 2003 the Ministry of Economic Affairs finally won the case - it was right to refuse an export licence for the compressor.[91] What happened with the other Slebos equipment impounded in 1998 is still unclear.

According to Vrij Nederland journalist Ko Colijn, Henk Slebos has recently been involved in much more business with Pakistan. In particular he is said to have been involved in trading large amounts of graphite and magnesium straight from China to Pakistan. The magnesium was of a quality grade specified on the list of the Nuclear Suppliers Group and therefore subject to Dutch export control.[92] Sources within the Justice Department say they think that the graphite was suitable for use in ultracentrifuges.[93]

In addition American intelligence sources claim that "a company in North-Holland" - where Slebos' firm is based - ordered so-called Baratron pressure meters from a German daughter of an unidentified American company.[94] These meters can be used to measure pressure in fuel tanks of missiles. Though an export licence is required, the "North-Holland" company had sold them to - again - the Institute of Industrial Automation. This case may be the same as the one mentioned in other media, namely an investigation by the court in Haarlem into illegal export of dual-use goods, supposedly by Slebos and supposedly with final destination Libya.[95]

The answers provided by the Dutch government to a series of written parliamentary questions about Slebos' role, by GreenLeft MP Farah Karimi, are meagre, but do provide some additional information.[96] According to the government, "S." (read Slebos) did not get any Dutch export permits for the export of *dual-use goods* to Pakistan, Libya, Iran or North Korea during the last four years. In "a number of cases" it has applied the catch-all clause to Slebos, requiring an export permit for goods that normally do not need a permit. Details on these catch-all cases have

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[88] Harm Ede Botje and Ko Colijn, "De vader van de islamitische bom verklaart zich nader", Vrij Nederland, 18 July 1998.
[89] Leoberdorfer Maschinenfabrik AG, Austria.
[90] Ko Colijn, "Explosieve handel tussen Montfoort en Islamabad", Vrij Nederland, 21 February 2004.
[91] College van Beroep voor het Bedrijfsleven [Court of Appeal for Trade and Industry], "LJN-nummer: A00900 Zaaknr: AWB 02/595", 29 October 2003; and "LJN-nummer: AB3001 Zaaknr: AWB 00/128", 27 June 2001.
[92] Regulation regarding trilateral trading relations ("driehoekshandel"): "If a Dutch resident engages in a financial action with regard to strategic goods which are outside the Community [meaning the European Union, Frank S.], [...] , a licence Financial Traffic Strategic goods ("vergunning Financieel Verkeer Strategische goederen" or FVS) is required."
[93] Colijn, Vrij Nederland, 21 February 2004.
[94] Colijn, Vrij Nederland, 21 February 2004.
[95] Alberts and Knip, "OM onderzoekt partner Khan", NRC Handelsblad, 17 February 2004. The link with Libya was earlier made by Matt Kelley, "Pakistan, nuclear black market linked", AP, 11 February 2004.
[96] "Beantwoording kamervragen over mogelijke verdenking door de Pakistaanse regering van het leveren van nucleaire technologie aan Iran, Lybië en Noord-Korea", 9 March 2004; Beantwoording kamervragen over het nucleaire smokkelwerk van Khan en Nederlandse connecties", 9 March 2004; "Beantwoording kamervragen Karimi over exportvergunning aan Henk S.", 30 March 2004. All at: www.minbuza.nl.

been provided to MPs on a confidential basis.[97] "Relevant investigation services" check whether Slebos has observed these export rulings. Pakistan has been asked to inform the Dutch government if any details about the possible involvement of "a Dutch national" emerge from their investigation into Khan's nuclear network.

Many questions remain, too, about Slebos' involvement as a middleman in proliferation-prone transactions that have never touched Dutch soil. Most recently, Slebos name has appeared in conjunction with the well-publicised case of the German owned 'BBC China' ship. The 'BBC China', laden with nuclear equipment and on its way to Libya, was caught by American inspectors in Italy on 4 October 2003.[98] The catch revealed a host of information on persons and companies, which were supplying Libya with nuclear-related materials. Implicated were not only Sri Lankan businessman Bukhari Sayed Abu Tahir (allegedly "the network's chief financial officer and money-launderer"), the Malaysian company Scomi Precision Engineering[99], and the Dubai-based Gulf Technical Industries (GTI) of UK citizen Peter Griffin. Also on board were aluminium castings and dynamos from the Turkish company ETI Elektroteknik[100] in which Slebos has a 15 percent share.[101]

All this fits very well with Slebos' business profile. "We find hard-to-get objects for customers all over the world. We have delivered machine parts of sawing machines, grinding wheels, fixings, iron and metal alloys, laboratories and testing equipment, software and much more", he writes on his website www.slebos.com. On the site he also advertises an anti-fouling system, of interest to the Royal Dutch Navy.[102] His businesses seem to come and go - a year ago his website also mentioned "Technical Troubleshooting", "Prefab Buildings", "Technical purchasing", "Technical Engineering" and even "Wine Import" - but not anymore.[103]

No boys' choir

The most explicit recent proof of Slebos' dealings with Pakistan became known in late 2003, when the Dutch Campaign Against Arms Trade revealed that Slebos Research was one of the sponsors of ISAM 2003, the International Symposium on Advanced Materials in Islamabad and KRL's main international scientific event.[104] Though both companies deliver almost identical technical services, another Dutch company Gemco denied having anything to do with another ISAM sponsor, Gemco Pakistan (Pvt.) Ltd. No longer chief of KRL, AQ Khan was still ISAM's main host, as "patron" of the organising committee. The "international scientific committee" consisted, among others, of Khan's former tutor, emeritus professor Brabers (see above).

In response to a number of questions from parliamentarians on the Dutch content of the meeting and its relation to Dutch non-proliferation policy, then Foreign Minister De Hoop Scheffer

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[97] This confidential note contains information on all (around twenty) catch-all cases since the creation of this ad hoc licensing legislation in 1996. Early April 2004 Ms. Karimi asked to (partly) declassify this information. At the time of writing no governmental answer was available yet.

[98] See for example William J. Broad, David E. Sanger and Raymond Bonner, "A tale of nuclear proliferation: How Pakistani built his network", New York Times, 12 February 2004.

[99] Plus some foreigners working for the company, like the Tanner brothers from Switzerland.

[100] Alberts and Knip, "Atoomhandel ging via Turkije", NRC Handelsblad, 27 February 2004.

[101] Alberts and Knip, "Atoomhandel ging via Turkije", NRC Handelsblad, 27 February 2004.

[102] "KNRM test vinding omstreden techneut", de Volkskrant, 24 February 2004. The system is made by SRAF Nederland BV, an acronym for Slebos Research Anti-Fouling.

[103] Other known companies in which Slebos was involved are: Sleedoorn Styling (home and office furnishing, bankrupt in 1989); RA Products (solar energy, dead 1996); Milieu- en Energiesystemen (energy, 34% share) (source: Alberts and Knip, "Pakistan verdenkt Nederlander 'Hanks'", NRC Handelsblad, 7 February 2004).

[104] Press Release Campagne tegen Wapenhandel, 3 September 2003, see www.stoparmstrade.org.

admitted that KRL is part of Pakistan's nuclear weapons industry, and that - though the government did not have information that ISAM was set up to further develop that industry - it was "not fully possible to exclude that the exchange of knowledge and information during the symposium directly or indirectly contributes to that development".[105]

Curiously, one Dutch participant, professor Das of ECN[106], afterwards admitted that he had been there in the pay of the Dutch intelligence service AIVD. Furthermore he had worked for them frequently, for many years and in many countries. At ISAM 2001 he had even visited Khan at home and met president Musharraf.[107]

Asked about ISAM, Slebos answered a journalist: "I do business in all of Asia, but not in Pakistan. I have nothing to hide and I don't even go to the symposium myself. I have only sponsored it. That is nothing peculiar though? [...] If I subsidise the boys' choir of St. Pancras, you also don't ask strange questions, do you?"[108]

[105] "Beantwoording kamervragen van het lid Van Velzen (SP) over mogelijke Nederlandse bedrijven en personen bij symposium van Pakistaans kernwapenlaboratorium", 2 October 2003 at www.minbuza.nl.
[106] Energieonderzoek Centrum Nederland - Energy Research Centre of the Netherlands.
[107] Aart Brouwer, "De offerkoeien van een kernmacht", De Groene Amsterdammer, 14 February 2004 and KRO Radio1, 10 February 2004.
[108] Aart Brouwer, "Nucleaire verkenners", Groene Amsterdammer, 3 September 2003.

CHAPTER III URENCO 1970 - 2004

Urenco Ltd is a consortium of British company INFL[109], the Dutch firm UCN BV and the German Uranit GmbH.[110] Founded in 1970, it is one of the world's leading uranium enrichment companies.[111],[112] It's origin and history is closely linked to the research and development of ultracentrifuge technology. Together with gas diffusion technology it is the most commonly used method of uranium enrichment. During the 60's and 70's there were high expectations of the growth of nuclear energy for power production, with a consequent need for uranium enrichment capacity. The supposition was that all or most nuclear reactors would need enriched uranium as nuclear fuel; hence the founding of Urenco.

Keeping the weapons options open

The history of Urenco is also closely linked to Western Europe's desire to be independent from the US with regard to nuclear reactors and enriched uranium. The US had a veto on the reprocessing of all nuclear fuel enriched in the US or burned in US-supplied or -licensed nuclear reactors. However, Germany, the UK and France wanted to reprocess used nuclear fuel to produce plutonium. Officially they wanted to use the plutonium in Fast Breeder Reactors, such as Kalkar in Germany or Phenix in France, which would breed more plutonium than they used. This was justified once again by an expected shortage of uranium and unrealistic prognoses of nuclear energy growth.[113] By enriching their uranium themselves, West European states were free to reprocess the used nuclear fuel and also free to develop their own industrial plutonium infrastructure, keeping their nuclear weapons options open.

Urenco's intention was to build a plant to manufacture ultracentrifuges and an enrichment plant in each of the three countries. Germany, however, was until 1985 not allowed by the US to build an enrichment plant, in order to prevent it from producing nuclear weapons materials. So, instead the German enrichment plant was constructed at the Dutch Urenco plant in Almelo. But Germany was allowed to manufacture ultracentrifuges, which took place at a plant in Jülich, owned by the German Urenco partner Uranit GmbH. In the UK the manufacturing plants were constructed at Capenhurst, next to the gas diffusion plant.

The E21 plant was the first gas centrifuge facility at Capenhurst. It began operations in 1976. The next generation gas centrifuge plant, the Capenhurst E22 plant, was completed in 1982. The E23 plant began operations in 1997.[114] The E21 was operated until 1991 and was subsequently decommissioned, just a few years after the closure and the beginning of decommissioning of the gas diffusion plant.[115] Two years after the completion of the E22 plant a separate centrifuge

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[109] INFL is a full subsidiary of British Nuclear Fuel Ltd (BNFL), owned by the UK government

[110] Shareholders of UCN BV are: Dutch government (98.9%) and Shell, Philips, DSM, VMF-Stork (1.1%). Shareholders from Uranit GmbH are: NUKEM GmbH (50%) and E.ON AG (50%). More information on http://www.antenna.nl/wise/uranium/ecure.html

[111] Boer, Joop; Uranium enrichment: No capacity growth in 20 years. WISE News Communique 499/500, Oct. 16, 1998. http://www.antenna.nl/wise/499-500/4932.html

[112] Further information about Urenco's corporate structure is contained in ANNEX I

[113] Kollert, R.; Die Politik der latenten Proliferation, 1994, DUV, p.127

[114] Johnson, Timothy C.; Internal memo NMSS: Foreign trip meeting summary: Louisiana Energy Services Technical Meeting and Site Visits; 26 July 2002. http://www.nrc.gov/materials/fuel-cycle-fac/ml022100265.pdf

[115] "Capenhurst, near Chester, was home to the gas diffusion uranium enrichment plants. Decommissioning of these huge structures began in 1989 and was complete by 1994." http://www.bnfl.com/index.aspx?page=572 ; Financial Times, 03 Nov. 1987: "Britain has just begun to dismantle an obsolete uranium enrichment factory at Capenhurst."

enrichment plant, Capenhurst A3, [116] was built for military purposes and from 1993 the plant operated for civil purposes.[117]

In the Netherlands, the enrichment plant was built southeast of the town of Almelo near the German border. Since the opening of the pilot plant in 1971, despite many actions and legal suits by local opponents, the plant has been substantially expanded.[118] The same is true of the plants in Gronau (Germany), only a few dozen kilometres from the Dutch Urenco factory in Almelo, and Capenhurst.

But by the time Urenco had built its first small enrichment plants, around 1980 it had become clear that far fewer nuclear power plants would be constructed than had been expected only a decade before. Instead of a shortage of enriched uranium, demand was only one-half of the combined production capacity at that time.[119] The US had huge stockpiles of HEU by then, and Russia also had an enormous overcapacity of enrichment plants and huge stockpiles of HEU, offering enriched uranium to the Western countries at low prices[120]. Russia had also developed and constructed LWR's in Russia and several Warsaw Pact countries.

Because of this oversupply and the low prices asked by the US and Russia for enrichment, Urenco made no profits, only losses, for fifteen years.[121] A large part of the money needed for research, development, construction and operation was paid for by the three governments involved. [122]

Plans for the future

Urenco is now expanding fast. Its management intends to double its production capacity at each of its three sites: Capenhurst (UK), Gronau (BRD) and Almelo (NL) and is trying to get permission to build a large enrichment plant at Lea County, New Mexico, US.[123] In this case Urenco works together with US nuclear firms in the Louisianna Energy Services (LES) consortium.

Urenco tried unsuccessfully to build a UC enrichment plant in the US in the 90's, also as major partner of the LES consortium, but abandoned the effort in the face of significant oppostion. Now Urenco is again trying to get a license to build a plant in the US, by far the largest market for enriched uranium. A centrifuge plant in the US will help Urenco to protect itself against the risks of an unfavourable dollar/euro exchange rate. It will also enable Urenco to compete with the US privatised enrichment company USEC, which is world leader in the enrichment business.

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[116] Currently, this gas centrifuge plant in Capenhurst has a capacity of 2,438 ton SWU/yr (SWU = Separative Work Unit: unit for the capacity of uranium enrichment).
Source: http://www.antenna.nl/wise/uranium/efac.html#ENRC

[117] Capenhurst A3 was bult for the purpose of producing enriched uranium for the military, using Urenco technology. However the plant never produced HEU. After it was started in 1984-85 it produced intermediate enriched uranium, it is above 5 percent uranium-235, for export to the US either for further enrichment to HEU, or in exchange for an equivalent amount of HEU. [Nuclear FuelVol.22, No.9, 05.05.1997, p.12 and: British Nuclear Facilities: http://nuclearweaponarchive.org/Uk/UKFacility.html]

[118] Currently Urenco Nederland B.V. has a license for a capacity of 2500 ton SWU/yr. The pilot plant in Almelo (SP1) had a capacity of 25 tSWU ('73); the demonstration plant (SP2): 200 tSWU ('75); and the commercial SP3 ('86): 1,000 tSW. In 1995 the capacity is expanded to 1,400 tSW. Currently the capacity is 1,950 tSWU (see source in note 108).

[119] Atomic Energy in Australia, July 1983, p.36

[120] Nuclear Fuel 05.10.1987, p.2

[121] UCN Annual Report 1986, p.13

[122] UCN Annual Report 1978,p.

[123] Nuclear Fuel, 29.03.2004, p.23

Currently USEC operates a gas diffusion enrichment plant in Paducah, Kentucky. It took over two gas diffusion enrichment plants from its predecessor, the Department of Energy, DOE, in 1993.[124] but the second facility in Portsmouth, Ohio, is kept in cold standby.[125],[126] USEC attempted to gain entry into Urenco but failed.[127] To stay competitive, USEC has to change from enrichment by the gas diffusion method to the ultracentrifuge technology.

In the 80's USEC predecessor, DOE, developed ultracentrifuges, but stopped this program before commercialisation could take place. Now USEC has resumed this centrifuge development program. In 2000 USEC signed an agreement with DOE on centrifuge development.[128] On 12 January 2004, USEC announced that it has chosen Piketon, Ohio as the site for its so-called "American Centrifuge" commercial uranium enrichment plant project.[129] On 12 February 2003, USEC submitted a license application for a gas centrifuge uranium enrichment test facility or "lead cascade".[130] In 2005, USEC expects to begin operating the American Centrifuge Demonstration Facility.[131] The demonstration facility, to be sited in Portsmouth, will contain a lead cascade of up to 240 full-size centrifuge.[132] A lead cascade is the basic building block of a commercial enrichment plant.[133] The USEC centrifuges have an eightfold larger output than the Urenco ultracentrifuges and are claimed to have a 100-year operating lifetime.[134]

Within a decade it is likely that centrifuge technology will be the dominant technique for uranium enrichment. Many countries have done research on laser enrichment, but the technology is not yet commercially viable. The three Urenco countries, France, Japan, the USA and others spent large sums of money on laser research in the nineties. The Urenco countries alone spent $300 million on laser research until 1994.[135] USEC suspended work on AVLIS in 1999 having spent US$2 billion over the project's lifetime.[136] The Japanese Laser-J research was ended in 2001, having cost billion of yens from 1980 onwards.[137] And in 2003 France's Commissariat à l'Energie Atomique (CEA) ended research into laser enrichment too, having spent over € 1 billion on the project.[138]

Until recently only the USEC funded Silex Systems research in Australia was left. USEC stopped funding it from April 2003.[139] Silex Systems is now looking for a new partner for the commercialisation of the SILEX uranium enrichment technology.[140]

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[124] Nuclear Fuel, 07.07.2003,p.18
[125] USEC press release, 18 May 2001; The Courier-Journal, 29 May 2001
[126] Nuclear Fuel , 05.01. 2004, p.3
[127] Nuclear Fuel, 15.09.2003,p.16
[128] Nuclear Fuel, 07.07.2003, p.1,17-20
[129] Nuclear Fuel, 19.01.04
[130] U.S. Enrichment Corporation Gas Centrifuge Facility: http://www.nrc.gov/materials/fuel-cycle-fac/usecfacility.html
[131] USEC Annual Report 2003, p.3.: http://www.usec.com/v2001_02/Content/Investors/2003pdf/USEC2003AnnualReport-Narrative.pdf
[132] Nuclear Fuel, 10.11. 2003, p.7
[133] http://www.antenna.nl/wise/uranium/epusec.html
[134] Nuclear Fuel, 29.03.2004,p.21,22
[135] Lenders, Maurice; Uranium Enrichment by gaseous Centrifuge, p.7, 16 May 2001, Dresden.
[136] Lenders, Maurice; Uranium Enrichment by Gaseous Centrifuge; 16 May 2001, Dresden
http://www.urenco.com/pdf/atomforum_May_2001.pdf
[137] http://www.etceteraweb.com/TYNC/10-04-01.laser-enrichment.pdf
http://www.japantimes.co.jp/cgi-bin/getarticle.pl5?nn20011004c2.htm
[138] Nuclear Fuel, 19 January 2004, 11; http://www.world-nuclear.org/news/2004/wd_jan23.htm
[139] Uranium Enrichment; Nuclear Issues Briefing Paper 33; June 2003; http://www.uic.com.au/nip33.htm
[140] SILEX – USEC settlement, 7 April 2004:
http://www.asx.com.au/asx/statistics/AnnHeadersForIssuer.jsp?ASXCode=slx&TimeFrame=past_year&from_year=1998&from_month=0&to_year=1998&to_month=0&x=11&y=9

Astonishingly, Iran has built a pilot laser enrichment plant, which actually produced small quantities of enriched uranium. The IAEA is studying this program[141].

CHAPTER IV URENCO AND PROLIFERATION

Although Urenco denies being responsible for proliferating its enrichment technology to other countries, in at least the case of Brazil, Urenco has acknowledged that its technology has ended up in Iraq, Pakistan and via Pakistan in North Korea, Iran, and Libya.[142] And as will be demonstrated below, there are certainly cases where problems with security have facilitated the theft of this technology.

A delivery for Brazil

On 2 April 1977 the first big demonstration against Urenco Almelo took place, with around 100,000 people protesting against the expansion of the enrichment plant. Expansion was necessary as Germany had agreed to export to Brazil 8 nuclear power plants, including the enriched uranium needed for the whole lifetime of the reactors, as well as nuclear fuel production plants, reprocessing and enrichment plants[143]. Because of the limitations on it enriching uranium, West Germany could not supply enriched uranium to Brazil if the Dutch Urenco plant did not deliver. Although the Dutch government had promised parliament it would have a say in approving the export from the Netherlands, this proved to be unnecessary, as in 1981 it became clear that the British Urenco plant in Capenhurst had exported enriched uranium to Brazil instead.[144]

At the time, Brazil had not signed the non-proliferation treaty (NPT) , the reason cited by the US in opposing delivery of low enriched uranium (LEU)[145] to Brazil. It was feared by the international community[146] that the transfer of sensitive nuclear technology, especially enrichment and reprocessing technology by German firms to Brazil, would result in Brazil making nuclear weapons by itself, or by using Urenco deliveries of enriched uranium. In 1978 Brazil started a nuclear weapons program, code-named "Solimoes", managed by the state-owned Brazilian Nuclear Corporation 'Nuclebras'.[147] This was based on the commercial nuclear energy program, which was under trilateral IAEA safeguards, because Germany was an NPT member.

In 1978 the Dutch Urenco partner, UCN, had also been importing uranium for more than four years from the Rössing mine of the British multinational Rio Tinto Zinc in Namibia, occupied by South Africa. According to the United Nations 1974 decree nr. 1 the export of raw material from Namibia was forbidden. The Dutch state was taken to court on the grounds of receiving plundered minerals. In 1985 The UN Steering Group for Namibia decided to take Urenco to court[148].

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[142] Nuclear Fuel, 20.01.2003, p.15; 07.07.2003, p.2024.11.2003, p.8,9; 15.03.2004, p.7-9; Nuclear Europe Worldscan, 11-12/1991,p.53.
[143] http://www.laka.org/teksten/verzet/1960-2001.PDF
[144] Sublette, Carey, Nuclear Weapons Frequently Asked Questions: Ch. 7: Nuclear Weapon Nations and Arsenals.
http://nuclearweaponarchive.org/Nwfaq/Nfaq7-4.html By 1997 it was reported that the Brazilian Isotopic Enrichment Facility (LEI) housed 725 centrifuges, which could produce enough HEU for one or two nuclear bombs a year. Currently there are plans to expand the capacity to 200,000 SWU/yr. Brazil apparently has the capability to produce HEU, but it is not known to have done so. Brazil plans to build nuclear submarines which use HEU as a nuclear fuel in their nuclear reactors.
[145] Light Enriched Uranium [LEU]: up to 20 percent Uranium-235; High Enriched Uranium [HEU]: more than 20 percent U-235
[146] Specter, Leonard S., The New Nuclear Nations, 1985, p.197-200; Vintage, NY.
[147] De La Court, T., ea, De Nuclear Fix,p.33-35, 1982, WISE Amsterdam.
[148] Twentse Courant 04.05.1985

Prolems with security

There are at least two *known* cases where secret ultracentrifuge technology has leaked from Urenco enrichment facilities. The most well known involving AQ Khan is detailed in Chapter I and II. The lesser-known case involved the Urenco plant at Gronau.

This case involved the theft, somewhere between 1985 and 1990, of blueprints with specifications of the then most modern UC, the TC11, and probably a list of subcontractors, by former workers of the company MAN, which was then a main shareholder of Uranit, the German Urenco firm. The ultracentrifuge experts, Bruno Stemmler and Schaab, still had old entry permits, allowing them to easily enter Uranit and copy the very secret blueprints, which they sold to Iraq.[149] Stemmler and another MAN expert, Walter Busse, stayed for months in Iraq during 1987 and 1988 to help the Iraqis solve technical problems they had with production and operating of ultracentrifuges.[150] The IAEA discovered the very advanced, carbon fiber reinforced TC11 ultracentrifuges in Iraq, after a top Iraqi official fled to Jordan, with a number of discriminating documents. [151]

There was also a case of a suspected theft 1984, which if conclusively proven would also demonstrate how easily nuclear proliferation can take place. The firm Leybold-Heraeus responded to tender from Uranit for delivery of cascade tubing, autoclaves for storage of natural UF6, UF6 containers and desublimators, for cooling of enriched UF6. To be able to test whether they could construct this technology, Leybold-Hereaus legally obtained the blueprints from Uranit. A Leybold employee, Gotthard Lerch, then ordered autoclaves, containers and desublimators from the Swiss firm MetalWerke Buchs, MWB, which produced them using the blueprints.[152],[153] A small part of the machinery produced was seized by Swiss customs, the largest part had already been shipped to Pakistan, via Dubai.[154] From the design of the equipment it was concluded that it was suitable for producing high-enriched uranium.[155]

In 1986 Uranit informed Aachen prosecutors that the blueprints, which it recovered from MWB, were copies for which it had copyright protection. Uranit said that Leybold-Hereaus got the blueprints from Urenco. In 1987 criminal prosecutors in Cologne concluded that two former Leybold employees, Otto Heiligbrunner and Lerch had stolen the Urenco know-how. In 1988 Leybold-Hereaus suggested that Lerch had had access to the blueprints, but in 1991 German prosecutors let it be known that the investigation of the accused had been terminated, because the Swiss authorities did not cooperate.[156]

Interestingly, in March 2004, Heiligbrunner, now 80, stated that Leybold-Hereaus had bought the rights to the know-how in the blueprints from Comprimo BV, a Dutch firm, located in Amsterdam. At the time, Comprimo had formed an architect/engineering partnership in the Urenco project with Interatom GmbH, itself a Siemens subsidiary, which was also a Urenco subcontractor for enrichment technology. According to Heiligbrunner, Comprimo developed the

[149] Nuclear Fuel 29.10.1990, p.10
[150] K.R.Timmerman, 1991, De Judaskus, Tirion, p.308,309
[151] Nucleonics Week 22.01.1996, Extra
[152] Die Stern 02.05.1987
[153] Nuclear Fuel 29.10.1990, p.10
[154] Nuclear Fuel 04.05.1987, Extra
[155] Nucleonics Week 18.05.1987,p.1,2
[156] Nuclear Fuel 28.11.1991,p.1

technology and had sold it later to Leybold-Hereaus, around 1978 or 1979. At that time the technology was not considered sensitive enough to be classified by the German government.[157] The director of Comprimo was the Dutch Professor, Barendregt, a nuclear scientist who knew A.Q.Khan and had visited Pakistan several times.

In February 2004, the Swiss started an inquiry into three suspects alleged by Malaysia to have been involved in the production of gas centrifuge parts for Libya by the Malaysian firm Machine Shop 1001. One of the suspects was again Gotthard Lerch. The Malaysian police alleged that Lerch tried to obtain supplies of pipes for this plant. A former Iranian official said Lerch had also been named by Iran as having been involved in Teheran's nuclear program.[158] The other two suspects are well known from other cases of nuclear smuggling: Friedrich Tinner and his son Urs. F. Tinner. Friedrich Tinner is currently president of the Swiss company Cetec, and is a former executive at the Swiss firm VAT, which supplied valves to Urenco since 1979[159] and also supplied valves for Leybold-Hereaus furnaces. Urs Tinner, the third suspect, was a consultant to the manager, B.S.A.Tahir, of the Malaysian company Machine Shop 1001, hired to set up the centrifuge parts factory until he left in Oct. 2003. Large quantities of aluminium and steel tubes were delivered to the Malaysian factory by a German subsidiary of the Singapore-based firm Bikar Metal Pte Ltd.[160]. The centrifuge parts made in Malaysia were made according to blueprints originating from Urenco designs, stolen by Kahn.[161]

It is remarkable that over such a long period the same individuals and companies are named repeatedly as being connected with cases of nuclear smuggling or brokering. Questions remain about how many other firms received blueprints from Uranit when they reacted to tender from the firm? It is also not known whether this was the normal way of ordering at the Urenco plants in the Netherlands and the UK. One thing is clear: a large firm like Urenco has many (former) subcontractors, which are much less controlled regarding their export of dual use goods or know-how than Urenco itself.

[157] Nuclear Fuel 01.03.2004
[158] Nuclear Fuel 01.02.2004
[159] Kollert, p.408
[160] Nuclear Fuel, 01.03.04
[161] IHT 21.02.2004; Guardian, 05.03.2004; LA Times, 22.02.2004; Nuclear Fuel, 01.02.2004.

CONCLUSION: THE NPT DILEMMA

The role played by Urenco in the proliferation of nuclear technology as described in this paper illustrates clearly that the use of this technology for peaceful or military purposes cannot be separated. Furthermore, the existing international treaty obligations, which call for free access to nuclear technology for all member countries and for applying safeguards to nuclear materials, have in fact obfuscated an extremely important fact: the development of nuclear power as a source of energy makes it possible to create the basis of a nuclear weapons program. A key part of this is the nuclear enrichment technology developed so successfully by Urenco.

Black market excuses

The production of the Pakistani and indeed any nuclear weapons depend on the import of technology, equipment and materials as well as the development of know-how. The case we have described clarifies how this can work in practice. Existing legal arrangements and guidelines for stopping or controlling the export of the technology from the Netherlands have failed on many occasions. The widely held explanation of this failure is based on an analysis in which this exporting process is largely seen as a problem of illegality. Hence the constant use of the term 'black market'. The use of this terminology in itself suggests that the solution to the proliferation problem needs only be sought in the tightening up of the laws and export regulations. President Bush's recent speech on the proliferation issue was a clear illustration of this. He stated:

"*Second, I call on all nations to strengthen the laws and international controls that govern proliferation. At the U.N. last fall, I proposed a new Security Council resolution requiring all states to criminalize proliferation, enact strict export controls, and secure all sensitive materials within their borders. The Security Council should pass this proposal quickly. And when they do, America stands ready to help other governments to draft and enforce the new laws that will help us deal with proliferation.*" [162]

However, the companies involved were largely operating perfectly legally. Either they exported licence-free products, which could be used to build key parts of the uranium enrichment chain; or they exported dual use goods as permitted under existing legislation. Alternatively and more controversially, key items were exported to third countries from where they were redirected to the final destination. It is, however, misleading to describe this solely as a gigantic black market operation that avoided the scrutiny of various law enforcement agencies. It is more accurate to describe this as a collection of particular transactions, which were not looked at too closely because of the prevailing political winds.

We believe that the post facto reconstruction of the events as a kind of sophisticated bank robbery is misleading and will in fact result in further mistakes being made in developing effective anti-proliferation policies.

The development of Urenco technology and its dissemination took place within an international policy framework, which allowed such a process to take place. Short-term opportunistic foreign policy was unfortunately aided by the nature of the Non-Proliferation Treaty itself, which in

[162] "Remarks by the President on weapons of mass destruction proliferation", Fort Lesley J. McNair - National Defense University, Washington, D.C., 11 February 2004.

article 4 states the following: *"Nothing in this Treaty shall be interpreted as affecting the inalienable right of all Parties to the Treaty to develop, research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of this Treaty."*

It therefore acknowledges the rights of all member countries to use nuclear technology for peaceful purposes, as a quid pro quo for not building nuclear weapons.

Strategic blindness

In the 'seventies and 'eighties Pakistan was a frontline state in the East-West confrontation. It was not in the interests of the West to confront Pakistan on the preparations it was making for its nuclear weapon programme, let alone the import of the basic elements of the enrichment technology. The country's strategic position made it an important strategic asset for the US as a counter to post-revolutionary Iran, communist China and in the 'eighties supporting the Afghan revolt against the Soviet occupation.

Similarly, Iraq was given maximum leeway in arming itself for the 1980-88 war with Iran. The US government countered the growing Iranian influence in the region by supporting Iraq in its invasion and subsequent long war against Iran. This support extended to the export of sophisticate weaponry to Iraq, including the technology that country needed for its nuclear weapons program.

Today Pakistan is an American ally in its war on terrorism. Since this involves the close co-operation of the present military ruler of Pakistan for military operations and, indeed, all aspects of US power projection into central Asia, it would be entirely contrary to US interests to weaken his power. That is why there have been no overt sanctions or reprisals against the state of Pakistan in response to the development of its nuclear weapons and the export of the related technology. Instead, all blame and responsibility has been placed squarely on the shoulders of the famous Mr. Khan. It is entirely beyond the bounds of belief that the Pakistani government itself was not involved in the various exchanges of nuclear technology with North Korea, Iran and Libya.[163]

There are some indications that the US government is playing a role in the custody of the Pakistani nuclear forces. There is also a possible political adjunct to this: UK foreign minister Jack Straw suggested that "the international community' was examining the feasibility of accepting Pakistan as an official NWS...."[164]

The political implication is very clear: if a state has made itself into a key ally of the most powerful state in the world, then it has a powerful lever to pursue its own interests, even if these ultimately run counter to those of that state.

There are other examples of close cooperation between the nuclear weapons states and their allies in the area of nuclear technology.

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[163] "Musharraf Named in Nuclear Probe", Washington Post, 3 February 2004.
[164] Nucleonics Week, 11 March 2004.

Russia, for example, has in the last decade provided Iran with nuclear reactors and the necessary technical expertise to run them. Iranian technicians were also trained in this. A large, modern LWR needs more know-how and therefore training to run than a relatively simple dual-use reactor. Once these programmes are initiated the receiving country can develop them further. In Iran an enrichment programme was also set up without notifying the IAEA. Israel's nuclear programme was set up with French help, while India was supported by Canada.

The key point is that the so-called civilian help laid the foundations for the military nuclear programme.

Inherent contradictions

There is another built-in barrier to effective counter proliferation policy, and that is the obvious co-existence of two sets of rules: one for the nuclear weapon states, the other for the non-nuclear weapons states. We distinguish five categories of involvement:

1. The five nuclear weapon states recognised by the Non Proliferation Treaty: US, Russian Federation, China, France, United Kingdom
2. The three, possibly four nuclear weapon states which have not signed the NPT but have a substantial nuclear strike capability: Israel, India, Pakistan. Most public intelligence estimates give North Korea a small number of nuclear bombs.[165]
3. The states covered by a nuclear umbrella. This includes all the NATO (formal) non-nuclear weapons states, which are involved in NATO nuclear planning and doctrine. Six of these non-nuclear member states have tasked part of their air forces to carry out nuclear strikes with US nuclear weapons, in accordance with US nuclear doctrine.[166]
4. The states striving to gain nuclear weapons, either within or without the NPT framework, like Iran.[167]
5. The states with a civil nuclear programme, which gives them the ability to build nuclear weapons if they were to make the political choice to do so. This is a group of 44 countries, as defined in the Comprehensive Test Ban Treaty. They include states like Japan, Republic of Korea and Brazil.[168]

It is generally recognised that the NPT is an extremely important treaty for curbing the proliferation of nuclear weapons technology. However, as we have shown in our case study, it has a built-in contradiction that at least partially defeats its purpose. That is, it explicitly encourages (in art. 4) the proliferation of nuclear technology suitable for building weapons. The measures suggested by President Bush in his February 2004 speech: curbing the export of the enrichment part of the nuclear cycle and agreeing to more international inspections, sound reasonable but have a fatal flaw. They would not apply to a substantial group of industrialised states included in the categories described above. Instead, the great majority of the signatories of the NPT would be affected. It would, in short be another way of ensuring the continuation of the nuclear weapons status quo, with no attempt to comply with the other part of the NPT which is rarely mentioned by spokespersons of the nuclear weapons states (NWS): the obligation to strive for nuclear disarmament (art. 6).

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[165] http://www.fas.org/nuke/
[166] "Questions of Command and Control", PENN (Project on European Nuclear Non-Proliferation) Research Report 2000.1.
[167] http://www.fas.org/nuke/
[168] http://www.ctbto.org

At the same time the US government has engaged in a strategic policy shift, which openly declares that pre-emptive warfare is legitimate. It reserves the right to wage nuclear war against states, which threaten to arm themselves with WMD.[169] In so doing the 'negative security assurances', promises made by the nuclear weapons states in 1995 not to attack the signatories of the NPT with nuclear weapons, are violated.[170]

The NPT review conferences (which are held every five years), are meant to review the effectiveness of the NPT: i.e. the degree to which the signatories have adhered to their treaty commitments. In 2000, all state parties except France (which abstained) recommitted themselves to nuclear disarmament. In 2005 these commitments will again be reviewed. There will obviously be sharp disagreements between the nuclear weapons states and those countries, which agreed in 1995 to the unlimited extension of the NPT. The former (most clearly the US) will be seen to have largely ignored their commitments, while at the same time developing coalitions of the willing (like the Nuclear Suppliers Group, the Proliferation Security Initiative) to counter horizontal proliferation, while ignoring vertical proliferation. Moreover, the US continues to develop new nuclear weapons systems and means of deploying them.[171]

It is entirely logical that countries that see themselves threatened by US pre-empting policies (or by those of other nuclear weapons states) will strive to develop weapons which will effectively defend them against possible attack. And of course, in so doing, they will be giving a reason for being attacked. This is a deadly spiral, which should be avoided.

The argument made by President Bush about the need to change the NPT is well taken. But it is of course an attack on the principle of free trade, on the article 4 right to nuclear technology. It would create a de facto oligopoly of nuclear suppliers, which would in turn give rise to strong opposition from existing and potential NPT signatories. In fact it is more logical to agree and implement a comprehensive fissile material treaty that bans all reprocessing and uranium plants, capable of producing pure plutonium and enriched uranium.

Director ElBaradei of the IAEA agreed with President Bush to some degree: but he added the extremely relevant comment:
"*Of course, a fundamental part of the non-proliferation bargain is the commitment of the five nuclear States recognized under the non-proliferation treaty — Britain, China, France, Russia and the United States — to move toward disarmament. Recent agreements between Russia and the United States are commendable, but they should be verifiable and irreversible. A clear road map for nuclear disarmament should be established — starting with a major reduction in the 30,000 nuclear warheads still in existence, and bringing into force the long-awaited Comprehensive Nuclear Test Ban Treaty.*"[172]

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[169] "Nuclear Posture Review Leaks; Outlines Targets, Contingencies", Arms Control Today, April 2002, http://www.armscontrol.org/act/2002_04/nprapril02.asp; "Bush Administration Releases Strategy on WMD Threat", Arms Control Today, January/February 2003, http://www.armscontrol.org/act/2003_01-02/wmdstrategy_janfeb03.asp.
[170] "U.S. Nuclear Policy: "Negative Security Assurances"", http://www.armscontrol.org/factsheets/negsec.asp
[171] See: http://www.armscontrol.org/act/2004_03/EnergyDepartment.asp
[172] IAEA Director General Dr. Mohamed ElBaradei, "Saving Ourselves From Self-Destruction", New York Times, 12 February 2004.

That is, the lack of verifiable and ireversible steps towards nuclear disarmament will make a stronger non-proliferation regime within a legal framework extremely difficult if not impossible to achieve.

Points for a policy debate
In view of the above developments we see a need for a fundamental debate along the following lines:

1. The NPT encourages the proliferation of nuclear technology. This in turn can be used by NPT signatories that want to develop nuclear weapons;

2. Certain changes are needed, in particular the prohibition on the production, transport and use of fissile materials in the nuclear fuel cycle;

3. This will run into strong opposition from NPT signatories who want to maintain maximum access to nuclear technology;

4. There is no sign at all that the NWS will abolish their nuclear weapons;

5. Unilateralist mechanisms (like the traditional arms export control agreements NSG, MTCR and now especially PSI) are being set up outside the NPT and other multilateral arms control mechanisms (CD) by the US, which is supported in this by a number of mainly Western (-oriented) industrialised countries. This means that the NPT is being undermined;

6. Pressure will logically be applied to change the NPT (along the lines suggested by Mr. ElBaradei and President Bush, undoubtedly with all kinds of variations on the theme): many signatories will likely resist this. Therefore a stalemate in 2005 seems very possible;

7. The threatening deadlock at the NPT review conference in 2005 makes a serious debate an urgent necessity. A key point that should be taken up is the connection between nuclear energy and nuclear weapons;

8. It would be wise to initiate this debate quickly, and not wait for a very likely deadlock in 2005. A possible point of action could be suggesting changes in the NPT. Either the treaty itself could be changed, or additional protocols added.

ANNEX I: URENCO CORPORATE STRUCTURE

In the Netherlands the state originally possessed 56% of the shares of Urenco Nederland, the private companies Philips, DSM, VMF-Werkspoor, RSV and Shell the rest. In 1980 a decision was made to construct new Dutch and German enrichment plants at Almelo. This decision was a consequence of a giant nuclear contract Germany had made with the military regime in Brazil. The Dutch Urenco private companies, however, were not prepared to invest as they did not expect to make a profit. Departing from the original intention of the government that the companies take over all their shares in the long term, the government – clearly under strong German pressure – decided to invest *f*470 million (€214 million) and to give loan guarantees. This larger financial involvement was translated into a larger state share from 1980: 98.9%, the companies were left with 1.1% of the shares.[173]

Until September 1993 Centec GmbH, located in Bensberg, West Germany, was an associate company of Urenco Ltd. As the technology holder, Centec co-ordinated the R&D programme for the entire Urenco Group. It had the same British and Dutch shareholders as Urenco Ltd, BNFL and UCN respectively. The German shareholder was Gesellschaft für nukleare Verfahrentechnik (GnV), which was jointly owned by Internationale Atomreaktorbau GmbH (Interatom) and MAN AG. UCN NV built the ultracentrifuges for Urenco Nederland BV and BNFL and GnV for the settlements in the UK and Germany.

Since the merger in September 1993 Urenco Ltd has taken over the enrichment plants of the Urenco Group and all related activities. The shareholders are Uranit, UCN and INFL, each for one third.

The activities of Urenco in the Netherlands are organised in Urenco Nederland BV. The Enrichment Division of the company operates the Dutch enrichment plant in Almelo, and the Manufacturing Division is responsible for the manufacturing of centrifuges for the whole group. In addition, Almelo is the centre of Urenco Aerospace. Urenco Nederland BV is a 100% subsidiary of Urenco Ltd.. The other two subsidiaries Urenco Deutschland GmbH and Urenco Ltd. operate the uranium enrichment plants.[174] The Dutch branch of Urenco was best known as Ultra-Centrifuge Netherlands (UCN). Currently, however, UCN is only the holding company of Urenco Nederland BV. In practice many people use the names Urenco or UCN for the operating plant.

The past bids on Urenco

In 1999, driven by orders of the European Commission to create a single market in electricity, holding companies for Preussenelektra AG, Germany's biggest nuclear power producer, and RWE Energie AG, the country's biggest utility, decided to sell their shares in Uranit.[175]
Since then, market sources reported, BNFL has likewise held talks with German and Dutch officials regarding the terms of sale of respectively Uranit and UCN to BNFL. As an existing shareholder, BNFL appeared to be in key position to acquire these shares. At the beginning of November 1999 it was expected that BNFL would take over Urenco.[176] Though not formally, Cogema countered the BNFL offer for Urenco.[177] During a meeting in Almelo on 10 November 1999, the German government laid down five points that it wanted to be fullfilled by BNFL or any other party that bought Uranit shares. It demanded a third of the proceeds of any sale of Uranit shares from Uranit's shareholders, Preussenelektra and RWE, through a change in ownership.[178] At the end of November 1999 BNFL reportedly pressed Urenco's German and Dutch shareholders to sell their shares of Uranit and UCN to the British company by 31 December 1999.[179] At the end of December 1999 Urenco's German utility owners made clear that they

[173] UCN, Annual Report 1992, p.45.
[174] Annual Reports Urenco 1976, '85, '92, '93
[175] NuclearFuel, 28 June 1999, 1.
[176] NuclearFuel, 1 November 1999, 14.
[177] NuclearFuel, 15 November 1999,1.
[178] NuclearFuel, 15 November 1999,11.
[179] NuclearFuel, 29 November 1999, 1 and 6.

firmly opposed plans by the German federal government to take a third of the proceeds and that BNFL had not come close to the amount that the two companies claimed the German Urenco shares were worth.[180] Shortly afterwards Cogema issued a formal bid for control of Urenco shares held by the Dutch and German shareholders. This bid was reported to be close to double the original BNFL bid. A meeting between Cogema and the German Ministry of Economics was taken as a sign that Germany was willing to accept the French company as a bidder.[181] In May 2000 Lauvergeon confirmed that Cogema had made an offer to buy all or part of the 66% of Urenco up for sale at that time. BNFL was reportedly seeking ways to increase its bid for Urenco, including a joint venture with USEC.[182] BNFL was aiming for control of 51% of the shares of Urenco. This majority ownership would ensure that BNFL would control Urenco's technology should it form a venture with USEC to build a centrifuge plant in the US. Because BNFL was joined by Cogema and USEC in the competition for the Urenco shares, the shareholders of Uranit considered starting the process again by formally soliciting official bids for the shares. This would no doubt have increased the price.[183] In September 2000 it was reported that Cogema was said to have been in talks with BNFL about a possible joint venture to buy the shares. The Canadian uranium mining company Cameco was also reported to be interested, and commentators speculated that the bidding process might lead to a number of joint venture options, as none of the interested parties "has enough money to buy up all the shares" at the asking price.[184]

Though there has not been a sale of the Dutch and German shares of Urenco, Cogema now has access to ultracentrifuge technology. Cogema's parent company Areva has made a first step to abandon uranium enrichment by gaseous diffusion. In a Memorandum of Understanding (2002) , Urenco and Areva have agreed to develop plans for working together in the field of centrifuge technology for uranium enrichment. The companies envisage a 50-50 joint venture to build a new centrifuge enrichment plant that would progessively replace the existing Tricastin plant capacity beginning from 2007.[185] The new enrichment plant will be named Georges Besse II. Actual construction is expected to get under way in early 2005, once government authorizations have been obtained and relevant international treaties have been modified allowing Areva to take an equity interest in Enrichment Technology Company (ETC). This is supposed to be done in the 4th quarter of 2004.

On 24 November 2003, Areva Group signed an agreement with Urenco shareholders, under which it will acquire a 50% equity interest in ETC. ETC comprises all of Urenco's centrifuge design and manufacturing activities as well as its R&D in the field of centrifuge equipment and installations for uranium enrichment to produce nuclear fuel.[186]

Of note is the fact that Iran still has a share in Eurodif.[187] [188]
In the 1970's the then ruling Shah of Iran planned to build 23 nuclear power plants throughout Iran by the mid-1990s. Consequently in 1974 Iran bought a 10% share of an enrichment facility being constructed in France by the Eurodif consortium and loaned US$1 billion to the French Atomic Energy Commission (CEA) toward the construction of a gaseous diffusion enrichment facility at Tricastin, France. These arrangements would have allowed Iran access to Eurodif enrichment technology and deliveries of the highly-enriched uranium (HEU) produced at the Tricastin plant.[189] Iran was expected to purchase 10% of

[180] NuclearFuel, 27 December 1999, 1 and 10.
[181] NF, 24 January 2000, 1 and 8.
[182] Uranium Institute News Briefing 00.22 | 24 - 30 May 2000:
http://www.world-nuclear.org/nb/nb00/nb0022.htm
[183] NF, 29 May 2000, 1 and 12.
[184] NF, 18 September, 2000, 1 and 13.
[185] Areva/Les Echos, Oct 9, 2002; http://www.antenna.nl/wise/uranium/epeur.html
[186] Areva Nov. 26, 2003.
[187] Haeri, Safa; IPS, Treated as a future head of state, Rohani ended visit to Paris, 16 Jan., 2004.
http://www.iran-press-service.com/articles_2004/Jan_04/france_iran_16104.html
[188] Scheinman, Lawrence; The Nuclear Fuel Cycle: A Challenge for Nonproliferation; Disarmament Diplomacy; Issue No. 76, March/April 2004;
http://www.acronym.org.uk/dd/dd76/76ls.htm
[189] Skootsky, Mark D.; US Nuclear Policy Toward Iran; 1 June 1995;

the 3%-enriched uranium fuel produced by Eurodif. In September 1986 France and Iran were near agreement on their dispute over the Eurodif enrichment plant. Iran wanted repayment of a US$1 billion loan to France's CEA for Iran's participation in Eurodif. France wanted compensation for the enrichment services allotted to Iran. The settlement with France might have included French participation in Iran's partially completed Bushehr nuclear units.[190] In 1991, the International Commerce Commission ruled that France must repay the loan and that Iran would keep a small share of Eurodif, but France stated that it would not sell enriched uranium to Iran.[191]

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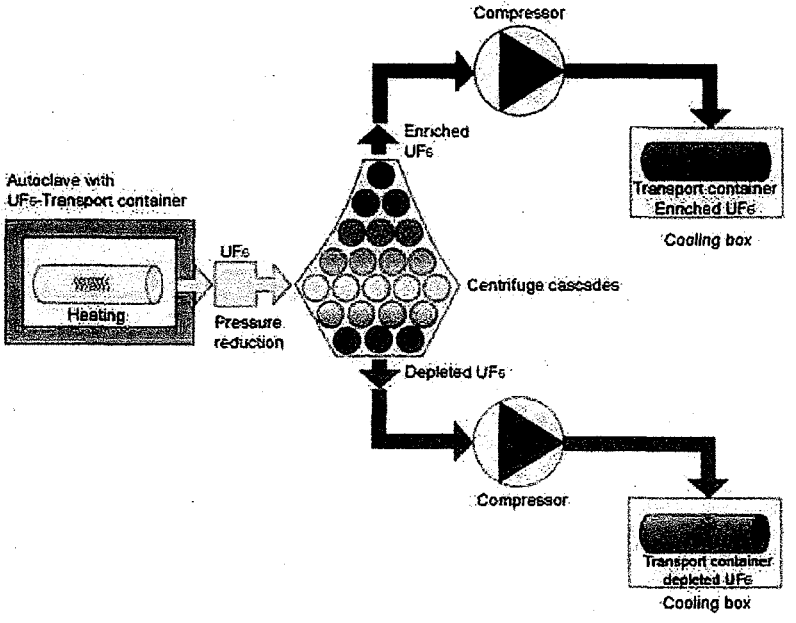
http://www.ai.mit.edu/people/boris/iran-nuke.text

[190] --"France and Iran may be nearing agreement," Nuclear News, September 1986, p. 90b.
http://www.nti.org/e_research/e1_iran_nch_1986.html

[191] http://cns.miis.edu/research/wmdme/flow/iran/enrich.htm

ANNEX II: URENCO AND THE ULTRCENTRIFUGE

The origin and history of Urenco is closely linked to the research and development of ultracentrifuge technology. Together with gas diffusion technology it is the most used method of uranium enrichment. Enrichment of uranium is part of the process which has to take place before the mined, purified and concentrated uranium enters the nuclear power plant in a nuclear fuel rod or becomes the explosive load of a nuclear weapon. The principle of an ultracentrifuge consists of high speed turning drums, which are coupled in a cascade and in which the heavier non-fissionable uranium 238 isotope is separated from the lighter usable fissionable uranium 235. In the seventies the Urenco ultracentrifuge was about one metre high. Currently the most modern Urenco UC's are around four meters high and are made from seven parts, connected by bellows.[192] At a certain number of revolutions per second, called the critical speed, the centrifuges tend to resonate like a string. Centrifuges which rotate at lower speeds are called sub-critical centrifuges. Centrifuges which rotate at higher speeds are called ultracentrifuges. Only special material can withstand the extreme centrifugal forces at which ultracentrifuges are subjected.[193] To lessen air resistance, the ultracentrifuges are built into castings, which are made vacuum. This enables higher speeds. As such this is highly sensitive technology, which the enrichment companies try to keep secret..



The first centrifuges for the separation of uranium isotopes[194] were used for the first time in the US[195] and further developed in Nazi Germany.[196] After World War II, the Russians took the leading centrifuge experts Zippe and Steenbeck with them.[197] Within eleven years they succeeded in developing such hi-tech centrifuges that the Russians were able to produce High Enriched Uranium (HEU) for the manufacture of

[192] Marx, Patrick, Verrijkt Uranium, Technisch Weekblad.
http://www.technischweekblad.nl/include/techarti/proned20.htm
[193] Federation of American Scientist. Uranium Production. http://www.fas.org/nuke/intro/nuke/uranium.htm
[194] Whitley, Whitley; Review of the gas centrifuge until 1962. Part I: Principles of separation physics (abstract), BNFLtd, Capenhurst Works, Chester, England: http://prola.aps.org/abstract/RMP/v56/i1/p41_1
[195] David Albright and Mark Hibbs, Iraq's shop-till-you-drop nuclear program, The Bulletin of the Atomic Scientists, Vol. 48, No. 3, April 1992. http://www.thebulletin.org/issues/1992/a92/a92.albright.html
[196] Klinkenberg, Wim; De ultracentrifuge 1937-1970, Van Gennep & In den Toren, 1971
[197] Ibid. pp.15-16.

nuclear weapons. Germany, the UK and the Netherlands (re)started centrifuge research after WW II. The spiritual father of the Dutch ultracentrifuge project, prof. dr. J. Kistemaker, accused of collaboration with the Nazis[198], started preparations for electromagnetic and ultracentrifuge isotope separation in the "Zeeman Laboratorium Amsterdam" from 1947.[199] Progress was slow. As soon as the centrifuges were spinning fast, they started to explode. After a few meetings with Zippe in Germany, who returned from Russian captivity in 1956, he perceived that Zippe's centrifuge design was superior to the Dutch design and convinced his team to select the former as a basis for further development.[200]

After WW II most European countries made plans to develop a nuclear weapon program. France and the UK succeeded in developing a nuclear weapon capability. However, countries like Germany, Spain, Sweden, Switzerland, Norway and the Netherlands wanted at least to have the option open. In the Netherlands, Germany, France and the UK research was done to develop methods for enriching of uranium. France and the UK had built enrichment plants based on the gas diffusion technology, for military use. In 1957 Euratom was founded with the intention to construct a common European nuclear industry, including enrichment and reprocessing plants. However, the Euratom countries were divided on the choice of an enrichment technology. Finally, the two groups of countries chose different technologies. France, together with Belgium, Spain and Italy, decided to build a gas diffusion enrichment plant at Tricastin in France. This company is called Eurodif.[201] Germany and the Netherlands were close to forming a joint venture to build an ultracentrifuge enrichment plant, but after some pressure from the United States, they accepted the United Kingdom as a partner. By doing so US influence in the European consortortium was ensured . In 1970 this troika founded Urenco.[202] Another way of obtaining fissile material for the manufacture of nuclear weapons is to build reprocessing plants, in which plutonium is separated from spent nuclear fuel. In Belgium a joint European reprocessing plant was built at Mol. France and the UK built their own reprocessing plants, first for military production and afterwards to separate plutonium from commercial reactor spent fuel.

The first country ever to build an ultracentrifuge enrichment plant was the Soviet Union. Other countries which have constructed ultracentrifuge enrichment plants, in addition to the UK, the Netherlands and Germany are: Brazil, China, India, Iran, Japan, Pakistan and the US.

Urenco and the Light Water Reactor

During the 'sixties and 'seventies there were high expectations of the growth of nuclear energy for power production. It was consequently expected there would be a shortage of uranium enrichment capacity too. That was one of the basic ideas behind the founding of Urenco. The supposition was clearly that all or most nuclear reactors would need enriched uranium as nuclear fuel. However, until the seventies it was not clear at all that Light Water Reactors, (LWR's) would be the winning design. A LWR uses enriched uranium as nuclear fuel and normal or 'light' water for cooling and for moderating the speed of fast neutrons, enabling them to split other uranium atoms. In Western Europe and elsewhere several different types of nuclear reactors were built. In Germany alone five different types of reactors were designed and constructed.

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[198] In 1937 the firm NV Cellastic was founded, which was in reality a scientific espionge department of the nazi intelligence service. Cellastic was financially close to the German Bank Rhodius Koenigs, dealing with espionage for atomic efforts of the Third Reich of which the ultracentrifuge was an important part. During World War II Kistemaker was a member of the staff of the Cellastic laboratory for nuclear physics in Paris under supervision of the German *Wehrmacht*. References: Goudsmit, Samuel A."ALSOS - the Failure in German Science" Londen 1947, p. 38-40; Bar-Zohar, Michel, "La Chasse aux Savants allemands (1944-1960)", Parijs 1965, p. 113; cited in 24.

[199] "De geschiedenis van het Nederlandse Ultracentrifuge Project", FOM, Institute for Atom and Molecule Physics, 1991.

[200] De Waarheid, "Al 13 jaar ultra-centrifuge in Nederland", 17 Nov. 1960. Klinkenberg, Wim; "Kistemaker en de Duitse A-bom", CPN, Nov. 1960.

[201] Salanave, Jean-Luc, et.al.; "Technological Transition With a Long-Term View", EURODIF Production, France, January-February 2003. http://npj.goinfo.com/NPJMain.nsf/0/d905c77d0dbfc2bb86256cdb006c3edc?OpenDocument&Click=

[202] Twentse Courant, "UC-Verdrag getekend", 4 March 1970; Keesings Historisch Archief, "Overeenkomst gas-ultracentrifugeprocédé ondertekend" (274/275), 8 May 1978.

During the 'fifties and 'sixties, the UK and France first constructed natural uranium reactors for their nuclear weapon programmes, which do not need enriched uranium. These reactors do not use light water for moderating, but heavy water or graphite and gas as a coolant, normal air or carbon dioxide.
They were especially designed to produce weapon-grade plutonium and electrical power at the same time, so-called 'dual use' reactors. That is what they were used for in the UK, France, Russia, China and later on in North Korea. The plutonium created in the reactor was afterwards separated from the used nuclear fuel. This happened in reprocessing plants, like those still functioning at la Hague in France, and at Sellafield in the UK. Natural uranium reactors have the relative advantage of not needing enriched uranium. Canada developed the CANDU reactor during the 'fifties which uses natural uranium and which is cooled and moderated by heavy water.

The majority of the early reactor types did not use enriched uranium. So why did the LWR become the dominant reactor type? [203]

There are four main reasons why this happened. The first is the fact that the USA Navy wanted to develop nuclear reactors for propulsion of their nuclear submarines, the advantage being that the subs could stay under water for months. They could not use a natural uranium reactor, because it needs at least a hundred tonnes of uranium as fuel. But if one uses enriched uranium, less nuclear fuel is needed. The more highly enriched the fuel is, the less fuel one needs. A 50 MegaWatt [MW] LWR reactor on board a nuclear submarine which uses HEU, enriched to 93% uranium-235, only needs about 50 kg HEU fuel. When a 50 MW reactor uses LEU, enriched to 4% U-235, as fuel, it needs about 1400 kg fuel.
Not surprisingly, the US Navy developed the LWR for the Nautilus, the first nuclear submarine built in 1954.

The second is that after the 'Atoms for Peace' speech of President Eisenhower in 1953, the US decided to declassify some nuclear know-how, so it could be used for 'peaceful' purposes to produce electrical power in civil nuclear reactors. But until then nuclear energy was only used for the military and no such civil nuclear reactor was developed in the USA. After the Atoms for Peace programme was announced, a commercial reactor had to be developed to make the message credible. The US was concerned that the USSR would be first in developing a commercial nuclear reactor and offer it to other countries. For the USA government that would be a political and economical disaster: It was therefore essential for it to develop a commercial reactor as soon as possible to offer to countries willing to sign up to the Atoms for Peace Program. Their military reactors were not found suitable for commercial use, they were not designed to produce power but to produce weapon-grade plutonium. The only reactor type available that could be developed in a short time for commercial use was the LWR. It could be built without major development costs, as the military had already paid for its initial development.

The third reason why the USA chose the LWR was based on its non-proliferation policy: it was not ideally suited to the production of weapons-grade plutonium.

And finally, the US had an overcapacity of uranium enrichment plants, which could now be used to produce LEU for the LWRs. The US thus created a monopoly: it was the only country that could guarantee the delivery of uranium and of enrichment services. Together with the UK, Canada and Australia they formed a uranium cartel.[204]

Although the Soviet Union built the first reactor that produced electrical power in 1954, the US followed in 1957 when the Shippingport LWR came into operation.[205] Once developed, the US civil nuclear reactor

[203] At the moment about 90% of all nuclear power plants are LWR's.
[204] Kollert, Die Politik der latenten Proliferation, 1994, DUV, p.137,450
[205] Kollert, p.65,78

industry was encouraged to build LWRs. The commercial breakthrough was reached in 1963, when a New Jersey energy company ordered the Oyster Creek LWR. By 1965 more than 30 nuclear power plants were ordered in the US.[206] The same development took place in the Soviet Union. It too used enriched uranium on board its nuclear submarines, developed and exported LWRs.

At that time the US Atomic Energy Commission had built three giant and very expensive uranium enrichment plants, using gas diffusion technology, one of which is still operating today. By 1964 two of them were put on standby, as they were no longer needed for the production of HEU for nuclear weapons. By this date there were huge stockpiles of HEU.[207]

From the industry's perspective, it was a logical and lucrative step to export LWRs and use the idled plants for the production of enriched uranium. The importing countries could buy LWRs from the US or get a license to build them themselves. The US guaranteed a life-long supply of enriched uranium. This had the deliberate side effect of giving the US control of the spent nuclear fuel and thereby also control over proliferation. Without permission from the US, the spent fuel could not be reprocessed to produce plutonium.[208]

In less than a decade most Western countries that went nuclear, chose the LWR. Almost the same happened in the Soviet Union and Eastern Europe: they too offered enrichment services for sale. The energy companies were to buy the uranium themselves and to ship it to the Soviet Union. Such was the expected demand for uranium enrichment services that many countries planned to build their own enrichment plants: Canada, Australia, Japan, France, Germany, the UK and the Netherlands.

[206] Kollert,p.78-80
[207] Bulletin of Atomic Scientists, April 1985,p.28
[208] Kollert, p.450

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ATTACHMENT 3

Higher ed headed for massive restructuring

y SCOTT DYER
apitol news bureau

Louisiana is the only state in the nation that as no sort of community college system, but hat's expected to soon change.

Whatever happens in the federal overnment's lawsuit over the desegregation f Louisiana colleges, higher education in ouisiana appears headed for a massive estructuring that will include the creation of new community college system.

Both a sweeping desegregation order ssued by a federal judge last month and a state compromise proposed as an alternative to that order call for the creation of a community college system.

When Arkansas began converting its vocational technical schools into community colleges two years ago, Louisiana became the last state without a community college system, said state Commissioner of Higher Education Sammie Cosper.

Like many state college leaders, Cosper blames low graduation rates at Louisiana four-year universities on the lack of a community college system.

Under Louisiana's current college system, many four-year schools have open admissions — that is, any high school graduate may enroll. But, making it easy to get into college has yielded a high frequency of dropouts.

Establishing an open admissions community college system would allow four-year schools to be more choosy about in-

☐ See COLLEGES, Page 17A

> **"But, how about the kid who flunks out? How about the one-third of the freshman class who aren't there after the first year? Where do they go?"**
>
> — Commissioner of Higher Education Sammie Cosper

Proposed La. plant probed

Nuclear enrichment process secrecy questioned

By PETER SHINKLE
Advocate staff writer

A Congressional committee is investigating whether a proposed uranium enrichment plant in northern Louisiana poses a threat of spreading nuclear bomb technology to other countries.

The probe took a twist when the committee's chairman, U.S. Rep. John Dingell, D-Mich., charged that a U.S. Department of Energy official misled congressional staff members investigating the Bush administration's actions concerning the plant.

Dingell's House Energy and Commerce Committee is studying whether an international treaty is necessary to protect secret information generated by the plant, which will be designed by Urenco, a European uranium enrichment corporation.

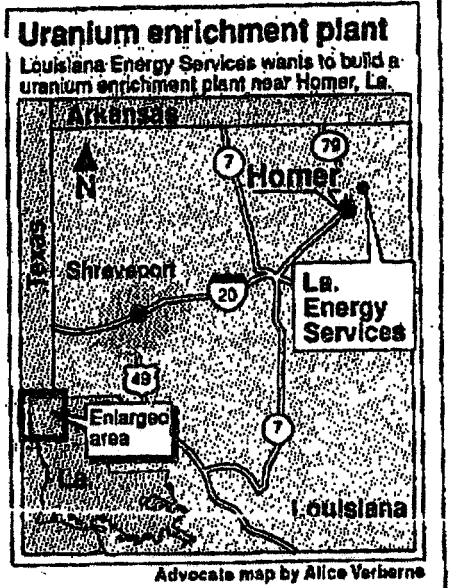
Urenco uranium enrichment technology probably was diverted to Iraq's clandestine nuclear weapons program, according to David Kay, former chief of the United Nations inspection team dismantling Iraq's weapons of mass destruction.

"The Iraqis had in their possession the designs of a very late generation gas centrifuge, including critical parts of the technology that have not been published. It was a direct linkage from a classified program — the Urenco program — more than likely," Kay said in a little-publicized address to the U.S. National Institute of Standards and Technology last May.

In addition to the designs, Iraq obtained parts for 10,000 centrifuges used to enrich uranium from Germany, one of the countries where Urenco is based, Kay said. German firms illegally exported the centrifuges, he said.

The centrifuges were poised to boost sharply Iraq's ability to make the highly enriched uranium needed for nuclear weapons. With the 10,000 centrifuges operating, Iraq could have produced 15-30 nuclear bombs a year, Kay said.

☐ See URENCO, Page 6A



Advocate map by Alice Verberne

Pair accused of aid

By PETER SHINKLE
Advocate staff writer

Two former employees of a Urenco subcontractor aided the Iraqi nuclear weapons program, a scientific journal has reported.

Urenco, a European uranium enrichment corporation, is part of the Louisiana Energy Services partnership, which is building a uranium enrichment plant in northern Louisiana.

Enriching uranium increases its concentration of U235—the form of uranium needed to cause a nuclear chain reaction.

However, enrichment technology poses a threat of nuclear proliferation because the same technology can be used to make the high-enriched uranium needed for nuclear bombs.

The International Atomic Energy Agency revealed in 1992 that more than a dozen European firms — many of them German — made high-technology equipment that was used in the Iraqi nuclear program.

Now, a German prosecutor accuses a German citizen and his wife of supplying more than 20 carbon-fiber rotors to Iraq for use in its centrifuge program in violation of German export laws, the Bulletin of the Atomic Scientists reported in its issue for January and February 1993.

Karl-Heinz Schaab was a former employee of a Urenco subcontractor, MAN Technologie AG in Munich, according to the Bulletin.

Schaab's wife, Brigitte, a co-owner of Schaab's business, was arrested, but Schaab cannot be found, the journal reported. He is believed to be in Brazil.

Another former MAN employee, Bruno Stemmler, recently said he secretly traveled to Iraq in 1988 and 1989 to assist the Iraqi centrifuge program, the Bulletin reported.

Stemmler said he did not provide the Iraqis with information specific to Urenco, which would have violated his commitment to protect classified information belonging to Urenco and MAN, the Bulletin reported.

Mary Boyd, a spokeswoman for Urenco and Louisiana Energy Services, said the firm would not comment on whether MAN or any other firm was in fact a subcontractor for Urenco.

Urenco is cooperating with the International Atomic Energy Agency's probe of Iraq's clandestine nuclear weapons program, Boyd said.

The Bulletin's report prompted criticism from Michael Mariotte, executive director of the Nuclear Information and Resource Service, a group that opposes construction of the uranium enrichment plant in Claiborne Parish.

The Dutch government concluded in 1980 that Urenco technology had been leaked to Pakistan's nuclear program, and now it's has been revealed that the Iraqi centrifuge program was based on Urenco designs, Mariotte said.

Mariotte admits there is so far no evidence that Urenco is directly responsible for providing equipment or data to Iraq, but the firm's subcontractors have done so, he said.

"It's obvious they don't have much control over their technology," he said. "We don't think Urenco is a very responsible company."

Boyd objected: "I can assure you that Urenco is a very responsible company, otherwise it would not be part of the Louisiana Energy Serv-

Urenco

CONTINUED FROM 1A

The Persian Gulf war and subsequent U.N. actions have stifled the Iraqi nuclear program. But because Iraq has significant nuclear know-how and international safeguards are weak, the program could resurge, he said.

The Energy and Commerce Committee staff, which has received classified briefings, said it could not comment on whether Urenco aided Iraq. However, the staff released a copy of Kay's address to The Advocate.

Mary Boyd, a spokeswoman for the American partnership that includes Urenco, rejected any suggestion that the firm was involved in assisting the Iraqi nuclear program.

"Urenco has never supplied centrifuge technology or equipment to Iraq," Boyd said.

She added that Urenco is cooperating with an investigation of Iraq's nuclear program by the International Atomic Energy Agency, of which the United States is a member.

Urenco, based in Germany, Great Britain and the Netherlands, is the key member of the partnership planning to build the northern Louisiana plant.

The partnership, called Louisiana Energy Services, includes Urenco and three utilities — Louisiana Power & Light Co., Northern States Power Co. and Duke Power Co. — and an engineering firm, Fluor Daniel.

The partnership has applied for a license to build the nation's first privately-owned uranium enrichment plant near the town of Homer in Claiborne Parish.

The $800 million plant, which will use technology now under development by Urenco, is expected to begin operating in 1997, Boyd said.

The U.S. nuclear power industry backs the project because it will make inexpensive low-enriched uranium needed to run nuclear power plants. The project also has the backing of U.S. Sen. J. Bennett Johnston, D-La., who chairs the Senate Committee on Energy and Natural Resources.

Enriching uranium increases its concentration of U235—the form of uranium needed to cause a nuclear chain reaction—by removing the less-valuable form, U238. In its natural form, uranium contains about .7 percent U235.

The Louisiana Energy Services plant is expected to use centrifuges to enrich uranium to about five percent U235, the level needed in fuel for nuclear power plants.

However, centrifuge technology poses a threat of nuclear proliferation because the same technology can be used to make the high-enriched uranium needed for nuclear bombs. High-enriched uranium usually exceeds 90 percent U235.

The Energy Committee's subcommittee on oversight and investigations is studying whether the Bush administration skirted requirements of the U.S. Atomic Energy Act that are aimed at controlling the spread of nuclear information.

Under the act, an "agreement for cooperation" must be submitted to Congress if certain nuclear information is being shared with other countries. Congress can then reject the agreement.

In 1991, some Congressional Democrats—including Dingell—looked into allegations that the Bush Administration ignored evidence that Iraq was building its nuclear and conventional weapons programs.

With the presidential election in the offing — and some Democratic candidates charging that Bush had coddled Iraqi president Saddam Hussein — it appeared the Urenco issue could have evolved into a political dogfight.

In January 1992, the subcommittee staff questioned Energy Department officials about the Louisiana Energy Services plant and its compliance with the Atomic Energy Act. Among the DOE officials present was Mark Schroeder, the department's deputy general counsel for energy resources and legislation.

The investigators asked Schroeder whether DOE drafted any documents to support the agency's determination that an agreement for cooperation was not necessary, Rep. Dingell wrote in a letter.

Schroeder replied that the department had prepared no such documents, Dingell wrote.

In response to Dingell's request for more information on the decision-making process, Energy Secretary James Watkins told Dingell that the agreement for cooperation was unnecessary.

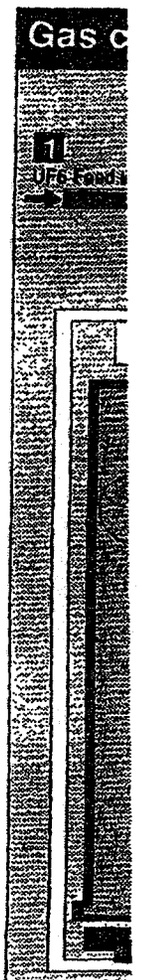
"Indeed, to suggest that such a formality is required to repatriate information already well-known to the recipient strikes me as illogical, if not absurd," Watkins told Dingell in a letter dated Feb. 28, 1992.

Watkins said it would "not be possible" to reconstruct the decision-making process that led the Bush administration to the conclusion that the Act did not require an agreement for cooperation.

The subcommittee continued its investigation, however, and the State Department released documents in May 1992 that showed there were indeed Energy Department documents concerning the decision on the agreement of cooperation.

Armed with the State Department documents, the subcommittee again asked the Energy Department to produce documents on Louisiana Energy Services.

In response, the Energy Department in May produced more than 20 internal memorandums and other documents, according to a letter Dingell wrote to Energy Secretary Watkins.



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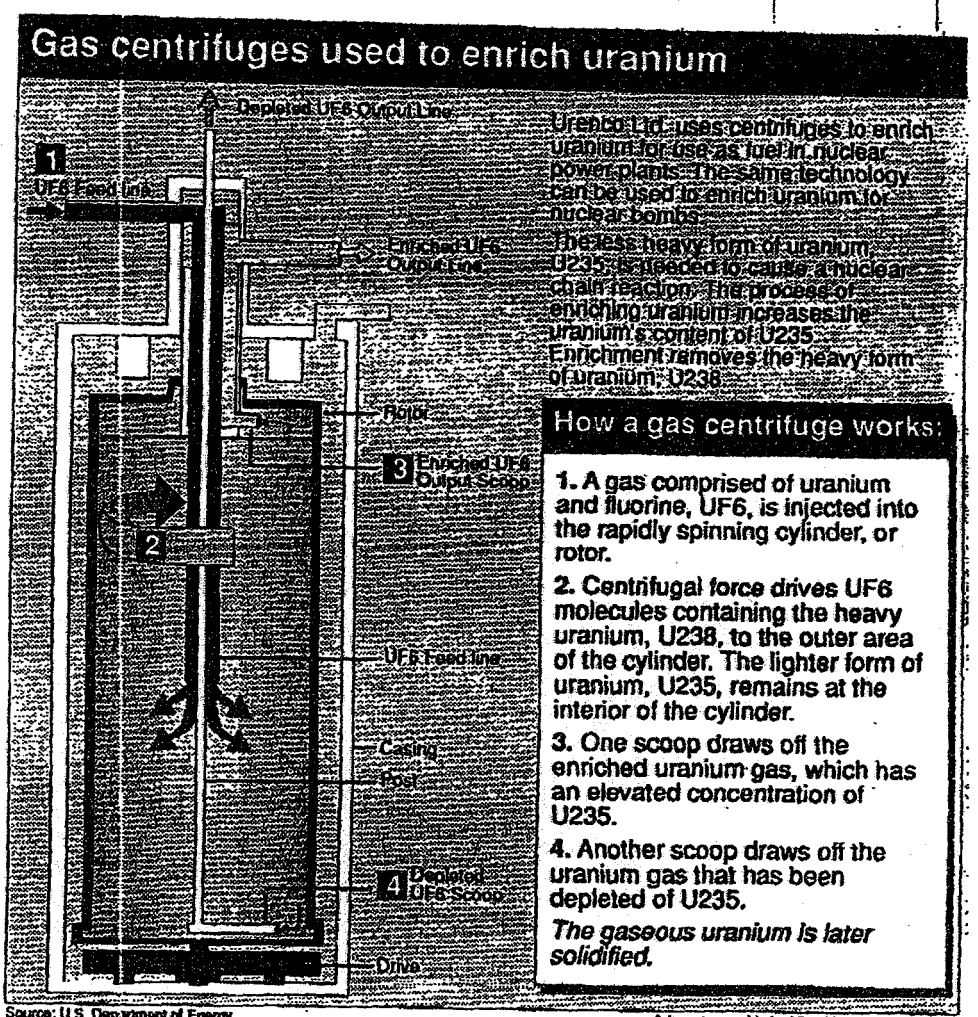
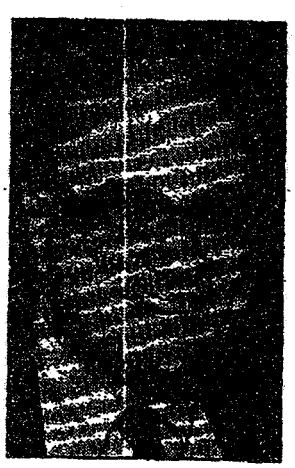


Source: U.S. Department of Energy

Advocate graphic by Alice M. Verbeme



Rep. John Dingell: Investigating plant

In the letter, dated Oct. 21, Dingell said, "Schroeder's statements to the subcommittee staff were untrue and Mr. Schroeder may have known they were untrue at the time he made them."

Two of the documents were authored by Schroeder, which made Schroeder's denial of their existence "particularly troublesome," Dingell said.

The subcommittee staff did not release any of the Energy Department documents to The Advocate, but staff investigators said all but one of the documents concluded that an agreement of cooperation was necessary.

In a Nov. 13 letter of response to Dingell, Energy Department acting general counsel Eric Fygi denied Schroeder lied to the subcommittee in the January 1992 meeting.

Schroeder had a narrow understanding of the question put to him by the subcommittee investigators, Fygi wrote. Schroeder thought the investigators were asking only about any written legal opinions on the department's "ultimate conclusion" that an agreement of cooperation was not necessary, Fygi said.

One subcommittee attorney flatly rejected Fygi's account as "patently absurd."

In July 1992, the administration concluded an agreement with the Urenco countries providing for the protection of classified information shared between the Louisiana Energy Services plant and those countries.

The agreement provided for the possibility of concluding an agreement for cooperation if any "new" data is produced by the plant.

Boyd, the Louisiana Energy Services spokeswoman, said she believed Dingell's concerns were resolved because "no new U.S. classified information will be flowing back to Europe."

But subcommittee investigators said they see no distinction between "old" and "new" classified information in the Act. The investigation is continuing, they said.

Dingell has asked the Energy Department to release more documents and said the department may not have released all the documents earlier requested.

Hazel O'Leary, the new Energy Secretary appointed by President Bill Clinton, must now deal with the investigation.

O'Leary is a former employee of Northern States Power, one of the partners in the Louisiana Energy project.

ATTACHMENT 4

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the Bulletin of the Atomic Scientists

Reports

On Clinton's Calender

Although the presidential campaign's domestic focus obscured president-elect Bill Clinton's foreign policy views, a close examination of his stump speeches suggests some continuity with the Bush administration on many arms control issues-as well as some promising changes.

First, Clinton indicated that his administration would continue to reduce proliferation risks by giving the START I Treaty and START II high priority. In his book, Putting People First, Clinton identified the ratification of START I as an important step to "pursue and strengthen" international arms control agreements. The day after his election, Clinton named the completion of START II as one of six foreign policy issues on which he would work "closely with President Bush to insure continuity." When asked about foreign policy priorities at his first post-election press conference, the second item Clinton mentioned was U.S.-Russian negotiations to reduce nuclear weapons.

Legislative branches in the United States, Russia, and Kazakhstan have all approved START I; Belarus is expected to follow suit soon. But Ukraine, which has 176 intercontinental ballistic missiles (ICBMs) on its soil, has indicated that it may delay ratification unless it receives money as well as security guarantees from Washington. More troubling is that hardline nationalist members of the Ukrainian parliament have talked about permanently retaining the nuclear weapons now on Ukrainian territory-a decision that would deep- six both START I and START II, and be a major defeat for U.S. nuclear nonproliferation policy.

Even if Ukraine ratifies START I promptly, the completion of START II will not be easy. The START II negotiating progress has been sluggish. The United States submitted a draft treaty to Moscow in late July based on a joint understanding Presidents Bush and Yeltsin signed in Washington in June 1992. In late September and early October, however, Moscow submitted a series of questions and raised several issues that may complicate the talks.

As part of START I, the former Soviet Union agreed to destroy half of its 308 SS-18 silos. Under START II, the Russians, to save money, want to convert rather than to destroy the other 154 SS-18 silos, and use them for single-warhead ICBMs such as the SS-25. The June summit discussions did not cover the issue of whether these remaining 154 silos would have to be destroyed.

The second issue concerns Russia's 170 six-warhead SS-19 ICBMs. Russia has asked, as a cost-saving measure, if the "downloading" rules agreed to in June could be modified to allow Russia to retain a single warhead version of the SS-19. The United States and Russia agreed at the Washington summit that no missile could be downloaded by more than four warheads. Since only single-warhead ICBMs will be permitted under START II and the SS-19 has six warheads, Russia could not retain this missile unless the four-warhead rule is changed.

If these issues are not resolved before January 20, inauguration day, the Clinton administration will have an opportunity to shepherd START I into force and then to complete START II.

As for Star Wars, Clinton's campaign statements strongly suggested that under his administration the United States would continue to adhere to the 1972 Anti-Ballistic Missile (ABM) Treaty, and it would move away from the Reagan

and Bush administrations' obsession with space-based Star Wars weapons whose planned testing and deployment would have violated the treaty.

In the March 1992 issue of Arms Control Today, Clinton said that the ABM Treaty had served U.S. security interests well during its 20-year existence, and he added that he "would only consider modest changes in it that clearly enhanced U.S. security interests and were negotiated in good faith with Russia. . . . At present, such changes are not needed."

In Putting People First, Clinton said the United States should conduct all missile defense research and development "in strict compliance" with the ABM Treaty. And he added that "deployment of a massive space-based defense, such as Brilliant Pebbles [proposed by the Bush administration], is not necessary." House Armed Services Committee Chairman Les Aspin who, for the last two years led committee efforts to kill the "Brilliant Pebbles" component of Star Wars, was one of Clinton's top campaign advisers on defense issues.

Clinton also indicated that his administration intends to spend far less money on the Strategic Defense Initiative (SDI) than the previous administration wanted. In a July 13 interview with Defense Week, Clinton said that "reorienting the SDI program" was one of three areas that would provide "the bulk" of his proposed defense spending reductions. (The Bush administration had hoped to spend as much as $8 billion per year on SDI.) As for the defense budget itself, Clinton is expected to ask for $60 billion less (for fiscal years 1993 through 1997) than the Bush administration's projected budget.

In addition to scaling back SDI, Clinton said in the March 1992 Arms Control Today that, unlike Bush, he supported negotiated limits on antisatellite (ASAT) weapons.

Throughout his campaign, Clinton made it clear that stemming proliferation of nuclear, biological, and chemical weapons and ballistic missiles would be a top foreign policy priority. Many of the anti-proliferation steps he described build on and reinforce sensible Bush administration policies. These include commitments to bolster the International Atomic Energy Agency's capacity to inspect suspect facilities through special inspections in member countries, to impose sanctions against companies or countries that export "special" weapons or their technology, to press other nations to tighten export laws and strengthen safeguards, to encourage more nations to abide by the Missile Technology Control Regime (MTCR), and to support ratification of the Chemical Weapons Convention (CWC).

The Bush administration, however, was sometimes reluctant to expend serious political capital on some of these anti-proliferation steps. For example, in 1992, the Bush administration opposed provisions in a bill by Ohio Democrat Sen. John Glenn that would have imposed mandatory economic sanctions against companies that exported nuclear weapons technology.

Clinton's campaign rhetoric suggested that he might be willing to take a harder line. He told the Los Angeles World Affairs Council on August 13, 1992: "We need to clamp down on countries and companies that sell proscribed technology. Violators should be punished, and we must work urgently with all countries for tough, enforceable, nonproliferation agreements. . . . The Clinton-Gore administration will not permit American firms again to sell key technology to outlaw states like Iraq."

Regarding China's missile sales to the Middle East, Clinton said in his August 13 speech that his administration "will link China's trading privileges to its human rights record, and its conduct of trade and weapons sales."

Clinton and Bush have expressed very different opinions on nuclear testing. On several occasions, Clinton explicitly endorsed a comprehensive test ban (CTB)-a step that Bush had vehemently opposed. During a roundtable discussion with employees of Sandia National Laboratory on September 18, 1992, Clinton said he favored the approach to a CTB that Congress was working on at the time. Signed into law in October, the congressional plan allows a total of 15 to 18 U.S. safety and reliability tests to be conducted between July 1, 1993 and September 30, 1996. After that, the United

States would not be permitted to test unless a foreign state conducts tests. The law also requires the United States to seek a multilateral test ban by September 30, 1996. (Prospects for a CTB with Russia, France, and Britain look reasonably good, but China has not indicated that it is prepared to stop nuclear testing.)

During the campaign, Clinton essentially supported the Bush administration's decision to sell F-16s to Taiwan and F-15s to Saudi Arabia, but there may be some notable differences in the Bush and Clinton approaches to conventional arms transfers. For instance, in supporting the F-15 sale, Clinton said that "there may have to be some limitations on the technology" on the planes sold to the Saudis. He has also said that the United States should "encourage the policies adopted by some donor countries and the World Bank in tying aid levels to the amounts spent by a country on arms." Finally, the Democratic platform statement on arms transfers said that the United States "must press for strong international limits on the dangerous and wasteful flow of conventional arms to troubled regions."

Based on Clinton's campaign statements, one could expect the new administration to cut the space-based elements of Star Wars, to work for a comprehensive test ban, and to put some teeth in arms control policies to which the Bush administration has only paid lip service. n

Dunbar Lockwood is a senior analyst at the Arms Control Association in Washington, D.C.

Supplier-spotting

Iraqi officials finally admitted, during the fifteenth inspection visit of the International Atomic Energy Agency (IAEA) in November, that they had been researching gas-centrifuge enrichment of uranium at Rashidiya, on the northern outskirts of Baghdad, rather than solely at the Tuwaitha nuclear research center, as Iraqi officials had previously insisted.

IAEA inspectors had long suspected that single-machine tests and other centrifuge research and development efforts had been conducted at Rashidiya before the Gulf War, but the Iraqis still denied that they did more than theoretical design work there. Inspectors said, however, that the center was too small to have held more than about ten test stands, each with one machine, and only a few of them could have been hooked together in a cascade. Mass production of centrifuges, and the development of a 100-machine cascade, were slated for the Al Furat plant, south of Baghdad, which was still incomplete at the time of the Gulf War.

The Rashidiya design center has been extensively modified by Iraq since the war, complicating inspectors' efforts to gain more data on its pre-war use. Ironically, Rashidiya was visited during the fourth inspection in the summer of 1991, when it was first discovered. But that visit was conducted so quickly that it failed to reveal Rashidiya's centrifuge activities.

Meanwhile, inspectors have not yet persuaded Iraqi officials to provide the names of foreign sources of nuclear know-how and components, including the supplier of 100 metric tons of high-grade maraging steel used in constructing centrifuges. But the inspectors have completed the task of destroying the maraging steel.

Continuing investigations in Germany, however, may have exposed portions of Iraq's procurement network.

Carbon fiber rotors. The German government seems to have made progress in solving one of the most important remaining mysteries of Iraq's gas centrifuge program. Wilma Resenschick, a prosecuting attorney in Augsburg, said in late October that the German firm RO-SCH Verbundwerkstoff GmbH, Kaufbeuren, supplied slightly more than 20

advanced carbon-fiber rotors to the Iraqi centrifuge program in 1989 and 1990 in violation of Germany's foreign trade act. The prosecutor said that RO-SCH needed export permits for these rotors.

According to one RO-SCH employee, the company develops commercial applications for carbon fibers, including strong, light-weight, prototype containers. The official declined to give any details about the rotor sale. RO-SCH officials no longer answer their phones.

On September 11, 1992, German prosecutors issued arrest warrants for Karl-Heinz Schaab, technical director of RO-SCH and for his wife, Brigitte, a co-owner of the firm. Brigitte Schaab was arrested in Austria on September 23, but her husband escaped arrest. A RO-SCH official, contacted in late October, said that Schaab was in Brazil. Prosecutor Resenschick said that if Schaab is in Brazil, he is unlikely to be extradited anytime soon. She said that Brazil has not honored requests for the extradition of suspects in past cases of illegal exports.

The carbon-fiber rotors allegedly supplied by RO-SCH used a hoop and helix winding pattern from a rotor that the European enrichment consortium Urenco deployed in the mid-1980s. Schaab once worked for a Urenco subcontractor, MAN Technologie AG in Munich, where he specialized in developing and making carbon-fiber rotors. Later, MAN subcontracted aspects of rotor development to Schaab's firm. Through his connection to MAN, Schaab had access to the particular winding pattern found on the Iraqi rotors.

German investigators believe it is unlikely that Iraq obtained significantly more rotors than the 20 it declared to IAEA inspectors a little over a year ago. Given that, it is unlikely that Iraq has hidden a stock of rotors or a gas centrifuge cascade from inspectors.

Because carbon-fiber rotors are so difficult to make, IAEA inspectors were surprised in the summer of 1991, when they were first found in Iraq. At that time, Iraqi officials told inspectors they had purchased the rotors from a "dealer" in Europe, but they refused to identify the firm or individual.

While they instigated a search for the dealer, IAEA inspectors also worried that if Iraq had produced the rotors indigenously, it could resume their production in secret. The fact that all the rotors did not have exactly the same winding pattern-and that a resin used to harden the windings was not the same as that used on Urenco rotors-seemed to indicate that the rotors were locally produced. But inspectors have found no evidence that Iraq had the manufacturing equipment necessary to make such high-quality rotors.

It is possible that RO-SCH supplied Iraq with a winding machine, but no evidence of such a transfer has been found. The specialized machine that wound the Iraqi rotors at RO-SCH was not sent to Iraq. RO-SCH had exported the machine to a firm in Austria. This machine has been examined, and its non-nuclear end use- manufacturing low-pressure, light-weight fuel tanks-has been confirmed. The machine found in Austria is a composite machine with a sophisticated control system that was apparently assembled by Schaab himself.

When confronted with this latest evidence during the fifteenth inspection, Iraqi officials refused to comment.

The rotors allegedly supplied by RO-SCH contributed significantly to Iraq's centrifuge research, IAEA inspectors believe. The core of the Iraqi program was aimed at making thousands of rotors of maraging steel, an advanced, strong but light-weight steel. When Iraq encountered difficulties in making these steel rotors, the imported carbon-fiber rotors allowed Iraq to continue centrifuge research.

At press time, Schaab remained at large, his precise whereabouts unknown. He was thought to be in Brazil, where, according to a former colleague, he had previously worked with other ex-MAN employees on civilian carbon-fiber applications. Skilled in assembling, operating, and maintaining advanced winding machines, and knowledgeable in winding at least one sophisticated rotor pattern, Schaab could shorten a centrifuge development program, should he

choose to do so. Bringing him to justice, determining the extent of his past activities, and establishing his guilt or innocence must remain a high priority.

Centrifuge design. New information is also emerging about the source of the centrifuge design found in Iraq. The designs and centrifuge parts that the IAEA found in Iraq are very similar to those of the Urenco G1 machine. According to the ninth on-site inspection report, each component "showed evidence of intelligent adaptation and development based on sound principles," although Iraq is unlikely to have been "able to make the observed design modifications without outside help."

Bruno Stemmler, a former MAN employee, recently shed some light on some of these modifications when he described his secret visits to Iraq in 1988 and 1989. During his 1988 visit, the Iraqis showed him full-size assembly drawings of a centrifuge similar to the G1 machine. He said that he believed Iraq acquired this design abroad; he does not believe that Iraqi centrifuge experts developed it themselves.

Stemmler said that the machine described in the drawings was not better than the original G1 design, and that the Iraqis might have had trouble operating it. In fact, he thought that some of the modifications would have reduced the machine's capability to enrich uranium.

Stemmler said that he made suggestions for improving individual components. He believes that the improvements he suggested were adopted, and that they improved the Iraqi design. He claimed he did not give Iraq either the most advanced centrifuge specifications or Urenco-specific data. Providing the latter, he said, would have violated his commitment to protect classified Urenco and MAN information. Stemmler maintains that he broke no law. In fact, he has never been charged.

Stemmler's recommendations included widening slightly the bottom bearing ball from 3 millimeters to 4 millimeters to provide greater reliability and durability, and installing a larger diameter vacuum pipe in the test stand. After he returned to Germany, Stemmler sent a handwritten note that answered Iraqi questions about the best placement of the uranium feed pipe and the product and waste scoops. This note, he said, was sent through H&H Metalform, a German firm identified as serving as an important funnel for equipment and know-how to Iraq [see April 1992 Bulletin].

Stemmler said that in 1989 he worked on ways to optimize the spiral-groove pattern on the bottom bearing ball. But before he could finish his calculations, the German government began investigating his activities, and told him to stop providing assistance to Iraq.

Stemmler's description indicates that Iraq purchased the drawings of the G1-type design and independently bought the services of experts to improve that design. But how did Iraq obtain these drawings? Both Stemmler and one U.S. government official said that they believe there is an international market in centrifuge designs. If a design is copied, one official said, it could "float around in a gray market."

A likely seller is Pakistan, which is believed to have sold centrifuge design information to foreign parties. Nucleonics Week reported in November 1991 that Pakistan re-exported secret Urenco information to Iraq, and perhaps to Iran. During the mid-1970s, a Pakistani national stole Urenco designs, probably both the G1 and G2 [see July/August Bulletin]. Earlier, according to a senior German official, Pakistan also obtained Urenco design information in Germany from an independent source who has never been identified. The G1 design could have been modified by experts working in Pakistan's extensive centrifuge program.

Exactly how the know-how would have been transferred to Iraq is unclear. Pakistan and Iraq have not cooperated extensively on nuclear matters, and Pakistan has closer ties to Iran. The know-how, however, could have been sold to a third party, which then transferred it to Iraq.

Brazil might also have provided centrifuge design information to Iraq. Brazil has supplied Iraq with natural uranium and large-scale uranium processing facilities. There have also been recurring reports that Brazil supplied enrichment technology to Iraq, although the Brazilian government denies doing so. One U.S. official confirmed a few years ago that Brazil provided some centrifuge information, although probably significantly less than Iraq wanted. n

David Albright, a Bulletin contributing editor, is a senior scientist at Friends of the Earth in Washington, D.C. Mark Hibbs is European editor of Nuclear Fuel and Nucleonics Week in Bonn, Germany.

PSR pinpoints problems

As recently as 1989, it looked as if a long-standing controversy over the Energy Department's studies of the effects of radiation on human health might eventually be resolved.

If all of the Energy Department's worker health records were made available in a single data base, it would represent the most complete record on health and radiation that could be assembled. But before 1989, the Energy Department had kept its records secret, allowing only Energy employees or Energy contractors access to the department's records for the purpose of conducting epidemiologic studies.

Critics charged that this policy resulted in a selective and possibly misleading group of published studies. They claimed that Energy's research was intrinsically flawed by the department's inherent conflict of interest.

In late 1989, the Physicians for Social Responsibility (PSR) formed a task force that included experts in epidemiology, public health, radiation biology, and occupational medicine, to begin a systematic review of epidemiologic studies conducted by the Energy Department, its predecessor agencies, and its contractors.

At about the same time, Energy Secretary James Watkins, who pledged he would run a more open department, directed Energy to implement the recommendations of the Secretarial Panel for the Evaluation of Epidemiologic Research Activities (SPEERA). One of SPEERA's chief recommendations was the formation of a central data base, the Comprehensive Epidemiologic Data Resource (CEDR). SPEERA suggested that the data base should include health statistics on military personnel, uranium miners, and other workers who experienced radiation exposures, in addition to statistics on Energy workers. CEDR, the panel concluded, should be open to independent researchers, with access controlled by the National Academy of Sciences rather than the Energy Department.

Watkins agreed, and in 1989 he endorsed three other proposals that researchers favored: making health studies of Energy workers the responsibility of the Department of Health and Human Services, establishing standardized methods for collecting epidemiologic data on department employees, and developing a department-wide comprehensive occupational health program.

Two and a half years later, however, the Energy Department has failed to follow through on its promises of reform. This is one of the major conclusions of the PSR task force report, Dead Reckoning (issued last summer), which details the obstacles Energy continues to throw in the path of radiation researchers.

The centerpiece of Energy's reform-the data base-is underfunded and incomplete, says PSR. The department has failed to survey files at its various sites in order to provide an accurate inventory of data that should be included. Instead, it intends merely to contribute limited quantities of centrally maintained "old" data.

Other reform proposals have met similar fates, the report says. For nine months, the Energy Department negotiated with Health and Human Services (HHS) on the terms under which HHS would take charge of health-effect studies. The result: a memorandum of understanding between the two agencies-an instrument that lacks the force of law. (It can be revoked at any time on 60 days' notice.)

The terms of the memorandum- which was signed in secret and released a few weeks after it went into force-fail to protect independent research design. Under the terms of the agreement, the Energy Department not only kept a tight rein on the budget, it retained the functions of data collection, quality control, and on-line, in-plant health and safety programs. In short, says PSR, Energy can manipulate HHS studies merely by limiting its own department's budget requests for research funds. More troubling still, Energy has recently claimed that the agreement with HHS absolves it of the need to collect new radiation and worker health data for HHS-directed studies.

After reviewing Energy Department-directed research, the PSR task force concluded that:

n The department's epidemiology program has been underfunded and flawed in scope. Two decades of nuclear production passed before nuclear agencies even began to contemplate conducting studies.

n There have been major inaccuracies and inconsistencies in the measurement of radiation exposures at the nuclear weapons complex, and a substantial fraction of the cumulative 600,000-person workforce has not been included in any study. Further, despite the fact that conditions vary widely from site to site, published studies cover only a small number of the facilities at which exposures may have occurred.

n The pace of major studies has been extremely slow. For instance, only slightly more than 3,000 workers are included in the largest ongoing comprehensive study, the so-called "5-rem" project, despite evidence that two to three times as many workers may have been exposed at that level.

n There have been long and inexplicable delays in gathering mortality statistics; information is often out-of-date by six to eight years; and many studies are short-term in focus-they are terminated before exposure-related tumors are likely to appear.

n By collecting information about death rates rather than by collecting data on non-lethal cancers as well, the department has produced studies that may be misleading. Similarly, it may also have reduced disease-incidence figures by failing to give sufficient weight to the "healthy worker" effect-the statistically lower likelihood of disease among the productively employed.

n The department argues that allowing independent researchers access to Energy's raw data would represent a "theft of intellectual property" from Energy-appointed investigators-a claim that has no foundation, says PSR. This false barrier to access not only violates the principle of open and unfettered scientific investigation, it is inappropriate behavior. Energy's epidemiology program has been publicly funded, but has evaded public accountability.

The authors of Dead Reckoning conclude that Energy Department-sponsored studies "offer no firm basis for the repeatedly expressed official position that the health of workers and the public has been fully protected and that there are no excess risks of disease and death in the nuclear worker cohorts. Statistically significant excess deaths from a wide variety of cancers have been found at major sites in the nuclear weapons complex. While these effects do not appear to be large, the problems and flaws evident in many of these investigations are precisely those which tend to produce falsely negative results."

To order copies of Dead Reckoning, which are available for $10.00 each (including postage), write PSR, 1000 Sixteenth Street, N.W., Washington, D.C. 20036. n

Linda Rothstein is managing editor of the Bulletin.

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ATTACHMENT 5

ENGINEER FOR HIRE

By DAVID ALBRIGHT

For more than two years, my colleague Mark Hibbs and I have written articles for the *Bulletin* about the secret Iraqi nuclear program. Using sources on four continents, we have pieced together a complex mosaic showing how Iraqi oil money was used to buy both hardware and expertise from Western nations, particularly Germany, in a fruitless effort to build a nuclear weapon.

As we put together the series of articles, I often talked to—and quoted—one of Iraq's German contacts, Bruno Stemmler. Stemmler, now about 60 years old, suffered a severe stroke late last year and is unable to speak. But in our earlier conversations he said he wanted his version of the story out. It's an intriguing tale that raises difficult questions about the role of scientists and engineers in today's murky world. After all, when Stemmler first became involved with Saddam Hussein's Iraq, the United States seemed to be supporting Iraq, and had done so throughout its protracted war with Iran.

For the record, then, here is the story of Bruno Stemmler, engineer for hire.

Unappreciated?

In the mid-1980s, Stemmler was unhappy with his job. He had worked as a physical chemist for MAN Technologie in Munich, Germany, since 1969. But he was embroiled in a conflict with management over what he regarded as inadequate compensation for his discoveries and perhaps inadequate appreciation of his talents.

Stemmler had been involved in the design and testing of gas centrifuges used to produce enriched uranium for nuclear reactor fuel, although the same centrifuges can be used to produce weapon material. MAN is an important partner in the European centrifuge enrichment consortium, Urenco, which sells non-weapon-grade low-enriched uranium to nuclear power plants.

Stemmler's search for new employment and recognition led him to both Brazil and Iraq. He said he was looking for irrigation and energy development contracts, and in fact, the colleague who led him to Iraq suggested jobs exclusively in non-nuclear areas. But the Iraqis proved to be more interested in what they could learn from him about uranium separation—they wanted to learn about the centrifuges Urenco had developed in the late 1960s and early 1970s.

Lured by the chance of finding new work, Stemmler visited Iraq in the fall of 1988 and the spring of 1989. Both visits were secret. In Iraq, he was soon recruited to provide technical assistance to the Iraqi centrifuge program. He planned to make additional trips—even to stay for some months—but early one morning in the summer of 1989, German investigators armed with a search warrant arrived at his home. After searching his house, the authorities took him away for questioning. They accused Stemmler of giving secret information about German centrifuges to the Iraqis, who were known to be trying to acquire nuclear weapons.

In the end, Stemmler was never charged, let alone tried, for any criminal act. But in December 1989, the German news weekly *Der*

Bruno Stemmler, a centrifuge designer for Urenco, felt inadequately compensated as well as unappreciated.

David Albright, president of the Institute for Science and International Security, is a Bulletin *contributing editor.*

Bruno Stemmler at home in Munich.

A colleague, Walter Busse, told Stemmler he could find work in Iraq.

Spiegel printed a story about him and his colleagues. Stemmler never discovered the source of this story, but he said it was published when the investigation was almost finished. After the story appeared, MAN suspended him; Stemmler said the bad publicity worried MAN, which was afraid it would lose business in both Germany and the United States. Still, MAN promised to pay his wages through 1990 and then to make a "fair settlement," which he thought would be another year's pay.

Then, in late 1991, he was quoted in an article in the London *Sunday Times*. This article also mentioned MAN. Stemmler says that after the *Sunday Times* story appeared, MAN decided not to make a final settlement.

It was at this point that I first met him. Stemmler claimed that the *Sunday Times* had misquoted him, portraying him as one of the central figures in the Iraqi effort to build gas centrifuges and exaggerating the Iraqis' progress. Stemmler agreed to talk to me in order to give his side of the story.

After our initial meeting, I continued to visit him regularly over the next two years. We drank tea at his kitchen table while he chain-smoked, and we discussed the Iraqi centrifuge program. These discussions continued until late 1992, when he suffered the stroke that left him incapacitated.

Tricks of the trade

Stemmler never built an atomic bomb for Iraqi scientists, nor did he build centrifuges. What he did provide was technical assistance and guidance in certain important areas of Iraq's centrifuge program, including design and assembly. According to Stemmler, the service he rendered was not then a violation of German export law. Today, it would be.

Since much of the difficulty in developing centrifuges involves identifying problems and knowing "tricks," expert assistance can significantly shorten the time it takes to successfully develop centrifuges. Export controls on the sale of nuclear-related equipment can help limit the spread of weapons. But scientists and technicians can play an equally important role, and thus their know-how is increasingly subject to export controls as well. But to make controls more effective, scientists like Stemmler should be suspicious about foreign employers with ready cash, since their abilities with even seemingly innocuous older technologies—like the centrifuges of the 1960s and 1970s—present a genuine danger.

Stemmler said he understands that now, and he often told me that he regrets that he did not think about the potential consequences of his actions in Iraq. But, he says, he was "never told that he was being taken to Iraq to talk about centrifuges." Once there, however, he felt justified discussing unclassified centrifuge technology with the Iraqis because the climate was very different when he first agreed to go. The West had supported Iraq in the Iran-Iraq war, which had just ended. And Iraq, then considered a friend of the West, was involved in a massive rebuilding program. Stemmler said he "never had the impression that Iraq was against the United States."

In addition, the Iraqis told him that their "only desire [was] to make nuclear fuel" for civil applications. During my first meetings with him, Stemmler often said that the Iraqi centrifuge could only have produced low-enriched uranium, not the highly enriched material needed for an atomic bomb. But as he learned more about other nuclear weapons programs, he was less confident about the latter claim. Information about Russia's centrifuge program was becoming available, including the revelation that Russia had produced about 1,200 metric tons of weapon-grade uranium with a less sophisticated machine than the design Stemmler saw in Iraq.

Drawn into the net

Stemmler was recruited by Walter Busse, a former colleague at MAN. Busse had retired several years earlier after being diagnosed with diabetes. He was a leading expert in forming specialty steel tubes and other components used in centrifuges, rockets, and other equipment. While at MAN, Busse had headed the section that manufactured centrifuges made of maraging steel, an extremely strong type of steel that can withstand rapid spinning. Centrifuge components made of maraging steel can be rotated faster than those made of conventional steels or aluminum.

Busse knew that Stemmler was unhappy at MAN, and he told him he wanted to help him get new contracts. Busse said nothing about Iraq's interest in centrifuges, although he did imply that there was a need to keep the trip a secret. Stemmler did not tell anyone at MAN that he was going to Iraq. One of Stemmler's colleagues said later that Stemmler had been suspended because he did not tell MAN about these trips.

Busse told Stemmler that he was a consultant to H&H Metalform GmbH, a German company that specializes in making the vertical flow-forming machines that shape maraging steel tubes. H&H organized both of Stemmler's visits to Iraq, and Busse and other H&H employees went with him. Stemmler said Busse had visited Iraq once before.

Stemmler said that the Iraqis had worked with H&H extensively, and had considerable

confidence in the company. He also told me that the centrifuge business was "only a small part" of H&H's dealings with Iraq. Post-war investigations by the International Atomic Energy Agency (IAEA) Action Team and German authorities revealed that H&H was a major funneler of technology, machine tools, and specialty equipment to the Iraqi missile and nuclear programs. H&H's two principal directors, who were arrested and are now in jail, have been identified as the major middlemen between Iraqi procurement agents and German and certain Swiss suppliers. H&H helped Iraq obtain a wide assortment of items and expert advice for its centrifuge program.

Stemmler did not know if H&H had recruited other experts to help the Iraqi nuclear or missile program. He said he "could imagine that they had, because the Iraqis confronted H&H with different problems, and H&H might have found other people."

The Iraqis asked Stemmler himself to recommend a German aircraft engineer who also knew something about rockets. The Iraqis said they wanted to learn more about the purpose of certain components found in the Iranian rockets they had captured during the eight-year war.

Stemmler told me he recommended Karl Otto Brauer, a retired German rocket specialist who initially worked on rockets in Germany during World War II. He then moved to the United States, where he worked on U.S. programs, including Apollo. After leaving the United States, Brauer worked in South Africa and then retired to Germany.

According to Stemmler, after he recruited Brauer, H&H arranged for Brauer to visit Iraq. He said Brauer, who had become a U.S. citizen, first contacted the U.S. embassy in Bonn to make sure he could go.

I was unable to talk to Brauer about his experiences in Iraq. By the time I learned about Brauer's visit, he was seriously ill; he died in August 1998.

After Brauer's death, I asked one of Brauer's colleagues about his work. The colleague said that the Iraqis had asked Brauer to develop a missile, but that Brauer had refused. I was unable to find out whether he had identified any missile parts. In any case, Stemmler said that Brauer and Busse were caught up in the same investigation that ensnared him in 1989—it was unlikely that either of them ever had contact with Iraq again.

On the ground

Each of Stemmler's trips to Iraq lasted four or five days. During his stay he was questioned by a total of about 15 Iraqi centrifuge experts in a guarded ministry building near the al-Rashid Hotel (where he stayed) in downtown Baghdad. He said that the chief Iraqi expert, who was also the host for his visits, was called Muhammad, but he was not sure if that was his real name.

During his first visit to the ministry, the Iraqis began by asking questions about his background. But they quickly turned to the subject of centrifuges. Stemmler said he was surprised and thought that they must have known about his past experience.

Once there, his conversations with the Iraqis soon turned to centrifuges.

Despite some hesitation about discussing centrifuges, Stemmler told the Iraqis that he had established the first "test stand" laboratory at MAN, which he directed from 1969 to 1972. It contained about 20 centrifuge testbeds. He also worked on the early MAN-Urenco centrifuge eventually known as the "G1" when it was deployed at the Urenco pilot plant at Almelo in the Netherlands. The G1 and its predecessors had a single rotor tube, a molecular pump, and magnetic top bearings. The G1's spinning components were made of maraging steel. He was also involved in the early stages of the development of the G2 centrifuge, which is similar to the G1 but has two rotor tubes connected by a bellows. Stemmler was also one of the principal inventors of a process for coating or "oxidizing" maraging steel centrifuge components. Oxidation protects the components from the corrosive effect of uranium hexafluoride, thereby significantly prolonging their life.

Stemmler had worked on physical and chemical problems associated with earlier versions of centrifuges at the German firm Dornier, and he had worked with centrifuge experts at the German nuclear research center near Julich. Because of his experience, he knew the intimate details of early centrifuge design and operation, he knew how to handle highly corrosive uranium hexafluoride gas, and he had had access to the classified literature—in other words, he knew the "tricks" of operating centrifuges.

Stemmler said that the Iraqis showed him general assembly drawings of centrifuge designs and asked him about various components. He later described each drawing as roughly the size of his kitchen table (about three by four-and-a-half feet). Stemmler was surprised to see the drawings. He said, "I was relatively sure it was a Urenco machine"—and he knew that Urenco designs were classified.

He thought the design was *nearly* a G1. It had two baffles, which, he said, was the main detail that identified it—later Urenco designs had only one. He said that there were other similarities. Over time, however, he began to think that the Iraqi machine was a "type of G1," one that he had never worked on.

He also noticed several differences between

Stemmler suggested ways to improve the Iraqi design.

the Urenco design and the Iraqi plans, especially in the feed, waste, and product systems. However, these differences were small. He also remembered that the bearings and the upper endcap differed from the original G1 components.

Stemmler thought that the Iraqi machine was not better, but different. He said, "I told the Iraqis that it might not work." But he suggested various improvements.

He told the Iraqis that they should make sure that their machine did not lose separative capacity, which is a measure of how well the machine functions. He thought the scoops were poorly placed, and he recommended that they change the location of the scoops and the feed intake, and he determined the optimal placement for these components after the Iraqis told him the rotor speed. He did these calculations after he returned home, and he gave his results to the Iraqis between visits. Stemmler said that because he did not give the Iraqis Urenco-specific values, he did not violate German security agreements.

He also discussed the size of the opening in the top of the rotor assembly. The size had to be small enough to limit the amount of uranium hexafluoride gas that could escape, but large enough to accommodate the feed and extraction system. He said that he did not convey any special information about the best diameter. He thought that the Iraqi experts already had some "very interesting" ideas about this aspect of the design, but their ideas were not yet experimentally proven. He thought at the time that they had probably already had some outside assistance.

Stemmler wondered to himself why anyone would want to use such an old design. According to one source, the G1 Urenco used at Almelo had worked poorly and was quickly replaced by more successful machines. Stemmler told the Iraqis that they should consider developing more advanced designs, but they said nothing in response, which amazed him. Stemmler later speculated that although the Iraqis wanted his help, they were careful not to tell him too much. He said, "The Iraqi experts did not go too deep, probably in order to protect what they knew."

Stemmler said that Iraq could not have produced these drawings, but had procured them abroad. He did not know where Iraq had acquired them.

There are a variety of opinions about how Iraq got its centrifuge design. One is that someone, possibly Stemmler or Busse, obtained a Urenco or MAN design and gave it to Iraq. Another view is that the designs were acquired on an international "gray market." On several occasions, Stemmler speculated that Pakistan was a possible source for the centrifuge design he saw in Iraq, although he said that he had no evidence for this belief. He added, however, that he thought a direct transfer from Pakistan to Iraq was unlikely.

Getting his bearings

On his first visit the Iraqis showed Stemmler a 10-centimeter-long model of a special type of low-friction bearing. This model was not suitable for use in a centrifuge, and Stemmler never saw inside it, but he believed that the Iraqis were well on their way to developing a "spiral-grooved" centrifuge bottom bearing.

This type of bearing contains a ball with spiral grooves and ridges that pump oil between a cup and the ball as the rotor spins. As a result, the ball touches only the oil film, not the walls of the cup, which greatly reduces friction. Stemmler likened the technology underlying the manufacture of the spiral ridges and rills to making high-speed dental drills or other types of high-speed drill bits.

To improve the bearing design, Stemmler recommended that they use a 4-millimeter bottom bearing instead of the 3-millimeter one in the Iraqi design. He told them a wider ball would provide more strength and durability.

Other sources tend to corroborate part of that story. During a meeting between IAEA inspectors and Iraqi centrifuge experts in November 1992, the chief Iraqi centrifuge expert at the meeting said that the open literature mentions a 3-millimeter ball. He claimed that it was he who had suggested a 4-millimeter ball as a more conservative design.

In the same meeting, an IAEA inspector noted that during the discussions of the bottom bearing, an Iraqi expert used the German word *kalotte* for the cup on which the ball spins. During my last interview with Stemmler in late November 1992, he said that the Iraqis asked him about the material used in the bottom cup, and he used this German word. He said that he discussed several ways to produce the cup, although he said the discussion was general in nature. He also did not recommend a potential supplier of the machine tools to make the cup. Stemmler's impression was that the Iraqis had not thought adequately about the problem of producing a ball and cup that would work in conjunction with each other.

Stemmler said that after his second visit he worked on optimizing the spiral-grooved pattern on the bottom bearing, but the German authorities visited his house before he could give his results to Iraq.

Blackened steel

Stemmler wanted to sell the Iraqis a license to use a patented process for applying a homoge-

nous oxide coating on maraging steel that he and a few colleagues at MAN had developed. Although maraging steel oxidizes naturally when formed into components or tubes, Stemmler had found that if the natural oxide layer is removed and replaced with a carefully applied uniform coating, the maraging steel components will resist corrosion a lot longer.

Because the process also turns the centrifuge rotor dark, the surface of the rotor radiates heat better. This is extremely important because the rotor operates in a vacuum, making heat transfer difficult. If excess heat is not properly dissipated, it interferes with the centrifuge's ability to separate uranium. Earlier rotors were painted black, but maraging steel rotors spun so fast that the paint flew off. Stemmler's oxidation process solved this problem.

The process had other potential applications. Stemmler hoped that he could find someone who would buy the patent—MAN had relinquished any claim, and he and his co-inventors retained ownership. Also, it was not classified.

Nevertheless, the patent was a major source of the conflict between Stemmler and MAN. Stemmler said that he and his co-patent holders wanted more money for the use of the process than MAN was prepared to pay. Stemmler said he wanted 50,000 Deutsche marks, but MAN offered only 15,000. He said that MAN claimed that it was using a variant of Stemmler's process in its production of maraging steel centrifuges. Stemmler said that the MAN process was actually equivalent to his, not a variant, and that he and his colleagues deserved more compensation. Stemmler said in early 1992 that he expected this dispute to go to court. One of his co-inventors told me in September 1993 that they still had not received any money from MAN.

In 1987 and 1988 Stemmler traveled to Brazil, trying to sell his process. He tried, unsuccessfully, to interest a Brazilian furnace company. On one of his trips he lectured on the oxidation process at the University of São Paulo. Stemmler said that some experts from the Brazilian centrifuge program who wanted to learn the process attended his lectures, but they were unable or unwilling to offer him a contract to teach them how to do it.

Iraq looked like a far better prospect for employment. Stemmler said that it was not only easier to get to, but Iraq had more money. During his first meeting in Iraq, Stemmler described the patent and the equipment that would be needed to properly oxidize maraging steel components. He told his hosts that oxidation furnaces and the necessary inserts could be obtained from Degussa, a German firm in Frankfurt that had supplied MAN many years earlier.

Stemmler included supplementary information about the patent in the hand-written note he sent to Iraq via H&H. He described how to apply a good oxide layer. He said he gave Iraqi experts enough information to start oxidizing maraging steel rotors.

He also sent crude sketches of the two key pieces of equipment needed to oxidize components in a vacuum furnace—a "recipient" and a "Christmas tree" (an insert to hold the components). The recipient is a double-walled casing that goes into the furnace; it allows the process to take place in a closed cycle. During oxidation, an inert gas is pumped out of the recipient and replaced by steam. When heated to the required temperatures for specified periods of time, the steam causes the desired reaction.

He hoped to sell his special oxidation process to them.

The insert is loaded with maraging steel components and then lowered into the recipient. The insert holds the components in place with a minimum of contact, which virtually eliminates untreated spots. He described an insert with shelves that held up to 12 rotors each, although the exact number of rotors that could be treated at once would depend on the size of the recipient.

Stemmler told me during one of our last meetings that when he went to Iraq the second time, the Iraqis were having trouble oxidizing components evenly. He said Iraq had acquired a small oxidation furnace between his first and second visits, but had not been able to master the process. He said he gave them some hints about how to solve the problem.

Even after providing all this information, Stemmler still "hoped to get a contract to teach the Iraqis how to do the coating properly." Achieving a homogeneous layer can be very difficult, and according to Stemmler, it "takes a long time to develop a feeling for the process." He expected to visit Iraq a third time, and he hoped for a direct contract with Iraq that would have involved spending many months in Iraq "making experiments together" with the Iraqis.

After the Gulf War, I showed Stemmler pictures of oxidized rotors that had been found in Iraq by the IAEA and U.N. inspectors. He said that the Iraqis had not done it correctly.

According to the Report of the Thirteenth IAEA On-Site Inspection in Iraq, the inspectors found two oxidation furnaces made by Degussa, and some ancillary equipment, including vacuum pumps and control systems, that were manufactured by Leybold, a German firm. Iraq had used a small oxidation furnace for research and development. A production-size furnace was still in packing crates. The inspectors found a chart at the furnace site that recorded temperatures and time periods consistent with Stemmler's process.

Stemmler told me that he had not contacted Degussa. According to company officials, the

Stemmler thought "Factory 10" was modern, but too dirty for manufacturing centrifuges.

contact was made by H&H and Iraqi procurement agents. The sale of the furnaces was arranged by H&H, although H&H personnel did not appear to know what the technical requirements of either the furnace or the ancillary equipment were. During meetings at the two companies, the Iraqis were more informed about the technical specifications than were the H&H people.

Degussa and Leybold officials say they did not realize that the equipment was going to be used to manufacture centrifuges. They said that the personnel involved in filling the original orders from MAN were no longer with their companies, and that the employees who filled the Iraqi order had no experience with centrifuges. Urenco and MAN stopped manufacturing maraging steel rotors several years ago, eliminating their need for large oxidation furnaces.

Cascading

Stemmler said he was also asked about methods of connecting centrifuges together by pipes to form a "cascade." "The boss of the Iraqis always wanted to talk about cascading," he said.

The Iraqis wanted Stemmler to get information about cascades. They even suggested that he visit a Urenco facility or some other suitable site to find out "something about cascades." Stemmler told them it would be impossible for him to enter a cascade; he lacked the proper clearance. The Iraqis were astonished. "They didn't believe me," Stemmler said.

He told them, however, that they were unlikely to gain much by hooking two or three machines together, or even 10–15. He said that he would think about how to hook 50–100 machines together.

"Factory 10"

On his first visit, Stemmler was driven for about two hours from Baghdad to a building he and Busse called "Factory 10"—a modern facility at a large complex. The buildings at this site were all fairly low and dispersed, as if designed to survive air raids.

He said that this facility was engaged in developing artillery pieces, and he specifically remembered seeing captured Iranian armored vehicles which were being modified for Iraqi use.

In Baghdad, the Iraqis said they were having trouble with a German-supplied Woton machine, which was being used to form precisely parallel metal pieces for artillery. Busse thought he might be able to fix the problem. As a result, they drove to Factory 10. Stemmler said he went along as an observer. They were accompanied by the chief centrifuge expert, who, according to Stemmler, appeared to be acquainted with Factory 10's director.

While Busse worked on the Woton machine, Stemmler looked at the other machines in the building. He saw a large machine used to rebore and regroove Iranian artillery pieces for Iraqi use. He saw many Swiss machine tools for milling, including many computer numerically controlled (CNC) machines. He also saw vacuum furnaces. He thought that some of the machines at Factory 10 were being used to produce precision gunsights for the artillery pieces.

Stemmler said that although the building was modern, it was not suitable for manufacturing centrifuges. It was too dirty, and it would have had to be cleaned up before it could successfully make centrifuge components. Stemmler said that the CNC machines he saw were, however, capable of making outer housings, baffles, and internal centrifuge components. He thought the furnaces could be modified to oxidize maraging steel rotors. He also said he saw what appeared to be an outer housing of a centrifuge.

Busse told the London *Sunday Times* in late 1990 that the Iraqis asked him "real production questions, for example on the caps for centrifuges." Busse, however, denied showing the Iraqis how to make components, except in general terms. Busse told *Nuclear Fuel* in late 1990 that he did not think Iraq was in a position to make either components or centrifuges. He said that he did not see any centrifuge components when he was in Iraq. No evidence has emerged since the Gulf War that would indicate that Busse provided much assistance to Iraq.

Nevertheless, Factory 10 did make centrifuge components for early Iraqi non-maraging steel centrifuge research machines, or at least tried to make them. The Iraqis called these machines "oil centrifuges." They were based on unclassified designs from the 1930s and 1940s and worked poorly. It is possible that neither Stemmler nor Busse were aware of the real purpose of their visit to Factory 10; typically, Iraqi security was tight. Factory 10 personnel did not know the purpose of the components they made.

Stemmler was apparently right in thinking that Factory 10 was not suitable for manufacturing centrifuge components. According to Iraqi declarations, Iraqi manufacturing sites had trouble producing components that met exacting specifications. The technical staff was not devoted exclusively to this type of work, which inhibited high quality. The parts needed to have accurate parallel and perpendicular surfaces, which were hard to form with existing Iraqi equipment.

Stemmler was never sure about Factory 10's location, although he believed it was located northwest of Baghdad. According to the IAEA Action Team's "Machine Tool Tally, 11th and 12th Missions," the only Woton machine on the list was located at the Saddam State Establishment, which was west of Baghdad, near Al Fallujah. The IAEA Tally lists many machine tools at this site, including Swiss machine tools. The Saddam Establishment was also involved in making artillery pieces, and the IAEA Tally lists several machines for making artillery barrels and gunsights at that location.

The Iraqis deliberately tried to confuse Stemmler and Busse about the location of sites they visited. Stemmler and Busse were taken north from Baghdad, as they stated, and they also turned left off this main north-south highway. But, unknown to them, the road gradually turned to the south. It ends at Al Fallujah.

Although the Saddam Establishment does not have a "Factory 10," it has a Building No. 10 that Iraq has said was involved in manufacturing components for the oil centrifuges.

Because they had problems manufacturing components for the early centrifuge, which required less accuracy than maraging steel machines, Iraq decided in late 1988 or 1989 to buy Urenco-type centrifuge parts abroad while working to establish a dedicated domestic manufacturing facility at Al Furat. This site would use imported, high-tech machine tools in "clean rooms" built by a German firm, and it would be manned by a staff that would concentrate solely on centrifuge manufacturing. By the time of the Gulf War, Iraq had not completed Al Furat, although the site was within a few years of full operation.

The test stand

On his second visit, the Iraqis told Stemmler that they were having trouble with the vacuum system of a test stand. Stemmler said they were "very anxious about rotors crashing." They wanted him to look at the test stand and help them fix the problem.

Stemmler, Busse, the chief Iraqi centrifuge expert, H&H personnel, and another Iraqi drove through Baghdad for about half an hour to a small building on the edge of town. Stemmler thought the building was to the south, but it was night and he was not sure of the actual location.

After passing through a guarded gate, they drove to a solitary two-story building that was about 30 meters by 15 meters. It was located in an otherwise empty area about the size of half a football field. The building was still under construction. The concrete outer walls were finished and the building had electricity and water but no air conditioning. The Iraqis said that they wanted to build more buildings nearby, although Stemmler saw no evidence of construction, just leveled fields. Stemmler was not told the name of the facility and he did not ask.

After entering the building, he was led up a set of stairs to the first floor. He was shown a pit sunk into the ground floor, at the bottom of which was a centrifuge test stand. The stand was essentially a round tube with flanges at its top and bottom that was hooked up to a vacuum system and a small power supply. The system did not have feed or extraction tubes, so it was not enriching uranium. He said the pit was only big enough for one or two test stands.

Stemmler said that such an arrangement would have been appropriate for the mechanical tests of the rotor and bearings that are typically conducted early in a centrifuge research program. If a centrifuge fails, it can explode like a grenade, causing debris to breach its outer housing. The purpose of the pit was evidently to contain the debris if the housing failed.

Stemmler told the Iraqis that MAN did not put their mechanical test stands in pits, just left them standing in laboratories. This, he said, astonished them.

With difficulty, Stemmler climbed down the ladder and into the pit to examine the vacuum system. An Iraqi turned on the machine, and Stemmler looked at the vacuum system. Stemmler helped them get the vacuum system working. He suggested that they use a wider pipe (at least 32 millimeters in width instead of 20 millimeters) in their vacuum line.

On his second visit, he helped get the vacuum system working.

Stemmler did not see any other centrifuge-related testing equipment in the building, although he said that a "lot of work had been done at this site." Because the inside of the building was still incomplete and very dusty, Stemmler thought it was unsuitable for anything but mechanical testing.

Stemmler's description of this facility is consistent with Iraq's declared centrifuge development time-line, which was focusing on mechanical tests in 1988 and 1989. Stemmler said that the test stand was not at the Tuwaitha Nuclear Research Center, directly south of Baghdad. Because it was dark, Stemmler was confused about where he went that night. But the Iraqis have declared that their mechanical stands were located at Building 63 at Tuwaitha, which is located in an isolated section of the site.

Impressions of Baghdad

On many occasions, Stemmler said that the Iraqi centrifuge experts displayed a lot of the-

Sometimes he felt he had helped the Iraqis a little, sometimes a lot.

oretical knowledge about centrifuges, but they lacked practical experience. He saw only primitive measuring and experimental equipment. Iraq also lacked "sufficient technical services and technicians to back up the engineers." Stemmler believed that the Iraqis were particularly interested in his practical experience.

He thought at the time that Iraq was many years away from serial production of maraging steel centrifuges. Stemmler said it is a "long distance from design to a practical machine." Any design faults can be aggravated during production, unless manufacturing processes are conducted very stringently.

Stemmler's assessment of the program is consistent with the findings of the IAEA Action Team. In its June 22, 1993, Fact Sheet, the IAEA Action Team for Iraq concluded: "The Iraqi centrifuge program was in a very early stage using clandestinely obtained European designs and illicitly obtained materials to build a few research machines."

Stemmler's contribution

During my interviews with Stemmler, he was inconsistent in evaluating his own contribution to the Iraqi program. At times he tried to minimize the importance of his assistance. He said that he did not provide the most modern specifications, or Urenco-specific values. In some cases, he said, he tried to give them minimal information that was not usable for their specific machine. He also said he told the Iraqis several times that he did not want to work on centrifuges.

At other times, he said he believed he had helped to improve the Iraqi centrifuge design, although he said he did not provide the Iraqis with classified information.

Stemmler's colleagues do not agree on the potential value of his contribution. In general, his colleagues respect his theoretical abilities. But some say that he had difficulty turning his ideas into practical products. This shortcoming, they say, contributed to his problems at MAN.

Nevertheless, Iraq succeeded in obtaining a design and then in getting help to improve and build on that design from some of its original developers. Despite the design's "crudeness," the machine could have made weapon-grade uranium, although probably at a slower pace than planned.

Even though Stemmler did not receive a contract, Iraq paid him 120,000DM in two equal payments (equivalent to about $75,000 at today's rate of exchange). Sometimes he felt that was a lot of money, sometimes a little. As a fraction of the total amount Iraq spent on its centrifuge program, Stemmler's payment was insignificant. But he believed that he would have received a lot more money if he had actually negotiated a contract and gone to Iraq for several months.

Stemmler believes he broke no laws. Nevertheless, he has suffered greatly because of his activities. As public concern heightened about the spread of nuclear weapons, Stemmler had to bear responsibility for his actions.

The negative stories in the press made it impossible for him to find work. Virtually every time we met he talked about his latest attempt to find employment to support his wife and teenage daughter. He told me that when he called one German company about a job, he was confronted as the man who had helped Iraq build nuclear weapons. As a result, he was looking for work in Brazil and the United States. He hoped to find work in Brazil on a project to develop a more efficient distillation process for producing alcohol-based fuel for Brazilian cars.

Stemmler's case shows how technical knowledge can be misused and scientists can allow themselves to be manipulated. Export controls on know-how need to be strengthened. But efforts to control proliferation will increasingly depend on finding ways to increase the awareness of experts like Stemmler about the potential danger of the information they carry in their heads. ■

ATTACHMENT 6

NUCLEAR-RELATED TRADE AND COOPERATION DEVELOPMENTS FOR SELECTED STATES, FEBRUARY-JUNE 1996

CONTENTS

OVERVIEW

During the February to July 1996 time frame, **Argentina**, **Brazil**, and **South Africa** continued their integration into the international nonproliferation community, reaping political and technical benefits. Also, progress was made on reducing the quantity of stockpiled weapons-grade fissile materials when **Russia** reached separate agreements with **Canada** and **France**. Steps toward implementation of the **Korean Peninsula Energy Development Organization (KEDO)** agreements provided evidence of growing multilateral cooperation in this region as well.

These advances were offset by repeated **Iraqi** confrontations with UNSCOM inspectors, the continuing race to develop nuclear capabilities in South Asia (**India** and **Pakistan**), more reports of nuclear smuggling in the former Soviet Union, and **U.S.-Chinese** confrontation over the transfer of nuclear technology to non-NPT member **Pakistan**. Such events demonstrate the continuing threat posed by those who strive to develop a nuclear weapons capability.

Using its newly found nonproliferation credentials, **Argentina** signed nuclear cooperation agreements with **Brazil**, the **European Union**, **France**, **Thailand**, and the **United States**, and entered into agreements to supply nuclear materials and equipment to **South Korea** and **Egypt**. Also, **Brazil** signed a nuclear cooperation agreement with the **United States**, while continuing discussions on the importation of nuclear technology and materials from **Canada**, **Russia**, and **Germany**. Meanwhile, **South Africa** signed an agreement with **France** to cooperate on developing laser uranium enrichment technology.

The effort to reduce stockpiles of weapons-grade nuclear materials in **Russia** gained momentum during the five-month period. **Russia** and **Canada** signed a Memorandum of Understanding on the burning of **Russian** weapons grade plutonium in **Canadian** CANDU reactors; plutonium shipments are expected to commence as early as 1999. In a related development, the **Russian** Ministry of Atomic Energy (Minatom) finalized a deal to supply **France** with highly enriched uranium (HEU) in 55 kg batches over a nine-year period. In a separate annex to the agreement, an additional 125 kg of HEU will be supplied over a nine-year period to a **French** research reactor. Furthermore, researchers in the **United States** developed the Advanced Recovery and Integrated Extraction System, a five-stage plan that uses technology to facilitate nuclear stockpile reductions. This technology will be shared with **Russia**.

In East Asia, **KEDO** and **North Korean** representatives signed the first of 10 implementation protocols, and the canning of **North Korean** spent fuel rods began. Other developments included a formal **Chinese** announcement that it "will not provide assistance to unsafeguarded nuclear facilities." However, the announcement came after the **United States** confronted Beijing with evidence that **China** had shipped ring magnets to an unsafeguarded uranium enrichment facility in **Pakistan**. **China** indicated that the ring magnets were not on the Nuclear Suppliers Group (NSG) "trigger list" of controlled items. Beijing's attitude toward the deal signaled that this may not be the end of **Chinese** assistance to **Pakistan's** nuclear program, which was extensive from February to June 1996. Aside from its deals with **China**, **Pakistan** was caught trying to acquire nuclear-related technology illegally from **France** and **Sweden**.

During the same period, **India** expanded its plutonium reprocessing capabilities and continued work on a prototype fast breeder reactor. However, the **Indian** nuclear program suffered a setback when a reactor designed for future submarine propulsion use failed important land tests.

In the Persian Gulf region, **Iraq** blocked UNSCOM inspectors five times in March and several more times in June, demonstrating **Iraqi** noncompliance with the United Nations resolutions governing the Gulf War cease-fire. Following these incidents, UNSCOM and **Iraqi** officials negotiated new inspections procedures. News reports revealed that before the 1990-91 Gulf War, **Iraq** acquired more sophisticated knowledge and equipment about gas centrifuge technology from **German** nuclear specialists than was previously believed. Meanwhile, **Russia** continued work on the **Iranian** nuclear power plant at Bushehr and will also provide **Iranian** technicians with nuclear-related training. **Iran** is allegedly developing a uranium hexafluoride plant as well as a gas centrifuge program.

As part of an effort to secure the signing of a Comprehensive Test Ban Treaty, the **United States** provided **France**, **China**, **Russia**, and the **United Kingdom** with technology to simulate nuclear explosions. Some American officials hinted that the **United States** may provide **Pakistan**, **India**, and **Israel** with some of this technology, although Congres-

sional action may block such transfers.

A number of smuggling incidents during the period underscored the continuing threat posed by inadequately secured nuclear materials, underdeveloped export control mechanisms, and the potential for nuclear theft or diversion in the former Soviet Union. One of the most worrisome events was the arrest of a former nuclear scientist in **Russia**. He is accused of having used his institute's equipment and facilities to produce a powder containing zirconium and hafnium, usable in a nuclear weapon, which he subsequently exported to **Germany** and possibly the **United Kingdom** and unnamed countries.

Of the smuggling cases reported during this period, the largest seizure of uranium (100 kg) occurred in **Kazakstan**. Smaller seizures included 13 kg of uranium that a group in **Lithuania** may have acquired from **Ukraine**, 2.7 kg of **Russian**-origin uranium (seized in the **Czech Republic**) that may have been destined for **Iraq** or **Iran** via a **Nigerian** firm, and 12 g of a 1.2 kg cache of uranium that was smuggled out of **Georgia** by a **Turkish** smuggling ring. Other countries reported as transit routes or destinations for these and other nuclear material seizures included **Switzerland**, **Libya**, **Germany**, **Austria**, **Hungary**, **Romania**, **Serbia**, **Pakistan**, and **Iran**.

In response to increased international concern over the proliferation dangers associated with nuclear materials smuggling, participants at the G7+1 summit in Moscow issued a declaration to establish a "Program for Prevention and Combating Illicit Trafficking in Nuclear Materials." This program is intended to improve cooperation in intelligence sharing, deterring potential traffickers, and preventing nuclear materials theft.

Kimber Cramer, Andrew Koch, and R. Adam Moody

NOTE:

A date marked with an "" indicates that an event was reported on that date; a date without an "*" is the date when an event actually occurred.*

The numbers listed in parentheses following the bibliographic references refer to the identification number of the document in the CNS Nuclear Database from which the news summaries are abstracted. Because of the rapidly changing nature of the subject matter, ***The Nonproliferation Review*** *is unable to guarantee that the information reported herein is complete or accurate, and disclaims liability to any party for any loss or damage caused by errors or omissions.*

ALBANIA

Internal Developments

6/29/96

Albanian police in Tirana arrested three unnamed Albanians and seized two containers holding 5 g each of an unidentified radioactive material. According to the daily newspaper *Albania*, the material could be used in a nuclear weapon. The three suspects allegedly worked with an unidentified foreigner who acted as an intermediary between them and an international smuggling ring.

ATA (Tirana), 6/30/96; in FBIS-EEU-96-128, 6/30/96 (15367).

ARGENTINA

Internal Developments

2/23/96*

According to a report by RAND's National Defense Research Institute, it is anticipated that Argentina will possess enough fissile material to build seven nuclear weapons per year by the mid-1990s.

Brian Chow, Richard Speier, and Gregory Jones, *The Proposed Fissile-Material Production Cutoff: Next Steps* (Santa Monica, Calif.: RAND, 1995), p. 13.

4/96*

Argentina possesses uranium production, nuclear fuel manufacturing, and nuclear power plant operations capabilities. The Malargue-Cordoba region contains natural uranium deposits, and the majority of Argentine mining and milling operations are located there. The uranium is then shipped to a purification plant near Cordoba. At Pilcaniyeu, a plant converts the uranium dioxide (UO2) into uranium hexafluoride (UF6). Pilcaniyeu also houses a gaseous-diffusion enrichment facility. At Ezeiza, a fuel fabrication plant manufactures the uranium for Argentina's heavy water reactors (HWRs). The Nuclear Center in Ezeiza has a plutonium reprocessing capability, that was closed in 1990. Fuel for Argentina's research reactors is manufactured at the Contituyentes Atomic Center. Argentina also operates the Embalse and Atucha-1 and -2 HWRs. All Argentina's facilities are under full-scope IAEA and Argentine-Brazilian Accounting and Control Commission (ABACC) safeguards.

Lisa Owens and Caroline Smith, *Journal Of Nuclear Materials Management*, 4/96, pp. 15-21 (15006).

Argentina with Brazil

2/26/96

Argentine Defense Minister Oscar Camilion is scheduled to meet with Brazilian Navy Minister Mauro Cesar Rodrigues, Army Minister Zenildo de Lucena, Foreign Minister Luiz Felipe Lampreia, and Strategic Affairs Secretary Ronaldo Sardenberg to discuss a nuclear cooperation agreement between Argentina and Brazil. Argentina is also expected to propose a cooperative project involving construction of the Caren light water research reactor, which would be under IAEA supervision. The proposal may be part of the cooperation agreement to be signed by the two countries during Brazilian President Cardoso's 3/96 visit to Argentina. The agreement will also establish a 120-day deadline for the development of plans for new projects by the nuclear energy commissions of the two countries.

Tania Malheiros, *Jornal do Brasil* (Rio de Janeiro), 2/29/96, p. 3; in FBIS-LAT-96-044, 2/29/96 (14881). Telam (Buenos Aires), 4/5/96; in FBIS-LAT-96-068, 4/5/96 (14633).

Argentina with Canada and South Korea

5/31/96*

Argentina has secured a contract to supply South Korea with 30 MT of heavy water, according to Canada's Ontario Hydro Corporation which made an unsuccessful bid for the contract. Argentina's heavy water plant became operational in 1995; when running at 85 percent capacity, it can produce 220 MT a year.

UNECAN News, 5/31/96, p. 6 (15450).

Argentina with Egypt

2/27/96*

According to the Egyptian magazine *Akhir Saah*, a nuclear reactor is being constructed at Inshas. A source in the Egyptian Atomic Energy Agency reported that, the Argentine firm Applied Research (Invap) was recently awarded a contract to build the Egyptian reactor, which will cost approximately 300 million Egyptian pounds and is scheduled to begin operations in early 1997.

Mena (Cairo), 2/27/96; in FBIS-NES-96-039, 2/27/96 (14617). *Clarin* (Buenos Aires), 6/6/96, p. 15; in FBIS-LAT-96-124, 6/6/96 (15271).

Argentina with European Union

6/16/96

Argentine President Carlos Menem met with members of the European Union (E.U.) in Brussels and completed discussions on a new nuclear cooperation agreement between Argentina and the E.U.

Nieves Guerrero, Telam (Buenos Aires), 6/15/96; in FBIS-LAT-96-118, 6/15/96 (15434).

Argentina with France

2/28/96

During a press conference at the Argentine embassy in Paris, President Carlos Menem announced that Argentina and France signed a nuclear cooperation agreement. The agreement was signed by the Argentine Nuclear Energy Commission (CNEA) and the National Nuclear Regulatory Agency (ENREN), and by the French Commissariat a l'Energie Atomique (CEA).

Noticias Argentinas (Buenos Aires), 2/28/96; in FBIS-TAC-96-004, 2/28/96 (14621).

Argentina with Iran

6/6/96*

The government of Argentina has agreed to pay Iran $5.5 million as a penalty for withdrawing from two nuclear contracts in 1992. The contracts to supply Iran with a uranium purification pilot-plant were to be fulfilled by the Argentine firm Applied Research (Invap), but were canceled by the Argentine Foreign Ministry following a U.S. request. During 5/96 negotiations in Vienna between

the Atomic Energy Organization of Iran (AEOI) and Invap, the government of Argentina agreed on the penalty rather than going to trial in an Iranian court. Argentina had supplied Iran's Bushehr reactor with enriched uranium and had trained Iranian nuclear specialists.

Clarin (Buenos Aires), 6/6/96, p. 15; in FBIS-LAT-96-124, 6/6/96 (15271). M. Rahman, *India Today*, 2/29/96, p. 116 (14832).

Argentina with Thailand

6/7/96

Thailand's Science, Technology, and Environment Minister Yingphan Manasikan and Argentina's Foreign Minister Guido Di Tella signed a nuclear cooperation agreement to promote research-data sharing and the exchange of nuclear experts. According to Anan Yutthamanop, deputy secretary-general of Thailand's Office of Atomic Energy for Peace (OAEP), the agreement does not include a plan for the construction of a 2 MW research reactor in Thailand. Anan said that the cabinet is expected to have a special committee conduct a feasibility study, and it is possible that specialists from both countries will construct Thailand's second research reactor at Ongkharak in Nakhon Nayok.

Bangkok Post (Bangkok), 6/8/96, p. 2; in FBIS-EAS-96-113, 6/8/96 (15390).

Argentina with United Kingdom

5/17/96*

The Argentine government is concerned about allegations that the British frigate *Sheffield*, sunk during the 1982 Falklands (Malvinas) War, was carrying nuclear weapons. The Argentine Foreign Ministry Press Office reported that "since 1982 we have followed with attention and concern rumors and debates on the possible presence of nuclear weapons aboard *Sheffield*." According to the press office, the IAEA published a report in 1991 that "discusses the possibility that the HMS *Sheffield* carried nuclear weapons."

Telam (Buenos Aires), 5/17/96; in FBIS-TEN-96-006, 5/17/96 (15188).

Argentina with United States

2/29/96

Argentine Foreign Minister Guido Di Tella and U.S. Secretary of State Warren Christopher signed a nuclear cooperation agreement valid "for an initial 30-year period." The agreement replaces a 1969 arrangement that was suspended by the U.S. in the late 1970s and was due to expire in 7/99. Improvements in the new agreement include "provisions for full-scope safeguards; perpetuity of safeguards; a ban on 'peaceful' nuclear explosives; a right to require the return of exported nuclear items in certain circumstances; a guarantee of adequate physical protection; and a consent right to enrichment of nuclear material subject to the agreement." To advance the cooperative effort, the Argentine Nuclear Energy Commission (CNEA) and National Nuclear Regulatory Agency (ENREN) will sign additional, complementary agreements with the U.S. Department of Energy (DOE) and Nuclear Regulatory Commission (NRC). The agreement was submitted to the U.S. Congress on 3/18/96 by President Bill Clinton.

Telam (Buenos Aires), 2/29/96; in FBIS-LAT-96-042, 2/29/96 (14620). Kathleen Hart, *NuclearFuel*, 3/25/96, p. 15 (14623).

ARMENIA

Armenia with Belarus, Kazakstan, Russia, Tajikistan, and Ukraine

Representatives of Armenia, Belarus, Kazakstan, Russia, Tajikistan, and Ukraine met in Minsk and approved a plan on cooperation in a number of areas, including nuclear power development, spent fuel, and radioactive waste management.

NucNet News, 5/30/96 (15423).

Armenia with France

1/31/96*

Armenia and the French firm Framatome signed an agreement to build a nuclear-waste treatment facility in Armenia. In accordance with an earlier treaty, France will contribute 40 million francs to build the facility, which will treat nuclear waste from Armenia's only nuclear power station, Metsamor. According to Ashot Martirosyan, chief of the Armenian Nuclear Safety and Supervision Committee (Armgostomnadzor), a new storage facility developed in the U.S. to Armgostomnadzor specifications will help solve the problem of nuclear wastes in Armenia during the next 50 to 60 years. Construction of the storage facility will be completed in 1997.

Interfax (Moscow), 1/31/96; in BBC Monitoring Summary of World Broadcasts, 2/2/96 (15429). Hamlet Matevosyan, *Segodnya*, 2/22/96, p. 9 (14417).

Armenia with Iran and Russia

2/10/96*

According to an Armenian Khabar-Servis News Agency report, in their efforts to obtain nuclear expertise from the former Soviet Union, Atomic Energy Organization of Iran (AEOI) officials have conducted "unofficial consultations" with specialists from the Metsamor nuclear power plant in Armenia. The Iranian embassy in Armenia denied cooperating with Armenia in general, but did not cite nuclear cooperation specifically. During the now regular consultations, Iran allegedly sought information from Armenian experts on "the functioning of nuclear reactors and the technology for the utilization of nuclear energy."

T. Salakhly, *Zerkalo* (Baku), 2/10/96, p. 18; in FBIS-TAC-96-004, 2/10/96 (14913).

AZERBAIJAN

Azerbaijan with Iran, Kazakstan, and Tajikistan

5/31/96

Iran could have obtained "the necessary components" to manufacture nuclear weapons from Azerbaijan, Tajikistan, and Kazakstan, making the country "practically ready to produce three nuclear warheads."

Aleksei Malashenko, *Prism*, 5/31/96 (15127).

BELARUS

BELARUS WITH AFRICA, CZECH REPUBLIC, GERMANY, AND RUSSIA

4/10/96*

A U.S. Senate investigator's report reveals new details on the 12/14/94 Prague uranium smuggling case. According to the report, the uranium was brought from the Russian town of Obninsk to Prague, Czech Republic, via Belarus and Poland in a rail car reserved for train employees. A train conductor delivered the material to smugglers in Prague, who later found a German buyer that paid $1,600 to $1,800 per gram. Meeting the buyer's request to supply 5 kg of highly enriched uranium per month, the Russian smugglers promised to deliver 40 kg of the uranium "within a short time frame," according to the report. Jan Rathausky, the Czech investigator on the case, believes that the Russian-origin uranium was destined for an unnamed African country. According to Czech investigators, Libya was not involved in the deal. The report includes information about the threats made to Rathausky in 1995 in a letter from an unidentified author. The letter offered money for releasing the Russian suspect, Aleksandr Shcherbinin, from jail. The author of the letter threatened to detonate a nuclear device at a Prague hotel if Shcherbinin was not released.

Maggie Ledford Lawson and Jan Stojaspal, *Prague Post*, 4/10/96-4/16/96, pp. 1, 4; in FBIS-EEU-96-122, 6/24/96 (15538). Maggie Ledford Lawson and Jan Stojaspal, *Prague Post*, 2/20/96, p. 1; in FBIS-EEU-96-053, 2/20/96 (14587).

BELARUS WITH:

Armenia, Kazakstan, Russia, Tajikistan, and Ukraine, 113

BELARUS WITH RUSSIA AND UKRAINE

4/17/96*

Posing as the representative of a Middle Eastern company, a *Komsomolskaya Pravda* reporter in Odessa met with four men known only as Tolya, Volodya, Lyosha, and Andrei, all of whom were connected with the Ukrainian black market. Tolya produced a certificate for a lead vacuum capsule filled with 99.9 percent pure radium-226, offering a total of 6 g. Lyosha offered 40 g of strontium-90 and produced a sample container. Tolya assured the reporter that there was no problem in shipping goods from Odessa. While the materials offered by the four Ukrainians may have come from Russia or Belarus, they may also have originated at the Yuzhmash defense plant in Dnepropetrovsk, Ukraine, the residence of two of the four black marketers.

Yevgeniy Strigunov, *Komsomolskaya Pravda*, 4/17/96, pp. 1, 2 (15543).

BRAZIL

INTERNAL DEVELOPMENTS

2/6/96

Navy Minister Mauro Cesar Rodrigues Pereira announced that construction of a Brazilian nuclear submarine is no longer a priority. After spending $670 million, the project has been suspended due to a shortage of funds. Building a prototype would have cost an additional $500 million, with at least $75 million needed in 1996. The Brazilian federal government had provided only $25 million in 1995, a figure that would have prevented the program from keeping to its timetable. Now the navy is requesting $50 million to invest in two new projects. First, facilities at the Aramar Navy Experimental Center will be used to construct power-generating nuclear reactors. Second, funds will be used to build conventional submarines. According to Pereira, the nuclear submarine project could "be resumed in the future." He emphasized that the current priority is to build Brazil's first entirely indigenous conventional submarine. In a separate interview, Pereira said that "the nuclear submarine is our highest priority," and that the switch to building a less expensive, conventional submarine was just a postponement of the nuclear program. A prototype reactor will be ready by 2000; then construction of the submarine itself will begin. During a visit by Brazilian President Fernando Henrique Cardoso to the Aramar center, Pereira criticized "the administration's failure to invest in a nuclear submarine project that was started over 15 years ago." Aramar's Technological Superintendent Sergio Garcia added that, if the appropriate funds were received, the prototype reactor would be available by 2003, and that the submarine could be completed by 2008.

Jose Maria Tomazela, *O Estado de Sao Paulo*, 2/7/96, p. A15; in FBIS-LAT-96-028, 2/7/96 (14786). *Defense News*, 4/8/96-4/14/96, p. 30 (14786). Florencia Costa, *O Globo* (Rio de Janeiro), 4/5/96, p. 4; in FBIS-LAT-96-069, 4/5/96 (14786).

2/23/96*

According to a report by RAND's National Defense Research Institute, it is anticipated that Brazil will possess enough fissile material to build one to seven nuclear weapons per year by the mid-1990s.

Brain Chow, Richard Speier, and Gregory Jones, *The Proposed Fissile-Material Production Cutoff: Next Steps* (Santa Monica, Calif.: RAND, 1995), p. 13.

3/3/96*

Following a decision by Brazil's Strategic Affairs Secretariat (SAE), Nuclear Industries of Brazil (INB) is dismantling and decontaminating its Santo Amaro (Usam) nuclear facility in Sao Paulo. The facility had been used to extract uranium and thorium from monazite sands. INB expects to spend approximately 1 million reals and use nearly 50 specialists in order to complete the dismantlement process by late 1996. INB is waiting for approval from the National Nuclear Energy Commission (CNEN) to relocate approximately 500 MT of uranium and thorium, known as "Cake II," still located at the Santo Amaro plant. The Cake II will be temporarily stored at the Interlagos facility (Usim) in Sao Paulo, before the uranium portion is transported to the Pocos de Caldas complex for transformation into yellowcake (U_3O_8). The Pocos de Caldas facility produces nuclear fuel for the Angra-1 plant, and already houses 1.5 MT of Cake II. In the past, the minerals transformed into Cake II at the Usam plant were extracted at the Buena mill in Rio de Janeiro.

Tania Malheiros, *Jornal do Brasil* (Rio de Janeiro), 3/3/96, p. 16; in FBIS-LAT-96-049, 3/3/96 (14833).

3/19/96*

The first phase of Brazil's isotopic enrichment plant at Resende is near completion, and will consist of a cascade of approximately 700 ultracentrifuges. According to Brazilian Navy Technological Center Director Admiral Ivan de Aquino Vianna, the enriched uranium from Resende will be used in the research reactors at the Nuclear Technology Development Center in Belo Horizonte, the Nuclear Engineering Institute in Rio de Janeiro, and Sao Paulo's Institute of Nuclear and Energy Research (IPEN). Vianna said that Brazil wants to have 4,000 more ultracentrifuges installed at the Resende enrichment facility by 1999. According to the Brazilian government, the Aramar Experimental Center would enrich uranium for use in its nuclear submarine program.

Jornal do Brasil (Rio de Janeiro), 3/19/96; in BBC Monitoring Service, 3/26/96 (14885).

6/96*

The Pocos de Caldas facility, run by INB, produced 108 MT of U308 in 1994, and 103 MT in 1995. In 1996, INB plans to maintain the output of 103 MT, ceasing Pocos de Caldas' mining operations in 1997 because uranium reserves in the area are nearly depleted. In 1998, operations will begin at the new Lagoa Real project to coincide with the commencement of operations at the Angra-2 nuclear power plant. The Lagoa Real mine has a nominal capacity of approximately 260 MT of yellowcake per year. Brazilian authorities are expected to authorize uranium mining in Caetite and Rio Real counties in 1996.

Tania Malheiros, *Jornal do Brasil* (Rio de Janeiro), 4/7/96, p. 6; in FBIS-LAT-96-070, 4/7/96 (14618). BBC Monitoring Summary Of World Broadcasts, 5/21/96; in *Uranium Institute News Briefing*, 5/15/96-5/21/96 (15272). *Nukem*, 6/96, p. 67 (15265).

6/3/96*

INB called for bids for the supply of approximately 15,000 kg of uranium, in uranium hexafluoride (UF6) form.

Michael Knapik and Ray Silver, *NuclearFuel*, 6/3/96, pp. 14-15 (15248).

BRAZIL WITH:

Argentina, 112

BRAZIL WITH CANADA AND RUSSIA

3/96

Representatives of the Canadian company Cameco met with Brazilian nuclear officials to discuss the possibility of selling yellowcake (U3O8) to Brazil. The Brazilian Strategic Affairs Secretariat (SAE) and the National Nuclear Energy Commission (CNEN) are reviewing the Canadian proposal following the signing of a nuclear cooperation agreement by Canadian Minister of Foreign Affairs Lloyd Axworthy and Brazilian Foreign Minister Luiz Felipe Lampreia on 5/22/96. A senior SAE official indicated that the purchase of Canadian yellowcake would be contingent on financial considerations and noted the possibility of buying the yellowcake from Russia instead. Russia has a surplus of yellowcake, a nuclear cooperation agreement with Brazil, and prices "more attractive than those of Canada."

Carlos Alberto, Voz do Brasil Network (Brasilia), 5/22/96; in FBIS-LAT-96-101, 5/22/96 (15269). *Enerpresse*, 5/28/96 (15269). EFE (Madrid), 5/22/96; in FBIS-LAT-96-101, 5/22/96 (15269). Tania Malheiros, *Jornal do Brasil* (Rio de Janeiro), 4/7/96, p. 6; in FBIS-LAT-96-070, 4/7/96 (14618).

BRAZIL WITH CHINA

6/96

A Chinese delegation is expected in Brazil to discuss using Nuclebras Heavy Equipment (Nuclep) facilities to produce nuclear reactor components for plants under construction in China. During the week of 3/25/96, Brazilian Strategic Affairs Secretariat (SAE) head Ronaldo Sardenberg stated that the Brazilian nuclear industry is capable of producing "complete nuclear plants." No accord will be signed by Brazil and China for the deal, because it involves only production of equipment that is not linked to the exchange of new technologies or to the use of fuel elements.

Tania Malheiros, *Jornal do Brasil* (Rio de Janeiro), 3/31/96, p. 16; in FBIS-TAC-95-005, 3/31/96 (15497).

BRAZIL WITH GERMANY

6/96*

Brazil decided to continue construction of the 1,300 MWe Angra-2 pressurized water reactor (PWR) with financial assistance from German banks as well as the Brazilian firms Furnas, Electrobras, and Finep. The project is to be completed by 7/99, and loading of the core is expected to be completed in 11/98.

Nuclear Engineering International, 6/96, p. 3 (15120). Richard Masters, *Nuclear Engineering International*, 6/96, pp. 31-35 (15255).

6/3/96

Brazilian Nuclear Corporation, Inc. (Nuclebras) Engineering President Ronaldo Fabricio announced that construction of the 1,220 MW Angra-3 nuclear power plant would resume by 1998. Fabricio said that Angra-3 will commence operations in 2005. Pedro Figueiredo, director of thermonuclear production for Furnas, added that the Brazilian project has already cost $1 billion and that nearly 40 percent of the plant's equipment has been purchased, some from Siemens of Germany.

Tania Malheiros, *Jornal do Brasil* (Rio de Janeiro), 6/4/96, p. 21; in FBIS-LAT-96-128, 6/4/96 (15435).

BRAZIL WITH GERMANY, IRAN, AND IRAQ

2/8/96*

The German government is attempting to confirm that a former German centrifuge specialist in the Urenco enrichment project, Karl-Heinz Schaab, fled to Iran after being accused of providing Iraq with the advanced TC-11 Urenco centrifuge. In late 1993, after his conviction for selling 32 carbon-fiber centrifuge rotors to Iraq, Schaab was believed to have moved to Brazil to work with other German specialists on an unsafeguarded centrifuge program at Ipero. As of 2/96, Schaab was believed to be in Iran. Some officials fear that Iran may protect Schaab to employ him in its uranium enrichment project. According to one Western official, the reports on Schaab's presence in Iran "are very bad, if they are correct. The Iranians are seeking to produce a nuclear bomb, but they lack accurate designs and high-tech skills."

Mark Hibbs, *Nucleonics Week*, 2/8/96, pp. 12-13 (15017). Alan George, *Al-Sharq Al-Awsat* (London), 2/11/96, pp. 1-4; in FBIS-NES-96-030, 2/11/96 (15017).

Brazil with United States

3/2/96

U.S. Secretary of State Warren Christopher signed a nuclear cooperation agreement with Brazil. The agreement, signed for Brazil by Foreign Minister Luiz Felipe Lampreia, emphasizes the peaceful use of nuclear energy in the fields of medicine, industry, and agriculture, and prohibits any military applications. It also confirms Brazil's intention to adhere to IAEA safeguards.

New York Times, 3/3/96, p. 6 (14632). Boris Casoy, SBT Television Network (Sao Paulo), 3/1/96; in FBIS-LAT-96-043, 3/1/96 (14632).

CHINA

Internal Developments

2/8/96*

Shanghai will construct a synchrotron light source capable of operating at 2.2 to 2.5 GV. The synchrotron will aid research in a range of disciplines, including nuclear physics. The project will cost at least $100 million, half of which will be provided by the Shanghai municipal government, according to the Chinese Academy of Sciences. China currently operates two synchrotrons, a first-generation model, which is used as an auxiliary to the Beijing Positron electron collider, and an 800 MeV second-generation accelerator located at the University of Science and Technology of China in Hefei, Anhui province.

Xinhua (Beijing); in FBIS-CHI-96-028, 2/8/96 (14660).

2/8/96*

Qinghua University Institute of Nuclear Energy Technology and Design has developed a new method of extracting transuranic elements from highly radioactive waste. An experiment conducted between 1/2/96 and 1/7/96 achieved an extraction rate exceeding 99.6 percent for alpha nuclides and 99 percent for cesium and strontium. Other transuranic elements separated by this process include curium and americium. Using this new process, highly radioactive waste is transformed into intermediate- and low-level waste that can subsequently be solidified in cement for disposal. Nuclides extracted by the process can be reused. Development of this new process included a heat-separation experiment for highly radioactive waste conducted at the European Transuranic Institute during the period covering China's eighth five-year plan. China National Nuclear Corporation began evaluating this process in 1994.

Keji Ribao (Beijing), p. 5; in FBIS-CST-96-004, 2/8/96 (14662).

3/20/96

When asked at a press conference if China would use nuclear weapons should the U.S. become involved in a military conflict between China and Taiwan, a Chinese Foreign Ministry spokesman Shen Guofang responded that "China would never be the first to use nuclear weapons."

Wen Wei Po (Hong Kong), p. A2; in FBIS-CHI-96-055, 3/20/96 (6126).

3/20/96

Representatives of the Chinese power industry and the China Nuclear Industry Corporation, and the deputy governor of Jiangsu province, Chen Biting, approved a site for the Jiangsu Nuclear Plant. It will be situated at Bashantou, Lianyungang City in Jiangsu province. Four reactors could be built at Bashantou, each producing 1,000 MW.

Zhongguo Xinwen She (Beijing); in FBIS-CHI-96-055, 3/20/96 (14635).

3/25/96

A five-day international nuclear exhibition, hosted by the China Nuclear Society, China Nuclear Industry Corporation, and the Beijing Municipal Foreign Trade and Economic Cooperation Commission opened in China. More than 80 companies participated, representing countries including the U.S., the U.K., France, Russia, Canada and Taiwan; they displayed nuclear technology and equipment. The Chinese Qinshan and Daya Bay nuclear plants also had displays at the exhibition. Thirteen seminars covered topics such as the technology, management, and applications of nuclear energy, as well as the production of nuclear fuel. More seminars are planned, with the goal of fostering Chinese technical exchanges and international commercial cooperation.

Xinhua (Beijing); in Executive News Service, 3/26/96 (14793).

3/28/96

China announced that a test flight of "single- and twin-seat unmanned, supersonic drones" was successful. The drones collected samples from nuclear test sites, the locations of which were not identified. According to a Western military expert, the drones may be equipped with sensors to survey temperature, radioactivity, and other elements present in the atmosphere. China now has unmanned drones which can fly at various altitudes and can be used in "nuclear testing and large-scale exercises." The drones work with all types of missiles in live-fire maneuvers.

Reuter; in Executive News Service, 3/28/96 (14880).

4/8/96*

As part of the "863" program, scientists from the Chinese Nuclear Energy Technology Design Research Institute at Qinghua University have been researching nuclear technologies for a 10 MW high-temperature, gas-cooled research reactor scheduled for completion by 2000. Construction of the reactor has already begun. This type of reactor could be used for generating electricity, thermoelectricity, heat extraction from heavy oil, and coal gasification and liquefaction. The Chinese scientists are working on various areas of research including "helium technology, helium circuits, fuel components, and the characteristics of spherical bed mobility." Two technologies in particular are being developed at Qinghua University: "microcomputer protection systems" to ensure the safety of nuclear reactors, and "pulse air-powered unloading equipment" used in handling nuclear fuel. A prototype of the microcomputer protection system has received approval from the Chinese State Nuclear Safety Bureau. Wang Dazhong of the Chinese Academy of Sciences developed the idea.

Xinhua (Beijing); in FBIS-CHI-96-077, 4/8/96 (14806).

5/3/96*

Chinese scientists at the Institute of High-Energy Electronics in Chengdu have conducted a successful experiment with a klystron, an electron tube that amplifies or generates intense microwave signals. The

Chinese scientists used the klystron as a high power microwave source for lower-hybrid-current-drive (LHCD) nuclear fusion experiments.

Li Mingguan, *Journal of the University of Electronic Science and Technology of China* (Chengdu), 2\96, pp. 52-58; in FBIS-CST-96-006, 5/3/96 (15547).

5/96

The Chinese Nuclear Industry Corporation approved a feasibility study for an experimental nuclear reactor. Sun Zhuxun, president of the Chinese Academy of Nuclear Energy, said that the fast-neutron reactor is designed to generate 65 MWt and 20 MWe. The reactor is due to be completed by 2000, and China plans to build the reactors commercially in the future.

Reuter; in Executive News Service, 7/1/96 (15549).

5/26/96*

In *China Daily Business Weekly* on 5/6/96, Li Hu, the director-general of the Science and Technology Department of the Chinese Ministry of Foreign Trade and Economic Cooperation, said that China plans to initiate an export control law to regulate transactions of sensitive technologies.

Jane McCartney, Reuter, 5/26/96; in Executive News Service, 5/28/96 (15521).

China with Afghanistan, Iran, Kazakstan, Pakistan, Russia, and Turkmenistan

1/96

Russian diplomats stationed in Mazar-e-Sharif, northern Afghanistan, have allegedly sold enriched uranium to Iran. According to sources in Pakistan, the uranium "has its origins in the 249 kg of enriched uranium" stolen by security guards at a nuclear power plant in Kazakstan and shipped to Mazar-e-Sharif in lead cylinders. For smugglers, Mazar-e-Sharif is a "transit point" on the way to Peshawar, Pakistan, the main destination for the nuclear dealers. In Peshawar, "enriched uranium, catalysts, super-powerful magnets, and alloys for making the shells of thermonuclear warheads" are sold by nuclear salesmen, mostly Afghans. According to one Western source, "Iranian colonels and majors [are] walking around [Peshawar] with suitcases full of $100 bills" looking to buy nuclear materials. The material sold in Peshawar is often radioactive, according to a Western art specialist, who was looking for antiquities but was offered 1,200 kg of enriched uranium instead. The uranium was stored in dozens of 5 kg lead cylinders and buried beneath the floor of a house in Peshawar. According to the smuggler, the uranium "was slipped out of a high-security plant, located close to Moscow, by one of the plant managers." The nuclear material was shipped to northern Afghanistan through Turkmenistan and then to Peshawar. "Enriched uranium," stolen during 11/95 or 12/95 from Ust-Kamenogorsk province in Kazakstan, may also be for sale. The uranium continues to arrive in Peshawar, via China, Russia, and other Central Asian states. Besides enriched uranium, other nuclear materials, such as strategic steel alloy (used in building nuclear weapon casings and nuclear submarine hulls) are offered for sale in Peshawar. One Russian engineer, who was selling the alloy in Peshawar, revealed that it had been smuggled from Turkmenistan to Afghanistan, and then through the Parachinar mountain pass to Pakistan. Pakistani Interior Minister General Nasrullah Barbar acknowledged that his government was confronted with nuclear smuggling, and that "a lot of these items are coming out [of the former Soviet Union]." Some officials suspect that salesmen from the former Soviet Union deceive Afghans by selling them useless, yet highly radioactive, "nuclear rubbish."

Tim McGirk, *Independent* (London), 3/28/96, p. 11; in FBIS-NES-96-062, 3/28/96 (14829). Behroz Khan, *News* (Islamabad), 4/9/96, p. 1; in FBIS-NES-96-070, 4/9/96 (14829). Tim McGirk, *Independent On Sunday* (London), 3/24/96, pp. 4-8; in FBIS-NES-96-062, 3/24/96 (14829). *Nation* (Islamabad), 4/5/96, p. 14; in FBIS-NES-96-069, 4/5/96 (14829).

China with:

Brazil, 115

China with France

3/96

China Nuclear Fuel Industry has awarded a $10 million contract to France's Framatome for the supply of components for two 600 MWe nuclear reactors in Qinshan. Framatome will outfit the plants, due to begin operation in 2001 and 2002, with structural components for the fuel assemblies of the reactor cores; two of its subsidiaries, FBFC and Zircotube, will provide components for the sub-assemblies (including control rods) and zirconium cladding tubes, respectively. The Yibin fuel plant, already equipped with an AFA fuel line, will produce fuel for the Qinshan plants according to Framatome's AFA-2G design.

Nuclear Engineering International, 3/96, p. 4 (14639).

China with France, India, Israel, Pakistan, Russia, United Kingdom, and United States

6/4/96

A U.S.-French secret agreement to share computer information derived from simulated nuclear weapon explosions may be a precursor to similar accords with Russia, Israel, Pakistan, India, and China. The agreement strengthens the relationship between U.S. and French nuclear weapons scientists working to ensure the safety of each country's nuclear stockpile. The agreement with France is highly classified, and the information had previously only been shared with the U.K. According to some U.S. officials, the U.S. provided Russia and China with less specific nuclear weapons data, and is considering sharing the same information with Israel, Pakistan, and India. In 12/95 and 5/96, top Russian and U.S. nuclear weapons officials met in London and Vienna, respectively. The U.S. House of Representatives has proposed an amendment to the FY 1997 defense authorization bill to develop nuclear cooperation with France and Britain, but to prohibit such cooperation with China and Russia. According to House National Security Committee Chairman Floyd Spence, "any plan by the administration to share our nation's nuclear secrets with Russia, China, or other proliferative countries such as Pakistan and India [is] extremely dangerous." The amendment has not been approved by the Senate. State Department spokesman Nicholas Burns, who publicly confirmed the report on the U.S.-French nuclear data agreement on 6/17/96, said he was not aware of whether the U.S. negotiated similar accords

with Russia, Britain, or China.

R. Jeffrey Smith, *Washington Post*, 6/17/96, p. A9 (15389). Martin Walker, *Guardian*, 6/18/96 (15389). Reuter, 6/17/96; in Executive News Service, 6/18/96 (15389).

China with France, Pakistan, and United Kingdom

2/14/96*

British authorities stopped a shipment of French valves with nuclear applications that were bound for Pakistan. However, France has since "allowed them [the valves] to be shipped directly." Reports of European nuclear equipment and materials being shipped to Pakistan, in conjunction with reports that Pakistan is receiving Chinese-origin "magnetic separators," used in extracting weapons-grade uranium, have raised fears about the Pakistani nuclear weapons program.

Alfred de Tavares and Sanjay Suri, *India Abroad*, 2/23/96, p. 27 (15018). *Asian Age*, 2/14/96; in *Strategic Digest*, 4/96, pp. 537-538 (15018).

China with Germany

6/12/96*

Germany supplied China with a nuclear fusion facility, known as ASDEX, to research power generation from controlled nuclear fusion at the Physics Research Institute in Chengdu, Sichuan province. The ASDEX facility was dismantled and shipped from the Max Planck Institute for Plasma Physics in Garching, Germany. The Germans have already moved to a new research facility, the ASDEX Upgrade.

Reuter (Beijing); in Executive News Service, 6/12/96 (15546).

China with India, Iran, and Russia

3/16/96*

Dr. Yevgeniy Velikov, director of Russia's Kurchatov Nuclear Center, said that India has joined the Asian Foundation for Thermonuclear Research (AFTR). The AFTR is being set up by the Chinese National Nuclear Corporation, the Atomic Energy Organization of Iran, several nuclear centers in Russia, and the Indian Institute of Plasma Research. The AFTR will reportedly construct a thermonuclear reactor by 1998. No location was specified.

Hindu, 3/16/96, p. 12. *Iran Brief*, 4/1/96, pp. 4-5. (15011.)

China with Iran

4/18/96

A Chinese delegation will be sent to the Isfahan nuclear complex in Iran to work on the final design phase of a uranium hexafluoride (UF6) plant. Iran intends to declare this plant to the IAEA for monitoring. Some intelligence sources believe a pilot "hex" plant was constructed several years ago at Rudan, near Shiraz, with Chinese assistance.

Iran Brief, 5/6/96, p. 1 (15606).

China with Iran, North Korea, and United States

4/11/96

At a Pentagon press conference, U.S. Defense Secretary William J. Perry released a report entitled *Proliferation: Threat and Response*. The report likened the threat of the spread of weapons of mass destruction (WMD) to that once posed by the Soviet Union's nuclear arsenal. Director of the Defense Intelligence Agency Lt. Gen. Patrick Hughes, who presented the report along with Perry, highlighted North Korea's WMD programs as a vital concern. "One facet of the threat," Hughes said, "is their capability to use missiles to deliver weapons of mass destruction of all kinds to some distant enemy." Assistant Defense Secretary for International Security Policy Ashton Carter, speaking at a press briefing, said that the report viewed China as pushing "the edge of what is acceptable nonproliferation behavior." Also highlighted in the report were Iran's efforts to acquire WMD and associated delivery vehicles, as well as China's and Russia's roles in supplying it with nuclear technology.

Bill Gertz, *Washington Times*, 4/12/96, p. A3 (14828). Tim Weiner, *New York Times*, 4/12/96, p. A4 (14828).

China with Japan

5/26/96

Japan's Ministry of International Trade and Industry will go ahead with a plan to assist China in constructing a trial 10 MW high temperature reactor; the plan includes supplying China with "graphites."

Nuke Info Tokyo, 5/96-6/96, p. 9 (15453).

China with Kazakstan and Kyrgyzstan

5/23/96

Zhang Yuechun, head of China's Xinjiang Environment Monitoring Station, said that 106.8 MT of scrap metal, which originated in Kazakstan and Kyrgyzstan, had radiation levels 1,000 times that of Chinese standards. The monitoring station detected radioactivity on the surface but not inside the scrap metal. Most of the 120,000 MT of scrap metal came from a Kazakstani nuclear test facility near Tacheng.

Reuter; in Executive News Service, 5/23/96 (15494).

China with Pakistan

1/4/96*

The U.S. alleged that China is assisting Pakistan in building a uranium centrifuge plant at Wah. Pakistani officials reportedly confirmed that Pakistan was constructing another enrichment plant in Golra Sharif.

Shahid-Ur-Rehman Khan, *Nucleonics Week*, 2/29/96, p. 14 (15065).

3/4/96*

China is helping Pakistan build a 300 MW nuclear power plant at its Chashma facility. China has shipped a set of auxiliary equipment to Chashma, and will provide it with nuclear fuel for the first three years of operation, scheduled to commence in 1998.

Strategic Digest, 2/96, pp. 250-251 (14595). *Asian Recorder*, 3/4/96-3/10/96, pp. 25457-25458 (15563).

4/3/96*

U.S. officials say that China is assisting with a plutonium plant associated with Pakistan's New Laboratories, near the Chashma reactor. This plant could produce plutonium from spent fuel from the Chashma reactor or the Khushab research reactor.

Tony Walker and Peter Montagnon, *Financial Times*, 4/1/96, p. 5 (14795). Bill Gertz, *Washington Times*, 4/3/96, p. A4 (14795.)

5/23/96*

According to Chinese reports, China National Nuclear Corporation shipped 40 tons

of heavy water to Pakistan for the partially built Khushab reactor in Punjab. The shipment followed an 8/95 visit by Pakistan Atomic Energy Commission head Ashfaq Ahmad. China has assisted in construction of the Khushab site, which is scheduled for completion by the end of 1996. China will provide nuclear specialists for the Khushab reactor. The reactor has not been placed under international safeguards because the Pakistani government has stated that it is only a research reactor.

All India Radio Network (Dehli); in FBIS-NES-96-078, 4/19/96 (15441). BBC Monitoring Service, 5/23/96 (15524).

China with Pakistan and United States

5/11/96

A Chinese Foreign Ministry spokesman announced formally that "China will not provide assistance to unsafeguarded nuclear facilities." Events leading to this announcement began in 2/96, when press reports leaked information from a U.S. Central Intelligence Agency report revealing that the China Nuclear Energy Industry Corporation, a state-owned nuclear equipment manufacturer, had shipped 5,000 custom-made ring magnets to a Pakistani uranium enrichment facility near its Chashma facility. (Ring magnets are used in centrifuges that produce enriched uranium.) The site to which the ring magnets were shipped is not under international safeguards, making the transfer against the MTCR and the NPT, both of which China has agreed to abide by either formally or informally. The U.S. also has its own laws under which China could be sanctioned, including the 1994 Nuclear Nonproliferation Act. After the Chinese and Pakistani governments denied that the transfers had occurred, China privately assured the U.S., in a meeting between U.S. Secretary of State Warren Christopher and Chinese Foreign Minister Qian Qichen on 4/19/96, that China would no longer supply ring magnets to foreign unsafeguarded nuclear facilities. Because China's private assurances are not considered reliable by many in the U.S., a Chinese Foreign Ministry spokesman made the formal announcement on 5/11/96. Although China's meaning of the term "assistance" in the formal announcement leaves room for uncertainty as to China's intentions, it was after this announcement that the U.S. decided not to impose sanctions.

Evan S. Medeiros, *Arms Control Today*, 5/96-6/96, p. 19. Carol Giacomo, Reuter; in Executive News Service, 5/14/96. (15561.)

China with Russia

6/13/96

The Russian Ministry for the Nuclear Industry informed Itar-Tass that Russia does not have computers which can simultaneously stage a series of nuclear explosions. The statement came in response to Japanese press allegations that Russia transferred to China "a special computer technology enabling the simultaneous staging of several nuclear explosions and creating missiles with several warheads." A Russian Ministry spokesperson said that "nuclear scientists see no connection between such tests and missile production," and that "high-yield rapid action servers" are not produced in Russia.

Itar-Tass (Moscow); in FBIS-SOV-96-115, 6/13/96 (15565).

China with Taiwan

3/7/96

There is concern for the security of Taiwan's three nuclear power plants following China's recent missile tests, specifically given the short distance between the plants and the "splash zone" of the missile tests. The Chinsahn-1 and the Shihmen-2 power plants, near the northern port of Keelung, are approximately 25 km from the sea. The splash zone for China's northeastern missile test site is 25 km offshore. China's southern missile test splash zone is 50 km from the coast of Kaohsiung, near the Hengchun plant. Chou Yuanching, deputy director of the department of nuclear regulation, a division of Taiwan's Atomic Energy Council, said that the government had made plans for evacuation in the event of a nuclear accident. If, however, a missile were to strike a nuclear plant, the plans would be ineffective, according to Kuo Hsing-kung, a board member of the Green group, because the entire island would have to be evacuated.

Eastern Express (Hong Kong) p. 1; in FBIS-CHI-96-047, 3/8/96 (14807).

China with United States

5/23/96

Wan Yuanxi, director of the Institute of Plasma Physics at the Chinese Academy of Sciences said that the Fusion Research Center at the University of Texas will assist China in constructing the HT-7U Superconductive Tokamak Controlled Thermonuclear Fusion Experimental Facility, if the program is approved by Chinese authorities. The facility, which would be located in Hefei, provincial capital of Anhui province, is expected to be completed by the year 2000 and would be the world's largest facility experimenting in the controlled use of nuclear fusion.

Xinhua (Beijing); in FBIS-CHI-96-103, 5/23/96 (15548).

6/28/96

Chinese customs officials in the city of Tianjin confiscated 78.336 tons of radioactive scrap metal imported from the city of Houston, Texas by China Materials Recycling Corporation. The contaminated iron was shipped in containers that varied in radioactivity, but one container exceeded the Chinese limit by a factor of 60.

UPI, 7/1/96; in Executive News Service, 7/2/96 (15494).

COMMONWEALTH OF INDEPENDENT STATES (CIS)

CIS with Canada and United States

4/22/96*

The U.S. Rochester Gas and Electric Corporation signed a contract with Canadian company Cameco to import 700,000 lb of U3O8 from the CIS over the next five years.

Michael Knapik and Pearl Marshall, *NuclearFuel*, 4/22/96, pp. 17-18 (15551).

CIS with India

6/30/96*

A pressurized water reactor (PWR) being developed for India's nuclear submarine

program failed tests at the Kalpakkam nuclear facility in 11/95 and 12/95. The failures were caused by "several integration and fabrication problems" that have yet to be solved. Indian designers have also had problems constructing the reactor's containment vessel. Called the advanced technology vessel (ATV), the project has cost the Indian Navy $285.7 million, with an estimated $714.3 million needed to complete the project. The Defense Research and Development Organization (DRDO) and the navy are designing the submarine, and the Department of Atomic Energy (DAE) is responsible for the reactor. The reactor is being built by the Bhabha Atomic Research Center (BARC), and the Rattehalli Rare Earth Plant will provide enriched uranium for fuel. The DRDO is seeking assistance for the nuclear submarine project from engineers and defense experts of the former Soviet Union; several Russian nuclear engineers are known to have been in India since 1991. According to Richard Sharpe, editor of *Jane's Fighting Ships*, the Russian submarine-design bureau Rubin is cooperating with the DRDO in developing the sub's 190 MW PWR, and that the Indian Navy already tested a nuclear-propulsion system ashore.

Vivek Raghuvanshi, *Defense News*, 6/24/96-6/30/96, p. 40 (15473). *Times Of India*, 12/29/96; in *Strategic Digest*, 3/96, pp. 440-441 (15176). Denis Baranets, *Moskovskiye Novosti*, 4/21/96-4/28/96, p. 3 (15176). Mahesh Hebbar, *Asian Age* (Delhi), 5/25/96, p. 1; in FBIS-NES-96-105, 5/25/96 (15176). Paul Majendie, Reuters, 5/22/96; in Executive News Service, 5/22/96 (15176).

CIS with Iran

5/31/96*

Iran currently employs 50 nuclear experts from the former Soviet Union in five operating nuclear power plants.

Aleksei Malashenko, *Prism*, 5/31/96 (15127).

CIS with Iran, Iraq, North Korea, and Syria

3/96*

CIA Director John Deutch testified before a U.S. Senate hearing that there is no clear evidence that Iraq, North Korea, or Syria have attempted to obtain fissile material from sources inside the Commonwealth of Independent States (CIS), or that any terrorist organization has actually acquired nuclear material from such sources. Deutch rejected the idea that organized crime rings are involved in nuclear smuggling, but added that the CIA does not "know all that's going on" with regard to trafficking of nuclear materials. Deutch's testimony also noted the poor security and accounting measures at Russian civilian research institutes containing weapons-grade material, and the related CIA belief that Russia is unable to account for the location of all its nuclear material. He said that security at military facilities is considered "significantly better," although according to a Russian source, the degree of inadequacy of warhead accounting procedures could allow the diversion of a warhead to go unnoticed for up to six months. In an analysis of the situation from a Senate Subcommittee on Investigations report released during the hearings, Kazakstan, Uzbekistan, Tajikistan, Kyrgyzstan, Turkmenistan, Georgia, Armenia, and Azerbaijan are apparently used as transit routes for nuclear material from Russia, and Iran, Iraq, and North Korea have attempted to recruit nuclear specialists from these countries to develop their own domestic nuclear programs. According to Glenn E. Schweitzer, former head of the International Science and Technology Center in Moscow, there has been "no major emigration" among the nearly 60,000 Russian scientists and engineers with weapons-designing experience, but "short-term visits abroad" and foreign contacts are "subject for concern."

Evan S. Medeiros, *Arms Control Today*, 3/96, p. 24 (15628).

CUBA

Cuba with Mexico

5/24/96

Cuban Minister of Science, Technology, and Environment Rosa Elena Simeon and Mexican Energy Secretary Jesus Reyes Heroles signed a nuclear cooperation agreement.

Prensa Latina (Havana), 5/25/96; in FBIS-LAT-96-104, 5/27/96 (15270).

Cuba with Russia

2/18/96

Russian Atomic Energy Minister Viktor Mikhailov arrived in Cuba to discuss construction of the Juragua nuclear power plant. According to Mikhailov, discussions will involve "the realistic task" of completing the first of two units at Juragua, to begin operations before the year 2000. A Russian-Cuban working group will be established to coordinate the international support necessary to complete construction. An estimated $750 million is needed to complete the project, which has already cost more than $1 billion.

Konstantin Zhukovskiy, Itar-Tass (Moscow), 2/18/96; in FBIS-LAT-96-034, 2/18/96 (14886). Michael Langan, AFP (Paris), 3/12/96; in FBIS-LAT-96-052, 3/12/96 (14886).

EGYPT

Internal Developments

2/24/96*

Construction of the 22 MW Inshas-2 reactor has been completed, and the Egyptian Atomic Energy Authority has begun initial testing with the intention of beginning operations in 6/96.

Adil Sabri, *Al-Wafd* (Cairo), 2/24/96, p. 1; in FBIS-NES-96-041, 2/24/96 (14629).

Egypt with:
Argentina, 112

ESTONIA

Estonia with Ireland, Russia, and United Kingdom

5/96*

A Russian Foreign Ministry official who had been in contact with British intelligence was arrested in Moscow. According to the British newspaper *Mail On Sunday*, the Russian

had attempted to give the British security service information concerning illegal transactions of arms, explosive materials, and the possible transfer of nuclear materials to the Irish Republican Army via Estonian firms.

Aleksandr Pakhomov, *Ogonyek*, 5/96, p. 11 (15206).

Estonia with United States

6/96*

The U.S. Customs Board provided Estonian Customs with a $250,000 van specially equipped to detect radioactive materials, nuclear weapons, and all types of explosives in an effort to curb cross-border smuggling. The van, which will be located in the town of Voru on the border with Russia, is capable of x-raying 1,500 pieces of luggage per hour.

Ecoinform, 6/96-7/96 (15478).

FINLAND

Internal Developments

5/18/96

A van containing radioactive iodine capsules, three instruments for radioactive material preparation, and several "small radiation sources" was stolen from an unguarded parking lot in Helsinki, Finland. The empty van was found in the city of Vantaa near Helsinki. Finnish Center for Radiation and Nuclear Safety spokesman Matti Asikainen said the material, which was stored in lead containers, could not be used in a nuclear weapon and was not dangerous for the public unless removed from the packaging. Finnish police reported that they had no suspects, but did not believe that East European organized crime gangs were involved in the theft.

John Acher, Reuter, 5/20/96; in Executive News Service, 5/20/96 (15245). Marat Zubko, *Izvestiya*, 5/24/96, p. 3 (15245).

GEORGIA

Georgia with Libya, Russia, Switzerland, and Turkey

4/17/96*

Police in Zurich, Switzerland, arrested members of a Turkish criminal group and confiscated 12 g of a 1.2 kg cache of uranium that was smuggled from Georgia to Turkey. The Turkish smugglers, headed by 53-year-old Gaidar Ackhan, had agreed to sell the uranium to Libya for $1.5 million. Two members of the group, Osman Oruk and Mekhmet Otsturk, testified that they traveled to Batumi, Georgia, in 1994, to meet with "Taraki," the seller who, the group claims, is the chief bodyguard for Georgian President Eduard Shevardnadze. In addition, another member of the group, Dirsun Yalkinkaya, said during cross examination that on 10/3/95 and 10/4/95, he also met with "Taraki" and discussed the possible sale of 3 kg of HEU for $200,000. According to Turkish police documents, Yalkinkaya went with "Taraki" to the Georgian town Kazuvri, where Yalkinkaya was shown a videotape about the nuclear storage facility where the uranium originated. Turkish police believe that the 3 kg of HEU from Georgia is currently concealed in the mountains in Turkey. According to the German magazine *Focus*, the Georgian uranium initially may have been smuggled from Russia.

Boris Lysenko, *Izvestiya*, 4/17/96, p. 3 (15207).

Georgia with Lithuania, Pakistan, and Sweden

2/10/96

As part of an undercover operation, Lithuanian police arrested six Lithuanians, a Georgian, and an Asian suspect with about 100 kg of uranium. The material was seized in Visiginas, a small town near the Ignalina nuclear power station. Lithuanian authorities are confident that the seized uranium was illegally brought into the country from another republic of the former Soviet Union. According to sources in the Lithuanian National Security Department and the Prosecutor General's Office, police and security officers pretended to be nuclear smugglers and made a $50,000 "deal" with the smugglers. Another source reported that the smugglers were planning to sell the uranium for $40,000. The deal was allegedly financed through an unnamed Asian trading firm based in Stockholm, Sweden. An unidentified arms specialist in Stockholm reported, "This purchase, if it was indeed by Pakistan, could have complemented a recent purchase by them of certain material from China. It also ties up with the purchase of laser equipment that is meant for measuring the process of enriching the radioactive substances." Representatives of Ignalina nuclear power station denied that the material originated there. According to Ignalina Director Viktor Shevaldin, the plant does not use this type of material. One report stated that the material might be part of the fuel assembly that disappeared from the Ignalina station in 1993. However, Shevaldin said that the material seized was not part of the missing fuel assembly.

Reuter (Vilnius), 2/12/96; in Executive News Service, 2/12/96 (14933). BNS (Tallinn), 2/12/96; in FBIS-SOV-96-030, 2/12/96 (14933). *Vechernyaya Moskva*, 2/20/96, p. 8; in WPS, 2/28/96, p. 12 (14537). Alfred de Tavares and Sanjay Suri, *India Abroad*, 2/23/96, p. 27 (15018).

GERMANY

Germany with Slovakia

6/7/96*

A 49-year-old Slovak engineer was arrested for smuggling 2.7 kg of uranium into Germany after a container holding uranium of unknown origin was found in a bank safe in Ulm. A tip-off by Austrian police to German officials assisted in the accused smuggler's arrest.

Segodnya, 6/7/96, p. 7 (15384).

INDIA

Internal Developments

2/96

During a conference sponsored by the Carnegie Endowment for International Peace, former Pakistani Prime Minister Nawaz Sharif claimed that India's continued production of weapons-grade plutonium led to India holding a 20-to-1 advantage over Pakistan in fissile material stocks. He said that in 1989, the fissile material stock ratio was 6-to-1 in India's favor.

Aziz Haniffa, *India Abroad*, 2/23/96, p. 22 (14847).

2/23/96*

According to a report by RAND's National Defense Research Institute, using current fissile material stocks, India could build 85 nuclear weapons. By the mid-1990s, it is anticipated that India will possess enough fissile material to build 100 bombs per year. The report said that India has probably reprocessed about 405 kg of plutonium from its Cirus and Dhruva research reactors, but only about 100 kg of reactor-grade plutonium has been recovered. The report estimates India's current stockpile of weapons-grade material to be 350 kg, but warns that India may begin to reprocess spent fuel from the unsafeguarded Madras-1 and -2 reactors at the Kalpakkam reprocessing facility now under construction.

Brian Chow, Richard Speier, and Gregory Jones, *The Proposed Fissile-Material Production Cutoff: Next Steps* (Santa Monica, Calif.: RAND, 1995), pp. 9, 13, 44.

2/29/96

Indian Finance Minister Manmohan Singh presented lawmakers with a FY 1997 budget that is about $43 million less than the Nuclear Power Corporation of India's (NPC) FY 1996 budget. The Indian government will fund up to $93 million for NPC in FY 1997, a major part of which is allocated for the Kaiga-1 and -2 and the Rajasthan-3 and -4 nuclear power plants. The Department of Atomic Energy (DAE) received a slight increase from $407 million to $418 million for FY 1997. The Bhabha Atomic Research Center (BARC), which conducts research on reactors, accelerators, nuclear materials and fuels, fuel reprocessing, waste management, lasers, robotics, automation, superconductivity, instrumentation, and radioisotope production, is being allocated $78 million. The Indira Gandhi Center for Atomic Research (IGCAR) was allocated $16.7 million, including $5.8 million for the Fast Breeder Test Reactor (FBTR) and $2.4 million for the reactor's fuel reprocessing plant. The Center for Advanced Technology in Indore, which researches lasers, accelerators, high vacuum technology, and cryogenics, was budgeted $8 million, while heavy water plants will receive $88.7 million. The NFC in Hyderabad, producer of zircalloy components, calandria tubes, stainless steel tubing, and ball-bearings, will receive $8.6 million; the Electronics Corporation was budgeted $4.4 million. The Uranium Corporation of India, which administers the Jaduguda uranium mines and mill, will receive $7.3 million, and Indian Rare Earths, manager of mineral separation plants at Chavara and Manavalakuruchi in southern India and the thorium factory at Trombay, will receive $8.7 million.

Neel Patri, *Nucleonics Week*, 3/7/96, pp. 17-18 (15067). Neel Patri, *Nucleonics Week*, 3/14/96, pp. 15-16 (15067).

Early 1996

The first land tests of the Indian nuclear submarine reactor were conducted at the Kalpakkam nuclear research center. Underwater tests on the reactor will begin in late 1996. The Indian nuclear submarine program is the most expensive undertaking conducted by the Defence Research and Development Organization (DRDO). DRDO officials reported that the submarine's nuclear plant was designed at the Bhabha Atomic Research Center, while construction of the plant is taking place at the Kalpakkam facility. DRDO officials added that the submarine will be completed in no less than five years and would need Rs2,500 crore more in financing. The nuclear submarine reactor will be placed in the capsule, which was produced in 1995 at Hajira, and is made of titanium steel. Construction of the hull, with a displacement of 6,000 MT, is expected to begin in 1997.

Info-Tass, 12/29/95; in *Byulleten Tsentra Obshchestvennoi Informatsii Po Atomnoi Energii*, No. 4-5, 1996, p. 77 (15396). *Times Of India*, 12/29/95; in *Strategic Digest*, 3/96, pp. 440-441 (15176). Mahesh Hebbar, *Asian Age* (Delhi), 5/25/96, p. 1; in FBIS-NES- 96-105, 5/25/96 (15176).

3/27/96

Indian Atomic Energy Commission (AEC) Chairman R. Chidambaram inaugurated a new reprocessing plant at IGCAR in Kalpakkam. The reprocessing facility has begun performing the first stage of "cold commissioning"; "hot" operations will begin with spent fuel from the Madras nuclear power plant in late 1996. The plant will have the capacity to reprocess 125 MT of heavy metal per year and will separate plutonium for the planned FBRT at Kalpakkam. India is also considering using the facility to produce mixed-oxide (MOX) fuel for the Tarapur boiling water reactors (BWRs). The Kalpakkam facility is the third reprocessing plant built in India. The first two were built at Trombay, which has a capacity to reprocess 50 MT of heavy metal per year, and Tarapur, which has the capacity to reprocess 100 MT per year.

Nuclear Engineering International, 5/96, p. 8 (15095). *Nuclear News*, 5/96, p. 43 (15095).

5/15/96

Indian President Shankar Dayal Sharma appointed Bharatiya Janata Party (BJP) leader Atal Bihari Vajpayee as Prime Minister. Vajpayee said the Hindu-nationalist BJP would carry through its pledges to declare India a nuclear weapon state and to deploy nuclear-armed missiles unless the nuclear powers agree to completely eliminate their own nuclear arsenals. The BJP had released a manifesto on 4/7/96 pledging to weaponize India's nuclear option. The BJP added that it would create a national security council to review India's current nuclear policy.

John F. Burns, *New York Times*, 5/16/96, pp. A1, A6 (15267). *Business Standard* (Delhi), 4/8/96, p. 3; in FBIS-NES-96-070, 4/20/96 (15078).

5/24/96

India's Chief of Naval Staff Admiral Vijay Singh Shekhawat denied reports that India will build a nuclear submarine in the near future. According to Shekhawat: "We (India) would like a nuclear submarine very

much, but money is a big constraint."
Pamela D'Mello, *Asian Age*, 5/25/96, p. 4; in FBIS-NES-96-105, 5/25/96 (15176).

6/96*

IGCAR expects the 500 MWe prototype FBTR to be "sanctioned" in 1997, despite delays in commissioning.
Richard Masters, *Nuclear Engineering International*, 6/96, pp. 31-35 (15255).

6/96*

Three new fuel-production facilities have been completed at the Nuclear Fuel Complex (NFC), doubling the facility's production to 600 MT per year.
Richard Masters, *Nuclear Engineering International*, 6/96, pp. 31-35 (15255).

6/96*

India is capable of producing 300 MT of uranium per year. India's uranium output could increase to "meet first core and reload needs," as new nuclear power plants, with a total capacity of 900 MWe, begin commercial operations in 1998 and 1999.
Nukem, 6/96, p. 67 (15265).

6/5/96

India's United Front government released a policy paper pledging to keep India's nuclear option open until worldwide nuclear disarmament is achieved.
Rahul Bedi, *Daily Telegraph*, 6/6/96, p. 9 (15358).

6/15/96*

According to former Pakistan Atomic Energy Commission Chairman Munir Ahmed Khan, each year India adds 50 kg of weapons grade plutonium as well as an unknown quantity of highly-enriched uranium (HEU) to its stocks. This increase allows India to augment its existing capability of more than 100 nuclear weapons with an additional 10 to 15 bombs per year.
Munir Ahmed Khan, *Dawn* (Karachi), 6/15/96, p. 11; in FBIS-NES-96-119, 6/15//96 (15260).

INDIA WITH:

INDIA WITH ISRAEL

3/26/96*

Indian Ambassador to Egypt Kanual Sibal denied in an interview that there is any nuclear cooperation between India and Israel. "We totally deny that there are relations with Israel in the field of nuclear weapons and nuclear technology," Sibal said.
Muhammad Jamal Arafah, *Al-Sha'b* (Cairo), 3/26/96, p. 7; in FBIS-NES-96-064, 3/26/96 (14919).

INDIA WITH RUSSIA

4/23/96*

Under pressure from the Clinton administration, Russia intends to renegotiate the terms of the 1988 sale of two nuclear power reactors to India. The new deal could include the shipment to Russia of all "fissile material produced from the nuclear power reactors." The 1,000 MW reactors, said to cost more than $1 billion, would be constructed at Koodankulam and would have to be placed under full-scope IAEA safeguards in order to head off U.S. opposition to the deal. Russian First Deputy Atomic Energy Minister Lev Ryabev emphasized that Russia is not going to link Russian-Indian nuclear cooperation with India's attitude towards signing the Comprehensive Test Ban Treaty (CTBT).
Jyoti Malhotra, *Business Standard* (Delhi), 4/23/96, p. 5; in FBIS-NES-96-080, 4/23/96 (14918). Interfax, 6/24/96 (15501).

INDIA WITH SOUTH KOREA

2/3/96*

Bhabha Atomic Research Center (BARC) Director A. N. Prasad said that India will export heavy water to South Korea.
All India Radio Network (Delhi), 2/3/96; in FBIS-NES-96-024, 2/3/96 (14216).

INDIA WITH THAILAND

6/26/96

Thai Ministry of Foreign Affairs Permanent Secretary Thep Thewakun announced that Thailand and India will sign a nuclear cooperation agreement before Thai Prime Minister Banhan Sinlapa-acha's visit to India in 9/96. The two countries announced the agreement after a visit to Thailand by an Indian delegation headed by Indian Secretary (East) K. Raghunath.
Thailand Times (Bangkok), 6/27/96, p. A2; in FBIS-EAS-96-128, 6/27/96 (15392).

INDIA WITH VIETNAM

2/23/96-2/26/96

The seventh Vietnam-India Intergovernmental Commission on Economic, Scientific, and Technological Cooperation will convene in New Delhi. Scientific and technological cooperation agreements are expected to be signed. During the past few years, India has assisted Vietnam in training nuclear energy personnel.
Voice Of Vietnam (Hanoi), 2/8/96; in FBIS-EAS-96-027, 2/8/96 (14783).

INDONESIA

INDONESIA WITH AUSTRALIA, JAPAN, AND SOUTH KOREA

3/15/96

Australia's Liberal-National coalition government announced that Australia's 13-year policy of limiting uranium exports would end. According to Resource Minister Warwick Parer, Australia would like to sell uranium to Indonesia, Japan, and South Korea.
Reuter, 3/15/96; in Executive News Service, 3/15/96 (14853).

INDONESIA WITH CANADA

Spring 1996*

Under a technical cooperation agreement reached by Canada's Atomic Energy Control Board (AECB) and the Indonesian National Atomic Energy Agency (Batan), six Indonesian specialists will receive training in Canada for a period of nine months. The Canadian International Development Agency's Industrial Cooperation Program, Atomic Energy of Canada, Ltd. (AECL), and other private Canadian firms are sponsoring the program.
Reporter, Spring 1996 (15380).

INDONESIA WITH CANADA, FRANCE, GERMANY, AND JAPAN

3/96*

According to Indonesian National Atomic Energy Agency (Batan) Director General Djali Ahimsa, construction of Indonesia's first nuclear power plant will probably begin in 1998. Ahimsa said that the plant will likely be built on Java's Muria Peninsula, and will be comprised of either two 900 MW units, or three 600 MW units. Westinghouse of the U.S., Mitsubishi Heavy Industries of Japan, Siemens of Germany, Framatome of France, and Atomic Energy of Canada Ltd. (AECL) are all possible suppliers for the project, which is estimated to take six years and approximately $7 billion to build. Ahimsa noted that high costs would prevent the recycling of nuclear waste, and that the waste would be stored "within the fuel elements." At a 3/96 conference in Tokyo, Ahimsa spoke on behalf of Indonesian Research and Technology Minister B. J. Habibie, and said that efforts were now directed toward determining financing methods for the project. Ahimsa noted that the Indonesian government was interested in a "Build, Operate, and Own" plan because it limits outside debt and discourages privatization. Habibie announced that the Canadian government had made a proposal that met the terms he was seeking, which included two or three CANDU-type reactors and $2 billion of Canadian investment (half of the estimated project cost).

Power In Asia, 2/5/96 (14882). Naoaki Usui, *Nucleonics Week*, 3/21/96, p. 2 (14882). *Enerpresse*, 2/5/96 (14882). *Nuclear Engineering International*, 3/96, p. 3 (14882).

INDONESIA WITH CANADA, FRANCE, JAPAN, AND UNITED STATES

6/28/96*

After a five-year feasibility study on the use of nuclear power in Indonesia, specialists from the Japanese company Newjec concluded that employment of a 600 or 900 MWe nuclear reactor by 2004 would "fulfill least-cost criteria and be competitive with [a] similar-sized coal plant with pollution controls." The list of recommended nuclear technology for the Indonesian project includes CANDU pressurized heavy water reactors (PHWRs), pressurized water reactors (PWRs) of U.S., French, or Japanese origin, and the GE-Hitachi-Toshiba boiling water reactor (BWR). The report, which the Atomic Energy Agency (Batan) has not yet released, recommended that the reactor be located at Ujung Lemahabang, about 450 km east of Jakarta.

Uranium Information Centre (http://www.uic.com.au), 6/28/96 (15376). *Nuclear Europe Worldscan*, 3/96-4/96, p. 28 (14882).

IRAN

INTERNAL DEVELOPMENTS

1/28/96-2/3/96*

Iraqi nuclear scientist Hussein al Shahristani maintains that "new international conditions" and a struggling economy render an Iranian nuclear weapons program unfeasible. According to Shahristani, the current Iranian nuclear program lacks "scientific expertise, equipment, and nuclear installations."

Ghalib Darwish, *Al-Majallah* (London), 1/28/96-2/3/96, pp. 22, 24; in FBIS-TAC-96-002, 2/12/96 (14594).

2/6/96*

According to Atomic Energy Organization of Iran (AEOI) head Reza Amrollahi, Iran has successfully developed laser technology and produced zero-power and miniature reactors.

Voice Of Islamic Republic Of Iran First Program Network (Tehran), 2/6/96; in FBIS-NES-96-025, 2/6/96 (14604).

2/7/96

The Iranian daily newspaper *Salam* reported that there are 80 nuclear projects under way in Iran "to provide the country's electricity needs by using atomic energy." Some of the projects are believed to be used in the construction of the Bushehr nuclear power station and an "Esteqlal (independence) atomic power plant." However, an AEOI spokesman claimed that the report was incorrect, and that a "Esteqlal atomic power plant" does not exist.

Reuter, 2/7/96; in Executive News Service, 2/7/96 (14606).

2/22/96*

The IAEA is likely to renew its investigations into whether Iran is developing a gas centrifuge project to enrich uranium. An IAEA team of investigators is scheduled to travel to Iran "to investigate suspicions that the Iranians are setting up a secret plant to enrich uranium through centrifugation which could be used for the development of nuclear weapons." According to Western officials, the CIA and U.S. Department of Energy (DOE) managed to obtain data on a secret Iranian uranium enrichment program aimed at developing and "bench-testing" gas centrifuges. However, the CIA does not any have any evidence of Iran enriching uranium hexafluoride (UF6) using centrifuges or planning the construction of a small laboratory centrifuge. According to one Western official, the CIA's report "should not be interpreted as evidence that Iran is violating the NPT or hadn't reported" its activities to the IAEA. Iran is obliged by its safeguards agreements to report any activity such as the actual enrichment of uranium to the IAEA, since there are no *de minimis* safeguard standards established. However, there is a possibility that the Iranian program has not been developed to the point that Iran would be required (under the safeguards agreement) to notify the IAEA.

Mark Hibbs, *Nucleonics Week*, 2/22/96, pp. 4-5 (14844). Aluf Ben, *Ha'aretz* (Tel Aviv), 3/6/96, p. A1; in FBIS-NES-96-045, 3/6/96 (14844).

2/29/96

U.S. Undersecretary of State Lynn Davis declared that the U.S. is convinced Iran is attempting to steal nuclear technology and materials in order to develop nuclear weapons. Iran is "many years away" from possessing a nuclear weapons capability, but stealing nuclear technology or material "can reduce the time dramatically in terms of developing a weapon," Davis said.

Irwin Arieff, Reuter, 2/29/96; in Executive News Service, 2/29/96 (14608).

2/29/96*

The AEOI is exploring uranium mining locations and sites for a second nuclear facility.

M. Rahman, *India Today*, 2/29/96, p. 116 (14832).

6/23/96*

Iran's Chief Security Advisor Dr. Majid Tehrani Abbaspur is reported to be actively participating in Iran's nuclear weapons program and has been granted "a special budget of millions of dollars to buy the necessary technology."

Con Coughlin, *Sunday Telegraph* (London), 6/23/96, p. 26; in FBIS-NES-96-123, 6/23/96 (15261).

IRAN WITH:

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IRAN WITH CZECH REPUBLIC, IRAQ, NIGERIA, AND RUSSIA

2/96

Czech police seized 2.7 kg of enriched uranium being smuggled by former Soviet scientists from Russia to Iraq via the Czech Republic. An unidentified Nigerian firm allegedly proposed to buy the uranium, and named "an African state" as the final recipient. However, an unnamed source said that a team of Iraqi agents were also involved in the deal. According to the report, Iran later tried to outbid Iraq for the Russian uranium.

Guido Olimpio, *Corriere Della Sera* (Milan), 5/4/96, p. 7; in FBIS-TAC-96-007, 5/4/96 (15091).

IRAN WITH GERMANY AND RUSSIA

3/28/96*

Russian nuclear experts, working on completing the Bushehr nuclear power station in Iran, announced that in order to finish the project as scheduled, the Russian organization Zarubezhatomenergostroy needs technical support documents from Germany's Siemens, which started Bushehr's construction in 1970s. According to the head of Zarubezhatomenergostroy's Teheran office Anatolii Zhilinskiy, the Atomic Energy Organization of Iran (AEOI) assured the Russians that they would acquire the necessary technical documentation from Siemens. If Iran fails to obtain the documentation, Russia will have to replace the German machinery with its own equipment. German officials reported that Siemens and its "subcontracted component suppliers" for the Bushehr nuclear power station hold the majority of technical documentation, although some of Siemen's design specifications remain in Iran. On 3/26/96, a senior German official indicated that an Iranian request for the documents would be "carefully weighed," and that the German government will not provide data on systems not already in Iran's possession.

Mark Hibbs, *Nucleonics Week*, 3/28/96, pp. 1, 10 (14832). *Salam* (Tehran), 3/17/96, p. 4; in FBIS-TAC-95-005, 3/17/96 (14906).

5/6/96*

The Russian Ministry of Atomic Energy (Minatom) is discussing the purchase of technology and equipment from the unfinished Hanau research reactor with the German government. According to unnamed sources, Minatom may seek to acquire technical data in order to use the German equipment stored at Iran's unfinished Bushehr nuclear reactor. Minatom contracted by Iran to finish Bushehr, cannot use the German reactor vessel and control equipment without the proper documentation. With the technical data from Germany's Hanau reactor, however, Minatom may be able to integrate the German equipment into the refurbished plant.

Iran Brief, 5/6/96, p. 11 (15600).

IRAN WITH ISRAEL, TURKEY, UNITED KINGDOM, AND UNITED STATES

4/1/96*

According to Israeli Government Press Office head Uri Dromi, it has become a "working assumption" that a "Western-led coalition" will conduct a pre-emptive attack against Iran to hinder its nuclear weapons program. Dromi's statement followed reports that Israel and the U.S. negotiated a possible airstrike against Iran's nuclear weapons plants at the Sharm al-Shaykh summit. Iran's secret Neka nuclear plant, located 100 miles northeast of Tehran on the Caspian Sea, was reported to be among the possible targets. During U.K. Defence Secretary Michael Portillo's 4/96 visit to Israel, joint Israeli-British military action against the Iranian nuclear plant may have been discussed. According to Egyptian sources, the underpinnings of the 1995 Israeli-Turkish military cooperation agreement may be plans for an airstrike against Iran's nuclear facilities, allowing Israel access to Turkish airbases from which "any Iranian target" is reachable. In response, Iran's land-force commander, Brigadier General Ahmad Dadbin, warned that "The Americans should think twice before attacking us. I believe no country in the world would dare to attack us."

Christopher Walker, *Times* (London), 4/19/96, p. 13; in FBIS-TOT-96-015-L, 4/19/96 (15382). James Bruce, *Jane's Defence Weekly*, 6/12/96, p. 27 (15382). Eric Salerno, *Il Messaggero* (Rome), 6/28/96, p. 9; in FBIS-NES-96-126, 6/28/96 (15382).

IRAN WITH ITALY AND JAPAN

3/4/96

According to banking sources, a $561 million syndicated loan was signed in London by Iran's Bank Saderat. The loan, an export credit guarantee to Iran, was syndicated by Italy's Mediocredito Centrale and the Banca Commerciale Italiana and will be 90 percent covered by SACE, Italy's export credit agency. The agreement is part of a $660 million deal between Danieli Officine Meccaniche and the National Iranian Steel Company (NISCO) to build four "specialty-steel plants" in Isfahan. Japan's Nippon Steel is also a party to the $660 million contract. According to Italian Ambassador to Washington Ferdinando Salleo, SACE halted all new export credit grantees to Iran in 2/93. Salleo noted that the agreement to finance the Danieli-NISCO project was reached in 7/92.

Iran Brief, 5/6/96, p. 5 (15609).

IRAN WITH RUSSIA

2/3/96*

There are currently about 30 Russian nuclear specialists working at Iran's Bushehr nuclear power plant. In 5/96, Russian specialists will conduct a survey of the buildings at the plant, said Aleksandr Bryukhov, an executive supervising the construction of Russian nuclear power plants abroad. The Bushehr plant is expected to start operating in 2001.

Aleksandr Kushnir, Voice Of Russia World Service (Moscow), 2/3/96; in FBIS-SOV-96-024, 2/3/96 (14605).

2/7/96

Minatom official Yevgeniy Mikerin stated that a Novosibirsk-based chemical plant will supply nuclear fuel to Iran's Bushehr nuclear power plant. The Russian plant produces fuel cassettes for VVER-1000 reactors and will start to produce fuel for the Bushehr reactor in 2000.

Veronika Romanenkova, Itar-Tass (Moscow), 2/7/96; in FBIS-SOV-96-27, 2/7/96 (14607).

3/17/96*

In an interview, Zarubezhatomenergostroy head Anatoliy Zhilinskiy stated that Russia has submitted a construction proposal to Iranian officials for building a new nuclear power plant in Iran. However, Iran is not likely to consider the proposal until the Bushehr nuclear power station is completed.

Salam (Tehran), 3/17/96, p. 4; in FBIS-TAC-95-005, 3/17/96 (14906).

3/21/96

Russian Nuclear Physics Research Institute Director of Foreign Affairs Andrei Gagarinskiy announced the Institute's plans to sign an agreement to train Iranian nuclear experts. Russian and Iranian officials discussed the possibility of training several dozen Iranian students in Moscow. A second report said the training of the Iranian nuclear specialists is expected to take place at the Novovoronezh nuclear power plant's training center 42 km from Voronezh, Russia.

Veronika Romanenkova, Itar-Tass (Moscow), 3/21/96; in FBIS-SOV-96-057, 3/21/96 (14843). Interfax (Moscow), 2/6/96; in FBIS-NES-96-026, 2/6/96 (14843).

3/25/96

Minatom officials claimed that Russia has not signed any nuclear agreements with Iran other than the contract to complete Bushehr's first unit. Russia has considered building the second unit at the Bushehr plant, although Russia and Iran have not yet held negotiations on this issue. Russian Ambassador to Iran Sergei Tretyakov had declared that Russia is likely to construct another nuclear plant after the completion of Bushehr. In his interview with the Iranian newspaper *Abrar*, Tretyakov said the Russian-Iranian agreement on "bilateral cooperation in the peaceful use of atomic energy is not confined to the Bushehr project alone." Sergei Treyakov added that Russia would help Iran build nuclear research reactors.

Oleg Kuzmin, Itar-Tass World Service (Moscow), 3/18/96; in FBIS-SOV- 96-053, 3/18/96 (14832). Interfax (Moscow), 3/19/96; in FBIS-SOV-96-055, 3/19/96 (14832). *Iran Brief*, 4/1/96, pp. 4-5 (15011).

4/20/96*

According to Russian sources, approximately 700 Iranian nuclear specialists may be trained in Russia. Along with the Russian company Zarubezhatomenergostroy, Russian scientific organizations such as the Kurchatov Institute and the Moscow Engineering Physics Institute are considering training Iranian nuclear experts. Other reports say the Kurchatov Institute is negotiating an agreement to provide a maximum of 500 Iranian specialists with training in the maintenance and operation of the Bushehr nuclear power plant.

Interfax (Moscow), 4/20/96 (15121). Peter Henderson, Reuter, 4/20/96; in Executive News Service, 4/23/96 (14912). Evan S. Medeiros, *Arms Control Today*, 5/96-6/96, p. 25 (15471).

6/4/96*

In 1996, Russia plans to invest $60 million in the construction of the Bushehr nuclear power plant. According to Gennadiy Nefedov, the deputy head of Minatom's Foreign Relations Department, the Russian company Zarubezhatomenergostroy is expected to sign a number of agreements with Iranian companies to supply facilities for completing Bushehr. Approximately 200 Russian nuclear specialists are presently employed at the Bushehr project.

Interfax (Moscow), 6/4/96; in FBIS-SOV-96-109, 6/4/96 (15381).

6/9/96*

Since 1995, Iran has reportedly obtained nuclear weapons-related equipment from Russian "middle men."

James Adams, *Sunday Times*, 6/9/96, p. 16 (15374).

6/27/96*

During an interview with the Iranian newspaper *Abrar*, Minatom head Viktor Mikhailov stated that all the equipment needed to complete Iran's Bushehr nuclear power plant had been sent. According to Mikhailov, Russia is able to build small facilities like "thermo-atomic" research reactors in countries such as Iran.

Iran News (Tehran), 6/27/96, pp. 1, 13; in FBIS-SOV-96-128, 6/27/96 (15378).

Iran with South Africa

2/21/96

South African Mineral and Energy Affairs Minister Pik Botha announced that South Africa had not provided Iran with any uranium in the previous five years. Botha indicated that "some years ago" South Africa had considered a commercial agreement to provide uranium to Iran under IAEA safeguards, but the contract was never implemented.

SAPA News Agency (Johannesburg), 2/21/96; in FBIS-TAC-96-007, 2/21/96 (15089).

Iran with United States

3/4/96*

Two former Alavi Foundation of New York presidents, Mohammad Mahallati and Manoucher Shafie, were under suspicion by the Federal Bureau of Investigations (FBI) in 1993 for nuclear smuggling, the *New York Daily News* reported. According to former electrical contractor and FBI undercover agent Dennis Pappas, the FBI believed that Mahallati and Shafie represented the Iranian government and that "their main thrust here is to bring in very bad material, nuclear material," to the U.S. for use in a terrorist act.

Iran Brief, 3/4/96, pp. 7-8 (14841).

IRAQ

Internal Developments

1/28/96-2/3/96*

In an interview, Iraqi nuclear scientist Hussein al Shahristani stated that Saddam Hussein changed the peaceful nature of Iraq's nuclear program when he took power in 7/79 and instructed all scientific facilities to develop nuclear weapons. Shahristani described how Iraq came close to enriching uranium to 93 percent with assistance from

Western companies. During the 1980s, Iraq established 15 "major nuclear installations" capable of enriching uranium through centrifuge, electromagnetic separation (EMIS), and laser techniques. Western companies also helped the Iraqi military develop complex detonation devices crucial to the successful explosion of a nuclear weapon. Al Shahristani believes the scientists who worked on the Iraqi nuclear weapons program are, for the most part, still in Iraq.

Ghalib Darwish, *Al-Majallah* (London), 1/28/96-2/3/96, pp. 22, 24; in FBIS-TAC-96-002, 2/12/96 (14594).

2/20/96

Saddam Hussein's sons-in-law Lt. Gen. Hussein Kamel and Saddam Kamel were "pardoned" as they crossed the border returning to Iraq. The two brothers had defected to Jordan in 8/95, raising the West's expectations about "an intelligence bonanza." Their return to Iraq, however, has made Western intelligence officials question the validity of information the brothers provided on the Iraqi nuclear weapons program. According to Kuwait's ambassador to the U.N. Mohammed A. Abulhasan, "Kamel's desire to return to Iraq proves what we knew all along, that the defection was a sham." In Abulhasan's opinion, the Iraqis sought to "inflate the importance" of data submitted to the U.N. by Kamel's desertion to Jordan. U.S. officials, though, attribute the Kamel brothers' return to their "frustration" about being exiled by Iraq. According to one U.S. official, "[Kamel] was a genuine defector," who supplied a significant amount of data on Iraq's nuclear, chemical, and biological weapons and missiles. UNSCOM head Rolf Ekeus reported on 2/20/96 that the information supplied by Kamel was confirmed by U.N. investigators, although it was incomplete. The Iraqi government reported on 2/23/96 that Kamel and his brother were murdered at their Baghdad residence by their relatives.

Amy Dockser Marcus, *Wall Street Journal*, 2/23/96, p. A6 (14908). Douglas Jehl, *New York Times*, 2/24/96, pp. A1, A5 (14908). Ben Barber and Bill Gertz, *Washington Times*, 2/21/96, pp. A1, A22 (14908).

2/26/96*

An editorial claims that if Iraq manages to obtain weapons-grade nuclear material, it could again get close to obtaining an atomic bomb. Iraq still possesses the essential resources to restart its nuclear weapons program: experienced nuclear scientists and technicians, a fairly advanced military-industrial capability, and a feasible nuclear weapon blueprint. Many Iraqi nuclear weapons design working groups have been retained, which allows Iraq to continue working on its weapons program in the absence of U.N. inspectors. Additionally, Iraq preserved large numbers of advanced machine tools at its civilian and industrial plants. Some Iraqi officials have already admitted to U.N. inspectors that they are capable of building the equipment necessary to construct a nuclear weapon. A renewed nuclear weapons project could be designed to be virtually invisible to foreigners, considering Iraq's "detailed understanding of the shortcomings of the U.N. monitoring regime and foreign-intelligence services," gained since 1991. The small number of technically proficient personnel and the wide availability of development sites make detection almost impossible. In order to maintain the secrecy of the program, bomb construction and testing could take place at "temporary or makeshift facilities (such as open-pit mines or construction sites) and small and inconspicuous permanent facilities (such as private homes or mosques)."

Michael Eisenstadt, *Washington Post*, 2/26/96, p. A19 (14774).

3/8/96-3/18/96

Iraq obstructed U.N. weapons inspection teams five times in "a pattern of violation on access to sites suspected of containing arms materials." UNSCOM head Rolf Ekeus stated, "We are very concerned that these incidents could form part of a pattern. They also demonstrate something odd and disturbing: that five years after the cease-fire Iraq still considers it of value to keep alive the option of weapons of mass destruction." On 3/8/96, 43 U.N. inspectors were blocked by Iraqi officials from entering Baghdad's Irrigation Ministry for 18 hours, during which time the U.N. inspectors observed smoke from an incinerator. On 3/11/96, Iraq delayed an UNSCOM team from inspecting a Presidential Guard training center in Sarabady for 12 hours. On 3/14/96, two incidents took place at sites affiliated with the Republican Guard, resulting in delays of nearly three hours. In the first case, the delay took place at a Republican Guard auto repair facility, where Iraqi officials also opposed UNSCOM surveillance helicopters taking pictures of the site. In the second case, Iraq blocked the entrance to the headquarters of the Special Guard, although helicopters were allowed to examine this location. On 3/15/96, UNSCOM inspectors were blocked from inspecting a Republican Guard command center for four hours.

Evelyn Leopold, Reuter, 3/18/96; in Executive News Service, 3/18/96 (14907). Ian Black, *Guardian*, 3/13/96 (14907). Anne Penketh, AFP (Paris), 3/9/96; in FBIS-NES-96-048, 3/9/96 (14907). Reuter, 3/13/96; in Executive News Service, 3/14/96 (14907). Catherine Toups, *Washington Times*, 3/12/96, p. A13 (14907).

3/27/96

The U.N. Security Council agreed to a monitoring system to prevent Iraq from obtaining weapons of mass destruction (WMD) after sanctions are lifted. The monitoring system is designed to detect dual-use items imported by Iraq, and will send that information to UNSCOM and the IAEA Director General. According to UNSCOM, "The mechanism adopted relies on notifications both by Iraq and the supplier states of planned supplies of dual-use items to Iraq and on inspection of those items in Iraq and monitoring at the end-user site." In order to prevent Iraq from re-acquiring WMD, the U.N. will organize "U2 surveillance flights, closed circuit television cameras and teams of specialist inspectors," UNSCOM head Rolf Ekeus said.

Washington Post, 3/28/96, p. A28 (15069). OTC, 3/27/96; in Executive News Service, 3/27/96 (15069). Michael Dynes, *Times* (London), 3/14/96 (15069).

6/11/96

Iraq blocked a 50-member U.N. inspection team led by Russian ballistic missile specialist Nikita Smidovich from entering an industrial site in Baghdad. Commenting on the eight-hour standoff, Iraqi Deputy Prime Minister Tariq Aziz said that out of the eight sites in the Abu Ghuraib region that UNSCOM chief Rolf Ekeus requested inspections of, "we denied access to two sites that belong to the Republican Guards" for reasons of "national security." Aziz proposed to the U.N. Security Council a plan to replace Smidovich's team, comprised of 22 U.S. and

eight U.K. officials, with a team of the council's permanent members. According to Aziz, "We have a legitimate right to be worried about the entry of the inspectors, who belong to countries that have hostile schemes against Iraq...and who could carry out intelligence activities." Aziz accused Ekeus of "carrying out intelligence activities on behalf of countries hostile to Iraq." According to Ekeus, the blocked sites allegedly contain "prohibited materials, materials concerning missiles and nuclear substances, in addition to documents that will provide us with details about arms purchases and Iraq's claims about sites and materials they had said they destroyed in 1996." This list includes documents on nuclear substances that were said to be destroyed in 1991. Some U.N. officials are convinced the standoffs were organized to cover up the removal of secret documents.

UPI, 6/12/96; in Executive News Service, 6/12/96 (15437). John M. Goshko, *Washington Post*, 6/13/96, p. A20 (15437). Khalil Mater, *Al-Sharq Al-Awsat*, 6/19/96, p. 2; in FBIS-NES-96-120, 6/19/96 (15437).

6/16/96

After a five-day standoff with Iraqi officials, UNSCOM Chairman Rolf Ekeus withdrew a 53-member U.N. arms inspection team from Baghdad. Ekeus believes that during the standoff, "vital" documents were removed from the five facilities that UNSCOM inspectors were barred from entering. Iraq argued that UNSCOM had "deliberately" picked facilities vital to Iraq's national security, justifying Iraq's refusal to allow the U.N. inspection. Iraq called for new "inspection procedures" in order to safeguard Iraq's national security. The U.N. Security Council, while denying the Iraqi request, declared that Iraq's barring of the inspections was a "flagrant violation" of the Persian Gulf War cease-fire agreement and demanded that Iraq provide the U.N. with "immediate, unconditional and unrestricted access." On 6/14/96, as part of a call for new procedures, Iraqi Deputy Prime Minister Tariq Aziz suggested that three UNSCOM members led by Ekeus, and three Iraqi officials led by Aziz, should conduct inspections of any disputed Iraqi facility. However, Aziz's statement that Iraq would permit "surprise inspections" confused Western officials.

Leon Barkho, Reuter, 6/18/96; in *Washington Times*, 6/18/96, p. A9 (15397). Reuter, 6/17/96; in Executive News Service, 6/18/96 (15397). Louis Meixler, *Washington Times*, 6/15/96, p. A6 (15397). Evelyn Leopold, Reuter, 6/17/96; in Executive News Service, 6/17/96 (15397).

6/19/96-6/22/96

Iraq and UNSCOM Chairman Rolf Ekeus signed an agreement that assures UNSCOM weapons inspectors "immediate, unconditional and unrestricted access to all sites which the Commission or the IAEA may wish to inspect." Ekeus said, "We will be obliged to do (unannounced inspections), because on substance nothing has happened during this mission. Iraq is still, according to our analysis, concealing some important components and weapons and also concealing important documents related to expanding their program." Iraq is known to have concealed documents in "exotic or remote facilities or sensitive facilities," and by using mobile storage units. By the end of 6/96, Iraq is expected to make a "full, final, and complete" accounting of its nuclear weapons program.

Judy Aita, United States Information Agency Server, 6/24/96 (15464).

6/24/96

IAEA Deputy Director Maurizio Zifferero stated that although some aspects of Iraq's nuclear capability have been "nullified," others need further "clarifications." Zifferero stated, "We never said that the nuclear file has been closed. We stated that we were satisfied with the fact that Iraq, at present, has no practical capability to restart [sic] nuclear weapons program. Iraq has been stripped of all industrial infrastructure which is needed to produce... enriched uranium."

Hassan Hafidh, Reuter, 6/24/96 (15377).

IRAQ WITH:

IRAQ WITH GERMANY

2/2/96

An IAEA official said that Iraqi engineers acquired nuclear know-how prior to the 1900-91 Gulf War through training programs in Germany and other Western countries. From 1989-90, 22 Iraqis—among them centrifuge-design experts—spent 43 weeks in a Siemens training program for welding technicians at Urenco's uranium enrichment plant in Gronau. The Iraqi engineers may have been privy to design information regarding the piping systems for the centrifuge cascades. Under scrutiny is a 1989-90 contract between Baghdad's Industrial Products Co. (IPC) and Interatom GmbH, a former Siemens AG subsidiary specializing in aluminum piping systems. Siemens was to sell Iraq a "clean room" called "central workshop B-01" and to train Iraqi personnel. In 1991, the IAEA discovered that B-01 would be a critical component of Iraq's centrifuge testing program at Al Furat. Siemens denounced IAEA reports—later confirmed—that B-01 would have nuclear applications. The contract indicates that the Siemens training program was tailored to provide Iraqi technicians with the ability to weld aluminum piping, a skill necessary for the construction of uranium hexaflouride (UF6)-resistant cascade piping. The Iraqi affirmation that it learned cascade design information from Siemens "cannot be verified," the IAEA said.

Mark Hibbs, *NuclearFuel*, 2/12/96, pp. 12-13 (14837). Steve Pagani, Reuter, 2/2/96; in Executive News Service, 2/2/96 (14837).

IRAQ WITH GERMANY, NETHERLANDS, AND UNITED KINGDOM

2/96

Western officials said that Bruno Stemmler, a former MAN Technologie employee, sold Iraq gas centrifuge design blueprints diverted from Urenco's German operation in 1988-89. In 1/96, top Urenco technician Karl-Heinz Schaab—also a former employee and consultant to MAN—was accused of selling blueprints to Iraq in 1989 or 1990. IAEA spokesman Hans Meyer said that both German scientists transferred centrifuge technology, "but Stemmler worked on older models." IAEA officials believe Stemmler provided Iraq with four to six Urenco G-1 and G-2 centrifuge blueprints. Although an internal investigation by the U.K., the Netherlands, and Germany revealed no security breaches at Urenco, a U.S. Department of Energy (DOE) official noted a "consistent pattern of data

leaving that [Urenco] program" and criticized Urenco employees for a "cavalier attitude" toward security. Urenco denied that designs were diverted, even though drawings Iraq forfeited to the IAEA in 1995 were labeled as classified property of MAN or Uranit GmbH, a Urenco partner before 1992. Urenco officials are conducting their own investigation. Urenco's chief executive Klaus Messer emphasized that the company's security measures were already strict, and he doubted that extra procedures would have prevented the violation. Iraq's possession of Urenco's blueprints is not enough to allow the immediate construction of its own uranium enrichment centrifuge, but these designs will enable Iraq to speed up construction efforts at a lower cost. Work on parts such as the lower bearing could be facilitated by possession of the designs.

Mark Hibbs, *NuclearFuel*, 2/12/96, pp. 1, 13 (14838). Caroline Drees, Reuter, 2/12/96; in Executive News Service, 2/13/96 (14838). *Nuclear Engineering International*, 3/96, p. 4 (14830).

Iraq with Russia

2/96*

Negotiations continue between Russia and the IAEA over the disposal of Iraqi fissile material. Russia has a contract to remove fissile material from Iraqi reactors. According to UNSCOM head Rolf Ekeus, Russian requests for payments "beyond the normal commercial practice" are jeopardizing negotiations.

Nuclear Engineering International, 2/96, p. 7 (14593).

Iraq with United Kingdom

2/12/96

The IAEA reported that the machine tool company Matrix Churchill was one of more than 12 Western companies which helped Iraq's nuclear program before the Gulf War. Matrix Churchill, owned by Iraq's TMG Engineering, supplied components for Iraq's gas centrifuge uranium enrichment program from 11/88-4/90 and "knowingly deceived" the U.K. government about exports of equipment designed for the Iraqi military. Iraq claimed that the components were for a compressor. According to former Matrix Churchill Managing Director Paul Henderson, a shipment sent to Iraq shortly after the 4/90 "Supergun" scandal left the U.K. without Henderson's permission. A Customs and Excise case against Matrix Churchill revealed that the U.K. government "implicitly encouraged" dual-use exports to Iraq, believing that Matrix Churchill was a valuable source of information on Iraq's weapons programs.

John Plender and Tim Laxton, *Financial Times*, 2/13/96, pp. 1, 16 (14836). Caroline Drees, Reuter, 2/13/96; in Executive News Service, 2/13/96 (14836).

2/15/96

After hearing 268 witnesses and examining thousands of documents, Sir Richard Scott's *Report of the Inquiry into the Export of Defence Equipment and Dual-Use Goods to Iraq and Related Prosecutions* was released. According to the 2,000-page report, British Secretary of State for Trade and Industry Peter Lilley stated that the British intelligence services knew about Iraqi efforts to obtain nuclear weapons. Lilley believed that if the machine tool firm Matrix Churchill was denied export licenses, the company would have had to close down, making it impossible for British intelligence to access "Habobi's" procurement network. According to Lilley, British officials were seeking crucial data "far more incriminating than magnet rings," which would allow the U.K. to convince other countries of the need to prevent Iraqi attempts to obtain nuclear materials. Lilley claimed that U.K. officials were sharing with their "partners" information on "an Iraqi attempt to procure magnets which could only have been intended for centrifuge rotors." Other information in the Scott report suggests that results of U.N. inspections in Iraq will confirm that Matrix Churchill assisted in the building of K1000, Iraq's centrifuge plant. U.K. defense, intelligence, and export-licensing officials failed to notify former Prime Minister Margaret Thatcher, as well as customs officials, about Matrix Churchill's operations. British Trade Secretary Ian Lang denied that ministers had conspired in the 1980s to sell arms to Iraq or had hidden evidence that could have resulted in the "wrongful" imprisonment of three businessmen.

Trust And Verify, 2/96-3/96, pp. 1-3 (14909). Fred Barbash, *Washington Post*, 2/16/96, p. A26 (15262). Stephanie Strom, *New York Times*, 2/16/96, pp. A1, A4 (15262). Alan Wheatley, Reuter, 2/26/96; in Executive News Service, 2/27/96 (15262).

ISRAEL

Internal Developments

2/7/96*

Wisconsin Project Executive Director Gary Milhollin said in an interview that Israel possessed approximately 200 nuclear weapons. According to Milhollin, Israel has had a nuclear capability since the 1960s and remains the only Middle Eastern country in possession of nuclear weapons.

Richard C. Gross, *Washington Times*, 2/7/96, p. A14 (14625).

2/23/96*

According to a report by RAND's National Defense Research Institute, using current fissile material stocks, Israel could build 70 nuclear weapons. By the mid-1990s, it is anticipated that Israel will possess enough fissile material to build three bombs per year.

Brian Chow, Richard Speier, and Gregory Jones, *The Proposed Fissile-Material Production Cutoff: Next Steps* (Santa Monica, Calif.: RAND, 1995), pp. 9, 13.

6/24/96

The Israel Atomic Energy Commission (IAEC) denied allegations that Israel is making preparations to construct a third nuclear reactor, 25 km from the town of Awajah in Sinai and near the Egyptian border. In refuting the statements of Egyptian Atomic Energy Agency specialist Muhammad Mustafa, the IAEC stating that "The report is not true. Israel is not currently constructing a nuclear power plant." The IAEC did say, however, that its licensing department "has been studying the findings of surveys that have been carried out in the Shivta area since the 1980s."

Maha Mansur, *Rose Al-Yusuf* (Cairo), 6/24/96, p. 18; in FBIS-NES-96-126, 6/24/96 (15372). *Ha'aretz* (Tel Aviv), 6/25/96, p. A12; in FBIS-NES-96-126, 6/25/96 (15372).

ISRAEL WITH:

China, France, India, Pakistan, Russia, United Kingdom, and United States, 117

India, 123

Iran, Turkey, United Kingdom, and United States, 125

ISRAEL WITH UNITED STATES

2/7/96*

The Pentagon criticized a Defense Investigative Service (DIS) memo issued to defense contractors warning them about Israeli efforts to spy on the U.S. defense community. Citing alleged Israeli espionage cases in the U.S., the DIS memo warned that Israel's top priority was to enlist agents to "collect information on nuclear, chemical and biological weapons." According to the DIS, Israeli efforts would rely on "strong ethnic ties," along with "financial aggrandizement and identification and exploitation of individual frailties," and try to place Israeli nationals in key positions within the U.S. defense sector. U.S. Assistant Secretary of Defense for Command, Control, Communications, and Intelligence Emmett Paige indicated that the memo was being withdrawn due to its focus on ethnicity.

Barbara Starr, *Jane's Defence Weekly*, 2/7/96, p. 4 (14624).

JAPAN

INTERNAL DEVELOPMENTS

2/5/96*

Japanese Federation of Electric Power Companies (FEPCO) Chairman Hiroshi Araki announced that design changes at the Rokkasho-mura reprocessing plant in Aomori Prefecture will raise construction costs and delay completion of the plant until 2003. Japan Nuclear Fuel (JNFL) President Kiyoshi Nozawa estimated total costs of the plant at $18.75 billion, following changes made to protect against earthquakes and radiation leaks, improved safeguard measures, and equipment modifications based on France's reprocessing experience. JNFL will now construct only one of the two originally planned reprocessing lines, giving the Rokkasho-mura facility an annual capacity of up to 800 MT.

Power In Asia, 2/5/96 (15021). *NucNet News* , 2/5/96 (15021). *Plutonium*, Spring 1996, pp. 15-17 (15021).

5/30/96*

By 2010, Japanese plutonium reserves from its civilian nuclear reactors are expected to increase to 100 MT.

Vladimir Belous, *Nezavisimaya Gazeta*, 5/30/96, p. 6 (15243).

5/30/96*

Japan is reportedly conducting research on uranium enrichment by Molecular Laser Isotope Separation (MLIS).

Vladimir Belous, *Nezavisimaya Gazeta*, 5/30/96, p. 6 (15243).

6/7/96*

The Japanese Ministry of International Trade and Industry (MITI) has decided to review its nuclear development program and to suspend construction of an advanced fast breeder reactor (FBR). MITI is also likely to review its long-term nuclear program as well as its plutonium supply program. An advisory council to MITI, the nuclear energy panel of the Advisory Committee for Energy (ACE), will review the FBR program as well as the "Pluthermal Program," a program to fuel a thermal neutron reactor with plutonium.

Nihon Keizai Shimbun (Tokyo), 6/7/96, p. 1; in FBIS-EAS-96-115, 6/13/96 (15460).

JAPAN WITH:

Australia, Indonesia, and South Korea, 123

JAPAN WITH BELGIUM

5/6/96*

According to Japanese utility and industry sources, two leading Japanese utilities, Toshiba and Tokyo Electric Power Co. (Tepco), "quietly" signed agreements with Belgium for the supply of approximately 60 mixed-oxide (MOX) fuel assemblies containing 400 kg of plutonium, despite the Japanese government's reluctance to permit MOX irradiation in light water reactors (LWRs). According to the agreements, Belgonucleaire would fabricate 400 kg of separated plutonium into 60 MOX fuel rods for Tepco's boiling water reactors (BWRs). The contracts, valued at several hundred million dollars, were uncovered when Greenpeace suspected that Belgium might decide to store Japanese nuclear waste. As of 1996, 1.7 MT of Japanese plutonium designated for fabrication of MOX fuel rods in Belgium are stored at Cogema's reprocessing plant in La Hague.

Ann MacLachlan, *NuclearFuel*, 5/6/96, pp. 13-14 (15263). Naoaki Usui, *NuclearFuel*, 3/11/96, p. 18 (15263). *Nuclear Engineering International*, 4/96, p. 8 (15263). Richard Masters, *Nuclear Engineering International*, 6/96, pp. 31-35 (15255).

JAPAN WITH BELGIUM, EUROPEAN UNION, AND FRANCE

5/6/96*

According to sources in Brussels, Japan and the E.U. will not complete a nuclear cooperation agreement for at least one year. The Japanese government wishes to sign such an agreement prior to approving MOX fuel fabrication contracts between Japanese utilities and the Franco-Belgian company Commox. According to Japanese officials, the Diet would not approve any agreement earlier than spring 1997. A European official stated that Japan and Belgium do not need to have a bilateral nuclear agreement to fulfill their MOX deal. According to the source, any nuclear transactions within Europe are regulated exclusively by EURATOM, leaving "nothing for the Japanese to approve." Japan refuses to approve the retransfer of separated Japanese plutonium from France to Belgium for MOX fuel rod production without a nuclear cooperation agreement, insisting on stricter regulations than those implemented by EURATOM.

Ann MacLachlan, *NuclearFuel*, 5/6/96, pp. 13-14 (15263). Ann MacLachlan, *NuclearFuel*, 4/8/96, pp. 9-10 (15263).

JAPAN WITH:

Canada, France, Germany, and Indonesia, 124

Canada, France, Indonesia, and United States, 124

China, 118

JAPAN WITH GERMANY, RUSSIA, AND UNITED STATES

Early 1996

An interim design report on the progress of the International Thermonuclear Experimental Reactor (ITER) has been completed and delivered by the Joint Central Team (JCT). The JCT is conducting a six-year engineering design study with a goal of constructing a Tokamak reactor that allows the controlled ignition and stationary burning of fusion plasma. According to the interim report, the main elements of the ITER construction and required technologies have been defined and specified. The JCT is conducting research and development activities at three sites: In Garching, Germany, all plasma-typical components and systems are being developed; in Naka, Japan, all peripheral systems activities are being studied; and in San Diego, U.S., studies on the integration of construction, nuclear integration, and safety are being conducted. Construction of the ITER will take approximately 9 to 10 years and will cost $5.85 billion, with an additional $770 to 800 million in unspecified costs. Also, $900 million is expected to be spent on the project's management and administration. Experimentation is scheduled to begin in 2008.

Karl Juergen Dietz, *Atomwirtschaft*, 5/96, pp. 317-323 (15510).

JAPAN WITH:

Iran and Italy, 125

JAPAN WITH NORTH KOREA

4/8/96

Japanese authorities arrested an ethnic Korean Yi Chong-chun for allegedly shipping sodium fluoride and hydrofluoric acid, which can be used to produce Sarin nerve gas and enrich uranium, from Japan to North Korea. Yi Chong-chun is a member of Chongnyon, the General Association of Korean Residents in Japan, and is employed by the affiliated Tong-a Technology and Industrial Company. Reportedly, Yi Chong-chun smuggled 100 kg of the chemicals to North Korea "twice in January and February" aboard a North Korean vessel out of the port of Kobe.

KBS-1 Television Network; in FBIS-EAS-96-069, 4/8/96 (14671).

JAPAN WITH RUSSIA

4/17/96*

Russia and Japan are negotiating to use Russian plutonium in Japanese fast-breeder reactors (FBRs).

Asahi Shimbun, 4/17/96 (15119).

JAPAN WITH:

Russia and G7, 139

JAPAN WITH UNITED STATES

3/22/96

Three licenses were issued by the U.S. Nuclear Regulatory Commission (NRC) to Mitsubishi International to export 5,893 kg of low-enriched uranium (LEU) to Japan's Ikata-3 and -5 reactors; 19,262 kg of LEU to Japan's Takahama-1; and 14,111 kg of LEU to Japan's Takahama-3 nuclear power plant. The NRC also issued Edlow International of the U.S. a license to export 3,459 kg of LEU to Ikata-3 and -5.

Nuclear Regulatory Commission, 4/96 (15603).

4/29/96

The NRC issued a license to Siemens Power Corp. to export LEU to Japan.

Nuclear Regulatory Commission, 5/96 (15602).

5/96

Mitsui USA was granted licenses by the NRC to sell 16,417 kg of LEU to Japan for the Tokai-2 reactor, and 20,164 kg of LEU to Japan for the Fukushima-2 reactor.

Nuclear Regulatory Commission, 6/96 (15604).

5/6/96*

A conflict between the U.S. State Department and the Department of Energy (DOE) over reprocessing and plutonium stockpiling is delaying action on Japan's 1995 request to add several European plutonium fuel cycle facilities to the Annex I register specified in the 1988 U.S.-Japan nuclear cooperation agreement. A source in the Clinton Administration said DOE will not "rubberstamp" the request, but will "take a real serious look" at plutonium stockpiling in Japan before approving additional European facilities for reprocessing U.S.-origin nuclear materials and mixed-oxide (MOX) fuel fabrication. Citing Japanese Citizens' Nuclear Information Center figures, a 3/1/96 letter to Energy Secretary Hazel O'Leary from the Nuclear Control Institute, Greenpeace, and the Natural Resources Defense Council warned that Japan's stockpile of 11 MT of plutonium would increase to 25 MT by the year 2000, jeopardizing U.S. security interests. The State Department contends that Japan's request covers facilities which meet U.S. safeguard standards and appear on the U.S.-EURATOM annex.

Kathleen Hart, *NuclearFuel*, 5/6/96, pp. 12-13 (14897).

KAZAKSTAN

INTERNAL DEVELOPMENTS

3/22/96

The Kazakstan State Investigative Committee and the National Security Service arrested two employees of the Ulba Metallurgical Joint-Stock Company in Ust-Kamenogorsk, Kazakstan, for illegal possession of 100 kg of U-235, one of the largest seizures of nuclear fuel in Kazakstan. The uranium apparently had been stolen from the facility in 11/95. In a related incident, a car leaving Ust-Kamenogorsk was found to be carrying 4 kg of uranium, 1 kg of thorium, and 10 ingots of indium, a rare-earth element, all believed to have originated at the Ulba Metallurgical Joint-Stock Company.

Sergei Borisov, *Obshchaya Gazeta* (Moscow), 5/5/96-5/11/96, p. 2; in FBIS-SOV-96-090, 5/8/96 (15491). Sergei Borisov, *Karavan-Blits* (Almaty), 3/26/96, p. 1; in FBIS-TAC-95-005 3/26/96 (15491).

KAZAKSTAN WITH:

Afghanistan, China, Iran, Pakistan, Russia, and Turkmenistan, 117
Armenia, Belarus, Russia, Tajikistan, and Ukraine, 113
Azerbaijan, Iran, and Tajikistan, 113
China and Kyrgyzstan, 118

Kazakstan with the European Union, Kyrgyzstan, Russia, and Uzbekistan

6/96*

The EURATOM Supply Agency (ESA) 1995 Annual Report notes that the CIS has "maintained its position as the European Union's (E.U.) largest source of (natural uranium) supply." In 1995, the E.U. imported 5,250 MT of natural uranium from the CIS, which constituted 33 percent of all natural uranium imports to the area. Russia provided 27 percent of the total to the E.U., while Kazakstan, Uzbekistan, and Kyrgyzstan supplied the remainder. Total 1995 CIS uranium exports to the E.U. were 13,000 MT.

Ann MacLachlan, *NuclearFuel*, 6/3/96, pp. 16-17 (15278).

Kazakstan with Lithuania

6/8/96*

Kazakstani customs officers arrested a Lithuanian citizen attempting to smuggle 200 kg of radioactive tantalum, worth approximately $100 million, out of Kazakstan. It is suspected that the material was stolen from the Ust-Kamenogorsk Metallurgical Joint-Stock Company, which produces nuclear fuel and rare earth metals for nuclear power plants.

Komsomolskaya Pravda, 6/8/96, p. 1 (15157).

KYRGYZSTAN

LATVIA

Latvia with Russia

5/18/96*

One hundred thirty grams of a radioactive substance, probably uranium, was found in the Latvian city of Ludza. A local police investigation determined that the radioactive substance was illegally acquired in St. Petersburg, Russia, and then brought to Daugavpils, Latvia, where it was purchased by two residents of Ludza.

Karen Markaryan, *Komsomolskaya Pravda*, 5/18/96, p. 3 (15047).

LIBYA

Libya with Austria

5/17/96

The court case against 57-year-old Peter Z., who was apprehended trying to sell a nuclear warhead to investigators from the Ministry for Internal Affairs, started in Austria. After the fall of the USSR, Peter Z. announced that he possessed a complete nuclear warhead, which was for sale for 60 billion Austrian shillings. Although the warhead apparently does not exist, a small amount of non-weapons-grade "Plutonium 289" [sic] does. Peter Z. alleged that Libya's Muammar Qaddafi was interested in buying the warhead.

Die Presse, 5/18/96 (15279). Peter Pisa, *Kurier*, 5/18/96 (15279).

Libya with Austria, Czech Republic, Monaco, and Russia

2/20/96

Czech police investigators have revealed that the buyer of smuggled weapons-grade uranium confiscated in Prague in 1994 was located in Africa. Although the police did not disclose the purchaser, they did say that Libya was not a participant in the deal. Head investigator Jan Rathausky will interrogate suspects in Russia, Monaco, and Austria before wrapping up the case. Police suspect that nuclear scientist Jaroslav Vagner, of Ceske Budejovice, and two men from the former Soviet Union, were involved in the deal. Police discovered 2.7 kg of highly-enriched uranium (HEU) in the men's car. The HEU is thought to have originated in the former Soviet Union.

Maggie Ledford Lawson and Jan Stojaspal, *Prague Post*, 2/20/96, p. 1; in FBIS-EEU-96-053, 2/20/96 (14587).

Libya with Bulgaria, Germany, and Ukraine

4/19/96*

Ukraine, and the city of Odessa in particular, are increasingly becoming a main route for nuclear smuggling, due to the country's economic difficulties and lack of government control. The biggest dangers come from Ukrainian strategic nuclear missile bases, which still possess radioactive materials, and from corrupt authorities at Odessa's seaport facilities. Recent reports by Western arms dealers suggest that an increasing number of Ukrainian nationals, including government officials, may be offering weapons-grade plutonium and uranium for sale. In Kherson, local authorities confiscated a large amount of cesium-137 stolen from a chemical plant in Vinnitsa, Ukraine, which was to be shipped to Libya on board a Bulgarian vessel. A reporter for *Die Woche*, pretending to be a representative of an Israeli company, was offered 40 g of strontium-90 at $35,000/g and 6 g of radium-226 at $8,000/g in 4/96.

Die Woche (Hamburg), 4/19/96, p. 31; in FBIS-TOT-95-015-L, 4/19/96 (15539).

Libya with Ukraine

6/10/96*

A 1995 U.S. intelligence report said that Ukrainian President Leonid Kuchma supervised the formation of a committee to oversee "comprehensive strategic cooperation" with Libya. The committee was allegedly

comprised of 13 officials at "the highest levels of the Ukrainian leadership," including the nuclear technology minister. According to the report, the committee authorized Libyan representatives to meet with an unnamed Ukrainian electronics company. The company, located in Kharkiv, has allegedly "been linked to discreet international dealings." Unidentified Libyans have also met with members of Kuchma's staff, several Ukrainian "trade and foreign economic officials," and the leaders of a number of scientific research institutions. Ukrainian Foreign Ministry spokesman Yuriy Serheyev denied the allegations, but did confirm that Ukrainian-Libyan negotiations on "future contracts and participation in tenders" were under way. Serheyev added that the negotiations do not include the transfer of nuclear technology.

Bill Gertz, *Washington Times*, 6/10/96, pp. A1, A10 (15465). Halya Pavlyva, *Intelnews* (Kiev), 6/12/96; in FBIS-SOV-96-114, 6/12/96 (15465).

LITHUANIA

Internal Developments

Early 1996

Lithuanian Security Department officers demonstrated weaknesses in the physical security of the Ignalina nuclear power plant by smuggling "explosive substances" into the Ignalina plant without interference from its staff. Director of the Lithuanian Security Department Jurgis Jurgelis stated that private company offices also exist on the Ignalina plant property. The offices employ relatives of the plant's staff, making it difficult to determine what property belongs to the Ignalina Plant and what is privately owned.

Radio Vilnius (Vilnius), 5/14/96; in FBIS-SOV-96-099, 5/21/96 (15107).

3/96*

Lithuanian authorities discovered a fuel rod containing 2.7 kg of uranium fuel in Visiginas, 15 km from the Ignalina nuclear power plant. The fuel rod is believed to be part of an entire fuel assembly that is missing from the Ignalina plant. At least 0.3 kg of uranium fuel pellets had been removed from either end of the fuel rod. Sigidas Kurselis, director of safeguards and physical protection for the Lithuanian Nuclear Power Safety Inspectorate, said that while it is not known exactly when the assembly was stolen, it is unlikely that it was stolen before delivery to the plant. According to Lithuanian officials, one person has been arrested and more arrests are expected. Kurselis said that many more than "two or three people" were involved with this incident. According to Kurselis, it has not yet been determined how much of the 3 kg of uranium that the rod originally held is missing. The 280 kg fuel assembly, which contains more than 100 kg of uranium, was discovered to be missing in early 1993.

Ariane Sains, *Nucleonics Week*, 3/21/96, pp. 15-16 (15210). Ariane Sains, *Nucleonics Week*, 3/14/96, pp. 14-15 (14932).

Lithuania with:

Georgia, Pakistan, and Sweden, 121
Kazakstan, 132

Lithuania with Ukraine

5/20/96

The Lithuanian Interior Ministry announced that police in Klaipeda arrested six people attempting to sell 13 kg of uranium (U-238) for $300,00. Police discovered the uranium in two containers, only one of which appeared equipped to transport radioactive material, according to the Baltic News Service. It is suspected that the radioactive material was stolen from a Ukrainian military base. Police officials, however, do not exclude the possibility that this uranium was brought to Klaipeda from the Ignalina nuclear power station. The arrests followed a joint operation by Lithuanian police, the State Security Service, and the Procurator General's office. The suspects are well-known residents of Klaipeda: 38-year-old Sigitas Petkyavichus is deputy director of the "Filia" joint-stock company and former member of the city council; 55-year-old Nikolay Ionidis is director of the "Grinidis" joint-stock company; Anatoliy Goncharov is president of the "Garmonia" joint-stock company and formerly people's judge of Klaipeda; and Goncharov's wife is a lawyer. All the smugglers were charged with obtaining, storing, and selling radioactive materials.

Reuter (Vilnius), 5/20/96; in Executive News Service, 5/21/96 (15108). Itar-Tass (Moscow), 5/21/96; in FBIS-SOV-96-100, 5/21/96 (15477).

NORTH KOREA

Internal Developments

Early 1996

In a report dealing with North Korea's nuclear weapons program, including its development, command and control, organization and use, Joseph Bermudez reveals that research into weapon design probably began in the late 1970s with exploration of the requirements for a basic nuclear device, a free-fall air-delivered bomb, and a ballistic missile warhead. North Korea likely completed its first fissile core by 1990. Citing unidentified sources, Bermudez says that, by 1991, North Korea constructed a nuclear device intended to be fitted on a railway car or carried by a military transport aircraft. He estimated that, also by 1991, North Korea had reprocessed 10-13 kg of plutonium, enough to manufacture one or two nuclear weapons, under ideal conditions. By 1994, having conducted a second refueling of its 5 MW reactor at Yongbyon, North Korea could have extracted an additional 18 to 22 kg of plutonium, enough to fabricate two to four more nuclear weapons. To date, North Korea has not reprocessed this fuel. In addition, Bermudez identified the constituent bodies of North Korea's nuclear organization as including: the Korean Workers' Party Second Economic Committee, the Ministry of Atomic Energy Industry, the Academy of Sciences, the Mining Industry Committee, the Ministry of Public Security, the Ministry of State Security, and the Ministry of the People's Armed Forces.

Joseph S. Bermudez, Jr., "North Korea's Nuclear Arsenal," *Jane's Intelligence Review*, Special Report No. 9, 1996, pp. 1-23 (14669).

2/3/96

A RAND Institute report analyzing the impact of a U.S.-proposed fissile material pro-

duction cutoff said that North Korea has the ability to produce 250 kg of plutonium per year. It noted, as a main proliferation concern, North Korea's occasional failure to abide by the terms of its international agreements. The report details the inventories, and production capabilities, and proliferation risks for all Third World countries of concern.

Brian G. Chow, Richard H. Speier, and Gregory S. Jones, *The Proposed Fissile-Material Production Cutoff: Next Steps* (Santa Monica, Calif.: RAND National Defense Research Institute, 1995) (16001).

2/8/96

The South Korean Agency for National Security Planning issued a report which indicates that North Korea may reprocess over 50 tons of spent fuel and continue developing nuclear weapons with the 7 to 22 kg of plutonium that it has stored.

Yonhap (Seoul); in FBIS-EAS-96-028, 2/9/96 (14211).

North Korea with:
China, Iran, and United States, 118
CIS, Iran, Iraq, and Syria, 120

North Korea with IAEA (International Atomic Energy Agency) and United States

3/18/96

Hans Blix, IAEA director general, reported to the board of governors that North Korea is not cooperating with IAEA efforts to ascertain the quantity of plutonium held at the Yongbyon nuclear facility. IAEA inspectors have made a number of attempts to photograph the facility since 9/95, in accordance with agreements made with Pyongyang, but North Korea has restricted them. Without access to the spent fuel rods at the Yongbyon facility, the IAEA will not be able to determine whether North Korea diverted the reactor fuel in 1991. Blix said that Pyongyang agreed to a fifth round of discussions on the issue, but that, "Without the implementation in the very near future of adequate preservation measures, there is a risk we may lose the possibility to verify the correctness and completeness of [North Korea's] initial declaration." While North Korea has allowed IAEA inspectors to be stationed permanently at the Yongbyon facility, Pyongyang has made short-notice inspections and inspector rotations difficult.

Steve Pagani, Reuter; in Executive News Service, 3/18/96 (14677).

4/27/96

The U.S. firm NAC International began canning 8,000 spent nuclear fuel rods from North Korea's Yongbyon nuclear reactor. The fuel rods, which are in a storage pond, must be removed, dried, and then put into stainless steel cans. The cans will then be shipped out of North Korea to a permanent storage site yet to be identified. The U.S. Department of Energy, which is funding and overseeing the process, spent $10 million in FY 1995, and has requested an additional $4.1 million for FY 1996 to complete the project. U.S. Special Envoy Spencer Richardson will oversee the removal.

Kathleen Hart, *Nuclear Fuel*, 5/6/96, pp. 5-6 (14810). Choe Won-ki, *Chunggang Ilbo* (Seoul), p. 1; in FBIS-EAS-96-054, 3/16/96 (14674).

5/27/96

David Kyd, spokesman for the IAEA, announced that North Korean officials have refused to allow inspectors to measure plutonium levels in the rods being canned from the Yongbyon facility (see above). Kyd said that the four IAEA inspectors involved with the storage process were allowed only to verify that the fuel rods had been "burnt." The IAEA estimates that storage of the 8,000 rods will be completed by 6/97, and said that it would continue to seek authorization to measure the plutonium.

KBS-1 Radio (Seoul); in FBIS-EAS-96-087, 5/2/96 (14823).

North Korea with:
Japan, 131

North Korea with KEDO (Korean Energy Development Organization)

2/7/96

A South Korean official announced that South Korea contributed $6 million to KEDO for "preliminary activities in the LWR project." The official stressed that the $6 million will not be used to pay for the heavy oil shipment to North Korea.

Chungang Ilbo (Seoul), p. 1; in FBIS-EAS-96-027, 2/8/96 (14652).

3/13/96

North Korea established an East Sea Atomic Reactor Project Planning Office. It will be comprised of representatives of the Foreign Ministry, the Atomic Energy Department and the External Economic Cooperation Committee. The office will develop negotiating strategies for KEDO and will serve as interagency policy coordinator.

Kim Pyong-chan, *Hanguk Ilbo* (Seoul), 3/14/96, p. 2; in FBIS-EAS-96-051, 3/14/96 (14673).

3/19/96

KEDO selected the Korean Electric Power Corporation (KEPCO) to be general contractor for the supply of the two light-water reactors (LWRs) to North Korea. This means that KEDO can begin the inspection process of the proposed site at Sinpo.

Koreaupdate, 4/1/96, p. 2 (14824).

3/26/96

A six-member delegation, led by Steven Bosworth, executive director of KEDO, arrived in North Korea for a four-day visit to Sinpo. Among the delegation were Choi Young-jin and Itaru Umezu, KEDO deputy directors.

Pyongyang Korean Central Broadcasting Network; in FBIS-EAS-96-059, 3/26/96 (14814).

5/6/96

Thirteen technical representatives from KEDO completed the fifth on-site inspection of the proposed light-water reactor (LWR) site (at Sinpo). The team arrived on 4/27/96 and surveyed the site to determine the preliminary infrastructure projects that will be necessary to support construction of two LWRs. Likely projects include construction of a road from the LWR site to the port of Yanghwa, an 8 km distance. In addition, a fiber optic telecommunications cable has been installed between Sinpo and Hamhung, and a road may be constructed between North and South Korea, through Panmunjom.

Ku Pon-yong, *Seoul Sinmun*, p. 1; in FBIS-EAS-96-048, 3/9/96 (14675). Yonhap (Seoul); in FBIS-EAS-96-089, 5/7/96 (14819). Yonhap (Seoul); in FBIS-EAS-96-114, 6/12/96 (15518).

5/22/96

Representatives of KEDO and North Korea signed the first of 10 supplementary diplomatic protocols necessary to bring into force the KEDO-North Korea supply agreement. This protocol covers the privileges and immunities that North Korea will grant to KEDO staff and representatives, addressing matters such as arrests, visas, and protection of property, assets, and income.

Koreaupdate, 6/10/96, p. 2 (15515).

North Korea with Russia

3/28/96*

North Korea maintains a permanent cadre of approximately 10 nuclear scientists at the Joint Atomic Energy Research Institute in Dubna, Russia. Since the 1970s, an estimated 230 North Korean scientists have received instruction at the institute, at an annual cost exceeding $100,000. These scientists played an important role in establishing the Yongbyon nuclear facility. The North Koreans are pursuing studies relating to nuclear reactor operations, superconductors, and particle accelerators.

Ko Tae-Yong, KSG-1 Television Network (Seoul); in FBIS-TAC-95-005 (14817).

North Korea with South Korea

3/19/96

The Chinese tanker *Liu He* will begin to deliver 42,000 tons of South Korean heavy oil to North Korea. The shipment, worth approximately $5.46 million, originated at the Honam Oil Refinery Company and will be sent to Sonbong, North Korea, from the South Korean port of Yuchon.

Reuter; in Executive News Service, 3/16/96 (14679).

North Korea with United States

4/27/96

The U.S. firm NAC International began the process of canning 8,000 spent nuclear fuel rods from North Korea's Yongbyon nuclear reactor. The fuel rods, which are in a storage pond, must be taken out, dried, and then put into stainless steel cans. Those cans will then be shipped out of North Korea to a permanent storage site yet to be identified. The U.S. Department of Energy, who is funding and overseeing the process, spent $10 million in FY 1995, and has requested an additional $4.1 million for FY 1996 to complete the project.

Kathleen Hart, *Nuclear Fuel*, 5/6/96, pp. 5-6 (14810).

NORWAY

Internal Developments

6/26/96*

During a routine inventory check, IAEA inspectors discovered that 2.178 MT of natural uranium were missing from a Norwegian facility. It has become clear to Norwegian media and government officials that control over uranium in Norway is currently inadequate.

Marat Zubko, *Izvestiya*, 6/26/96, p. 3 (15370).

PAKISTAN

Internal Developments

10/20/95*

Pakistan's Atomic Energy Commission (PAEC) Chairman Ishfq Ahmed said that embargoes and restrictions placed on Western exporters of nuclear materials to Pakistan were forcing the "indigenization" of Pakistan's nuclear program. Pakistan's nuclear power plant at Karachi runs on uranium from a mining and processing facility in the Dera Ghazi Khan region, but deposits there are reportedly almost depleted. Pakistan will begin mining the Qabul Khel uranium deposits in the Lakki Marwat district.

Khaleej Times, 10/20/95; in *Strategic Digest*, 2/96, pp. 250-251 (14595).

2/20/96*

Any large-scale manufacturing of nuclear weapons in Pakistan is expected to occur at the top-secret ordnance complex at Wah. Pakistan also runs a nuclear research and development center in Golra.

Marcus Warren, *Washington Times*, 2/20/96, pp. A1, A16 (14835).

2/23/96*

According to a report by RAND's National Defense Research Institute, Pakistan could build 12 nuclear weapons using current fissile material stocks. By the mid-1990s, it is anticipated that Pakistan will possess enough fissile material to build two bombs per year.

Brian Chow, Richard Speier, and Gregory Jones, *The Proposed Fissile-Material Production Cutoff: Next Steps* (Santa Monica, Calif.: RAND, 1995), pp. 9, 13.

3/96

Unnamed Pakistani nuclear officials denied allegations made by the magazine *Power in Asia* that a 50 MW power reactor has been built near Khushab.

NucNet News, 3/28/96 (15015).

4/2/96

Unnamed sources in Pakistan said allegations that U.S. intelligence agents found blueprints for a Pakistani atomic bomb in the luggage of Dr. A. Q. Khan in the early 1980s are false.

Nation (Islamabad), 4/3/96, pp. 1, 5; in FBIS-NES-96-066, 4/3/96 (14846).

5/28/96*

Independent estimates from the U.S. media, intelligence community, State Department, CIA, and Defense Department indicate that Pakistan possesses 12-20 nuclear weapons. The Pakistani National Command Authority (NCA), which includes the president, the army chief of staff, the Joint Chiefs of Staff (JCS) chairman, and the JCS director general, control the Pakistani nuclear program and arsenal.

General Ashok Mehta, *Pioneer* (Delhi), 5/28/96, p. 10; in FBIS-NES-96-105, 5/28/96 (15066).

6/96*

While several Indian military and senior government officials believe that Pakistan possesses a sufficient nuclear capability to act as a deterrent, Indian nuclear scientists question such an assessment. In 1995, former Indian Atomic Energy Commission Chairman Dr. P. K. Iyengar said, "If you ask me, 'Is there any scientific evidence, that Pakistan has a nuclear-weapon capability?', I would say no." Indian scientists believe that Pakistan could build "a few devices" using foreign material, but could not maintain an "indigenous program."

W. P. S. Sidhu, *Jane's Intelligence Review*, 6/96, pp. 278-280 (15436).

PAKISTAN WITH:

Afghanistan, China, Iran, Kazakstan, Russia, and Turkmenistan, 117
China, 118
China, France, India, Israel, Russia, United Kingdom, and United States, 117
China, France, and United Kingdom, 118
China and United States, 119
Georgia, Lithuania, and Sweden, 121

PAKISTAN WITH GERMANY

2/8/96*

Pakistan has a history of attempting to acquire top bearing parts for gas centrifuges from abroad. According to Western intelligence reports, in 1991 and then in 1995, Pakistan approached German firms to obtain magnetic equipment for its centrifuges. Because the Kahuta uranium enrichment plant's design is based primarily on technology stolen from the European consortium Urenco during the mid- 1970s, all magnetic bearing parts imported by Pakistan to date have met the specifications of Urenco's G-1 and G-2 centrifuges. Specifically, these magnetic bearing parts have been constructed of an aluminum, nickel, and cobalt alloy called Alnico. Pakistan's G-1 and G-2 type centrifuges use two Alnico magnets, an upper one suspended from a housing and a lower magnet attached to the top cap of the rotor assembly.

Mark Hibbs, *Nucleonics Week*, 2/8/96, pp. 1, 12 (14658).

PAKISTAN WITH HUNGARY

2/23/96*

Laser equipment that could be used in a nuclear weapons program was found in a Hungarian shipment to Pakistan in 1995.

Alfred de Tavares and Sanjay Suri, *India Abroad*, 2/23/96, p. 27 (15018).

PAKISTAN WITH ITALY

4/96

Equipment which could be used for manufacturing chemical and nuclear weapons was impounded by officials at the port of Naples, Italy, before it could be shipped to Lahore, Pakistan. The equipment was found in five containers, inside of which customs officers discovered a reactor with a cooling sheath, distilling equipment, pumps, and centrifuges. According to the exporting company, Smith Kline, the equipment was for manufacturing an antibiotic called Cefadrin.

RAI Uno Television Network (Rome), 423/96; in FBIS-TAC-96-007, 4/23/96 (15122).

PAKISTAN WITH MOROCCO

5/96

During an interview with the Moroccan daily *La Opinion*, Pakistani Foreign Minister Sardar Ahmad Ali said that Pakistan is prepared to share its nuclear technology with peaceful countries such as Morocco.

Aroosa Alam, *Muslim* (Islamabad), 5/31/96, pp. 1, 4; in FBIS-TAC-96-007, 5/31/96 (15173).

PAKISTAN WITH SWEDEN AND UNITED KINGDOM

2/96

British officials seized Swedish dual-use laser equipment destined for Pakistan at London's Heathrow Airport. A similar deal was halted in 1995 that involved the sale of laser equipment by the Swedish laser manufacturer Fixturlaser to Global Consultants, an alleged Pakistani front company. The 11/95 deal was stopped by British customs after they seized the laser-measuring instruments from a British Airways flight destined for Karachi, Pakistani. A Pakistani High Commission employee, Mohammed Saleem, was accused by the British government of obtaining laser equipment for Pakistan's nuclear weapons program, and the government announced its intention to deport him. Pakistani High Commission in London officials, however, have rejected the accusations of involvement by either the Commission or Saleem. U.S. officials claim Saleem is the European buyer for the A. Q. Khan Research Laboratory in Kahuta. Indian Major General Dipanker Bannerjee claimed that the laser devices were for a uranium enrichment facility.

Alfred de Tavares and Sanjay Suri, *India Abroad*, 2/23/96, p. 27 (15018). *Asian Age*, 2/14/96; in Strategic Digest, 4/96, pp. 537-538 (15018). Major General Dipanker Bannerjee, India Radio Network (Delhi), 2/5/96; in FBIS-TAC-96-003, 2/5/96 (15172). Ahmad Ishtiaq, *Nation* (Islamabad), 2/13/96, pp. 1, 15; in FBIS-TAC-96-003, 2/13/96 (14391). Marcus Warren, *Washington Times*, 2/20/96, pp. A1, A16 (14835). Marcus Warren, *Washington Times*, 4/13/96, p. A8 (14835).

PAKISTAN WITH VIETNAM

4/8/96-4/14/96*

In Vietnam, the departure of top scientists and engineers has paralyzed efforts to develop a planned $3 billion nuclear power industry. According to Dalat Nuclear Research Institute director Tran Ha Anh, more than 20 nuclear specialists have left the Dalat Institute, home to Vietnam's only nuclear reactor. Anh said that Vietnamese scientists have gone to work in Pakistan, at the IAEA, and in other jobs where salaries are higher. Vietnam has several hundred personnel involved in the nuclear field, around 130 of whom are at Dalat.

Le Minh Quan, *Vietnam Investment Review* (Hanoi), 4/8/96-4/14/96, p. 8; in FBIS-EAS-96-080, 4/24/96 (14634).

ROMANIA

INTERNAL DEVELOPMENTS

3/8/96*

Anti-Organized Crime Service officers of the Timis County Police Inspectorate, Romania, discovered a car carrying 82 kg of radioactive material (later identified as uranium). The car was also carrying secret documents that driver Andrei Ilie, a foreman at the Oravita Mining Corporation, had stolen from the Banatul Mining Company of Oravita. The documents were the property of the Magurele Research and Design Center for Radioactive Metals, located near Bucharest, and were to be taken to an hidden place to be photocopied in exchange for 10 million lei.

Adevarul (Bucharest), 3/8/96, p. 1; in FBIS-TAC-95-005, 3/8/96 (14892).

ROMANIA WITH:
Bulgaria, Moldova, and Russia, 138
Germany, Hungary, Russia, Serbia, and Switzerland, 139

RUSSIA

INTERNAL DEVELOPMENTS

2/6/96*

Five blocks of gamma-sources containing cesium-137 were stolen from the joint stock company Stroidetal in the Kardim district of Russia's Smolensk region. Local law enforcement agents are attempting to locate the missing blocks, as there is a possibility that they may fall into the hands of terrorists. The quantity of stolen material is currently being calculated.

Kommersant-Daily, 2/8/96, p. 4; in WPS, 2/14/96, p. 4 (15096).

4/16/96

Chechen rebel leader Aslambek Abdukhadyev threatened to explode containers holding radioactive material in Moscow. The warning came after a claim that the Russians had bombed villages, killing civilians and children. Abdukhadyev said, "There are already several radioactive containers in Moscow. We can put in more. We will explode them all."

AFP (Paris), 4/16/96; in FBIS-TEN-96-005, 4/16/96 (15106).

6/18/96*

Two containers holding 60 liters of nuclear materials were discovered at a sandpit near Khabarovsk, Russia, 300 m from the Khabarovsk-Vladivostok highway. The containers were taken to the special enterprise Radon. Local investigators are attempting to locate the owner of the containers.

Rossiiskaya Gazeta, 6/18/96, p. 3 (15201). *Krasnaya Zvezda*, 6/18/96, p. 1; in WPS, 6/19/96, p. 1 (15309).

RUSSIA WITH:
Afghanistan, China, Iran, Kazakstan, Pakistan, and Turkmenistan, 117
Africa, Belarus, Czech Republic, and Germany, 114
Armenia, Belarus, Kazakstan, Tajikistan, and Ukraine, 113
Armenia and Iran, 113
Austria, Czech Republic, Libya, and Monaco, 132
Belarus and Ukraine, 114

RUSSIA WITH BELGIUM, FRANCE, GERMANY, AND NETHERLANDS

3/96*

In order to assure "longer-term" highly enriched uranium (HEU) fuel supplies, EURATOM intends to sign a contract with Russia, a plan "hailed" as a means to use Russian HEU for peaceful purposes. According to EURATOM, Europe is capable of supplying 5-10 years worth of HEU to the three existing research reactors fueled by HEU; the Belgian BR-3 at Mol, the Petten reactor in the Netherlands, and the French neutron beam reactor at the Laue-Langevin Institute in Grenoble, in addition to Germany's FRM-2 research reactor. The FRM-2 reactor in Garching, construction of which is scheduled to begin in 8/96, will use 93 percent enriched uranium.

Simon Rippon, *Nuclear News*, 3/96, p. 45 (15019). *Nuclear News*, 5/96, p. 55 (15019).

RUSSIA WITH:
Brazil and Canada, 115

RUSSIA WITH BULGARIA, FRANCE, GERMANY, AND UNITED STATES

5/31/96*

Bulgarian Committee of Energy Chairman Konstantin Russinov reported that Bulgaria is currently negotiating with French, German, Russian, and U.S. firms about the completion of the Belene-1 nuclear power plant. Belene-1, a VVER-1000 pressurized water reactor (PWR) of Russian design, is estimated to cost $1.4 billion, which Bulgaria hopes to finance through an international consortium of European and world financial institutions.

BTA News Agency (Sofia), 5/31/96; in BBC Monitoring Summary of World Broadcasts, 6/3/96 (15462). Srebri Valchev, *NucNet News*, 6/7/96 (15462).

RUSSIA WITH BULGARIA, GERMANY, TAIWAN, AND UKRAINE

4/4/96

The Russian Supreme Court ruled to outlaw a paragraph of the 1/25/95 Russian Presidential Decree "On State Support of Structural Rebuilding and Conversion of the Nuclear Industry in Zheleznogorsk, Krasnoyarsk Region" that permits foreign imports of spent nuclear fuel for reprocessing at the nuclear plant in Zheleznogorsk (Krasnoyarsk-26) from nuclear power stations that had been designed and constructed under other-than-Russian projects. According to the director of the nuclear plant, the RT-2 reprocessing facility at Zheleznogorsk will not be completed before 2000. The court ruled that spent nuclear fuel may be imported into Russia only if there are specific international agreements regulating the import of spent fuel that have passed an environmental analysis. According to Russian Greenpeace members, the RT-2 reprocessing facility was specially designed to reprocess imported nuclear waste at a level of at least 1000 MT annually; only at this level of reprocessing would the RT-2 facility be profitable. According to a statement issued by First Deputy Minister of Atomic Energy Nikolai Yegorov, construction of the RT-2 facility will continue and additional financing will be received from foreign investors in accordance with international agreements. According to Russian Greenpeace representative Ivan Blokov, the court's decision prohibits the uncontrolled import of nuclear waste into Russia. Zheleznogorsk nuclear reprocessing facilities are currently reprocessing nuclear fuel from Ukraine and Bulgaria, and negotiations on nuclear waste imports are being conducted with Germany and Taiwan. According to Blokov, since the RT-2 facility is incomplete, the Russian government and Zheleznogorsk plant managers were planning to simply bury nuclear waste from Western Europe until the RT-2 facility is completed.

K. B., *Ogonyek*, 4/96, p. 49 (15509). Vadim Kantor, *Segodnya*, 4/6/96, p. 12 (15509).

Russia with Bulgaria, Moldova, and Romania

5/23/96*

In late 1996, Russian nuclear fuel designated for the Kozloduy power station in Bulgaria is scheduled to be transported by train through Moldova and Romania.

Valeriy Demidetsky, Itar-Tass (Moscow), 5/23/96; in FBIS-SOV-96-103, 5/23/96 (14895).

Russia with Canada

4/17/96*

Viktor Mikhailov, head of the Russian Ministry of Atomic Energy, said that talks between Russia and Canada to use Russian weapons grade plutonium in CANDU reactors have reached a "final stage." Mikhailov also said that Russia intends to reprocess 12 MT of highly-enriched uranium (HEU) in 1996, and 25 MT in 1997.

Asahi Shimbun (summarized translation), 4/17/96 (15119).

4/19/96-4/20/96

During the nuclear safety summit in Moscow from 4/19/96 to 4/20/96, Canada and Russia signed a Memorandum of Understanding regarding procedures for continued feasibility studies on burning excess Russian weapons grade plutonium in Canadian CANDU reactors.

Uranium Institute News Briefing, 4/17/96-4/23/96 (15111).

Russia with Canada, Germany, and Switzerland

3/11/96*

Siemens AG will supply Germany's Obrigheim and Switzerland's Goesgen pressurized water reactors (PWRs) with fuel fabricated at Russia's Elektrostal facility, using Canadian-origin uranium as fuel feedstock. In 1995, the German reactor loaded 16 test rods fabricated at Elektrostal; another four complete fuel assemblies made with fuel from Elektrostal will be added in mid-1996.

Mark Hibbs, *NuclearFuel*, 3/11/96, p. 12 (14778).

Russia with Canada and United States

6/96*

A high-ranking official from the Canadian government said that Canadian nuclear reactors may begin using Russian and U.S. plutonium in 1999-2000. Russian Minister of Atomic Energy Viktor Mikhailov and Canadian Ambassador to Moscow Jeremy Kinsman have already signed a memorandum of understanding on nuclear cooperation.

Nuclear Engineering International, 6/96, p. 8 (15140).

Russia with:

China, 119
China, France, India, Israel, Pakistan, United Kingdom, and United States, 117
China, India, and Iran, 118
Cuba, 120

Russia with Czech Republic, France, Germany, and Slovakia

4/16/96

Slovenske Elektarne (SE) and 10 firms from Eastern, Central, and Western Europe signed an agreement in Bratislava to complete two VVER-440 reactors at Mochovce, Slovakia. Among the suppliers to the project are the Russian firms Atomenergoexport and Zarubezhatomenergostroy, the Czech companies Energoprojekt Prague, the Slovak firms Skoda Prague, Hydrostav Bratislava, EZ-Elektrosystemy Bratislava, and Vuje Trnava, as well as the European Consortium Mochovce (Eucom), a Framatome (France)/ Siemens (Germany) joint venture. Electricite de France (EdF) will also participate in Mochovce's construction.

Ann MacLachlan, Hannah Wolfson, and Ariane Sains, *Nucleonics Week*, 4/18/96, pp. 1-2 (15090).

Russia with:

Czech Republic, Iran, Iraq, and Nigeria, 125
Estonia, Ireland, and United Kingdom, 120
European Union, Kazakstan, Kyrgyzstan, and Uzbekistan, 132

Russia with European Union and Ukraine

5/24/96

Ukrainian Minister of Environment Yuriy Kostenko announced that Ukraine is experiencing serious problems burying its spent nuclear fuel. However, Kostenko predicted that Ukraine will possess its own nuclear waste depository in 30 to 50 years. The depository's construction will be partially funded by the European Union's TACIS program. Ukraine is currently sending its nuclear waste to Russian facilities in Chelyabinsk and Krasnoyarsk for reprocessing in accordance with a decree by Russian President Boris Yeltsin sanctioning the use of Ukrainian spent fuel at nuclear facilities in Russia. Kostenko criticized Russia for taking unfair economic advantage in its processing of spent Ukrainian fuel, which Russia processes at $600/kg.

Intelnews (Kiev), 5/26/96; in FBIS-TEN-96-006, 5/26/96 (15482).

Russia with France

6/7/96

At the French Ministry of Industry in Paris, Russian Ministry of Atomic Energy (Minatom) head Viktor Mikhailov and French Commissariat a l'Energie Atomique (CEA) Administrator-General Yannick d'Escatha finalized an agreement on the supply of Russian HEU (93 percent enriched) to two French research reactors. According to the contract, which is the first annex to a framework agreement between CEA and Minatom, Russia will supply 55 kg batches of HEU each year for a nine-year period to the Max von Laue-Paul Langevin Institute (ILL) in Grenoble. In a second annex, Russia will supply a total of 125 kg of HEU over a nine-year period to the CEA's Orphee research reactor in Saclay. In exchange for supplying HEU to the ILL, Russia will become a partner at ILL; in exchange for the HEU supplied to Orphee, Russia will receive French accelerator components.

Ann MacLachlan, *Nucleonics Week*, 6/13/96, pp. 3-4 (15383). Oleg Bergazov, *Segodnya*, 6/11/96, p. 2 (15319). Judy Redfearn, *Physics World*, 6/96, p. 9 (15412). Mark Hibbs, *NuclearFuel*, 5/20/96, pp. 1-2 (15007). Mark Hibbs, *NuclearFuel*, 5/6/96, p. 3 (15007).

Russia with G7

4/20/96

Participants at the G7 summit in Moscow issued a final declaration on a "Program for Preventing and Combating Illicit Trafficking in Nuclear Material." In the declaration, the summit participants agreed to cooperate in preventing the theft of nuclear materials, to share intelligence to prevent transportation and sales of stolen materials, and to deter potential traffickers. Russian President Boris Yeltsin proposed a nine-point plan for nuclear security. Yeltsin's plan called for increasing international cooperation in designing and operating nuclear facilities, finalizing a convention on safe handling of nuclear waste, using nuclear materials from dismantled nuclear missiles for peaceful purposes, exchanging specialists and information, converting the military-industrial complex to civilian manufacturing, reinforcing the nuclear nonproliferation regime, observing mutual obligations not to deploy nuclear weapons on the territory of nonnuclear states, and fighting nuclear smuggling.

Craig Cerniello, *Arms Control Today*, 4/96, pp. 19, 25 (15621). *Monitor*, Vol. 2, No. 3, Summer 1996, p. 24-28 (15621). Aleksandr Krasulin and Nikolai Paklin, *Rossiiskaya Gazeta*, 4/23/96, pp. 1, 7 (15314). Oleg Bergazov, *Segodnya*, 4/23/96, p. 1 (15152).

Russia with:
Georgia, Libya, Switzerland, and Turkey, 121

Russia with Germany

3/25/96*

The Technical University of Munich (TUM) in Germany may attempt to purchase Russian HEU for the proposed FRM-2 nuclear reactor. The price of U.S.-origin HEU is higher than Russian-origin HEU, and FRM-2 can use U-235 (enriched to only 70 percent) in the future. The German firm NUKEM is expected to offer TUM 200 kg of HEU for cash, with another 200 kg of HEU placed under a contract option. Nukem officials claim that they could provide enough HEU for FRM-2 for the first 10 years of operation, although a European research reactor official has stated that Nukem has faced difficulties finding HEU, which is much more valuable than it was five years ago. Some sources indicate Nukem received a five-year supply of HEU from the fresh fuel inventory at the THTR-300 reactor for FRM-2, while the remaining 200 kg of HEU will be available at a premium from other inventories.

Mark Hibbs, *NuclearFuel*, 3/25/96, pp. 13-14 (14947).

4/96*

German police arrested a man for possession of 6 g of uranium. Investigators suspect that the uranium was illegally brought from Russia. Although it has not been confirmed that the stolen uranium is of Russian origin, storing radioactive materials continues to be a serious problem in Russia.

Aleksandr Kondrashov, *Argumenti i Fakti*, 4/96, p. 7 (15156).

5/96

Germany is considering a plan, presented to Chancellor Helmut Kohl by U.S. Presidential Science and Technology Advisor John Gibbons, to reprocess plutonium from Russian warheads. The plan stipulates that Russian-origin plutonium will be reprocessed into reactor-usable mixed-oxide (MOX) fuel at Siemens' partially built Hanau plant. In another report, German officials said that plutonium reprocessing equipment may be transferred from Siemens' MOX fuel fabrication plant in Hanau to Chelyabinsk-65, where the plutonium will be reprocessed.

Terence Gallagher, Reuter, 6/27/96; in Executive News Service, 6/27/96 (15610). Mark Hibbs and Ann MacLachlan, *NuclearFuel*, 6/3/96, pp. 11-13 (15511).

Russia with Germany, Hungary, Romania, Serbia, and Switzerland

3/15/96*

Romanian police caught two Serbs at the Hungarian border smuggling a radioactive isotope of osmium destined for Switzerland, which was allegedly arranged by a German. Zivorad Vranic and Aleksandr Neskovic were caught driving across the Hungarian border at Bors, near the northern Romanian town of Oradea, carrying 15 g of osmium in glass canisters. Police spokesman Marian Chirion verified that the police discovered two fax messages from Germany arranging delivery of the osmium. The Romanian newspaper *Adevarul* reported that the osmium's final destination was a buyer in Switzerland. The suspects also had in their possession another fax order from Russia requesting 20 kg of osmium.

Reuter, 3/15/96; in Executive News Service, 3/15/96 (15072). *Tanjug* (Belgrade), 3/20/96; in FBIS-TAC-95-005, 3/20/96 (15072).

Russia with:
Germany and Iran, 125
Germany, Japan, and United States, 131

Russia with Germany and Turkey

3/7/96*

Turkish police arrested five Turkish nationals attempting to sell 20 kg of smuggled uranium for DM7 million in Antal'ya, Turkey. Turkish authorities suspect that the two special containers of uranium were brought illegally from Russia. During the past three years, Turkish police have registered more than 20 attempts to smuggle nuclear materials from Russia.

Byulleten' Tsentra Obshchestvennoy Informatsii Po Atomnoy Energii, No. 6, 1996, p. 79 (15476).

Russia with Germany and United Kingdom

5/8/96

The Krasnoyarsk Kray office of the Russian Federal Security Service (FSB) arrested a 41-year-old former Russian nuclear scientist identified only as "A. S." who worked formerly at a regional scientific research institute. Another report identified the scientist as "A. Plakhov." The suspect, who was a director of a Russian commercial firm, was arrested for the illegal production and sale of 5 kg of a powder containing zirconium and hafnium to a German importer. Another report said that the scientist had exported more than 1 kg of a radioactive dual-use substance to the United Kingdom and other unnamed countries. According to information provided by the FSB, the suspect worked for a federal agency and had access to classified political and defense information. Another report stated that the FSB arrested a

metallurgist technician, not a nuclear physicist, after discovering a 1 kg discrepancy between the plant's book and physical inventories of zirconium. According to Konstantin Moryev, a spokesman for the Krasnoyarsk FSB, the total amount of material sold abroad could range from 1 kg to 10 kg. It was initially reported that the substance was a radioactive powder that could have military applications. Anatoly Samkov, head of the Krasnoyarsk branch of the FSB, was later quoted as saying that the material "was not plutonium or uranium or anything of that sort [but] a substance that might be used as a component of nuclear devices—a [heat resistant] coating [i.e., zirconium], pipe, or something like that." The FSB was alerted when it found that the substance indicated on a package's export documentation did not correspond to the material within the package. The suspect had used his own "explosion technology" to produce the material—a radioactive powder consisting of particles approaching the hardness of artificial diamonds. The material, which was originally developed and patented by a laboratory at Krasnoyarsk Technical University, had been illegally manufactured by the suspect, who used his institute's facilities and equipment. Boris Kostenko, a spokesman for the FSB, said that the suspect was charged with "illegal exports of dual-purpose materials," but not with smuggling of fissile materials (as was originally stated by another FSB spokesman). FSB officials have begun an investigation and are searching for possible collaborators in the smuggling operation.

NTV (Moscow), 5/9/96; in FBIS-SOV-96-092, 5/9/96 (15105). Anatoly Verbin, Reuter (Moscow), 5/7/96; in Executive News Service, 5/7/96 (15591). UPI (Moscow), 5/7/96; in Executive News Service, 5/7/96 (15591). Itar-Tass (Moscow), 5/8/96; in FBIS-SOV-96-091, 5/8/96 (15591). Michael Binyon and Thomas de Wall, *Times* (London), 5/8/96, p. 13; in FBIS-TAC-96-006, 5/8/96 (15113). *Rossiiskaya Gazeta*, 5/8/96, p. 1 (15054). *Moskovskiye Novosti*, 6/9/96-6/16/96, p. 2 (15324). Aleksei Tarasov, *Izvestiya*, 5/12/96, p. 2 (15475).

Russia with:
India, 123
Iran, 125
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Russia with Italy, Slovenia, Somalia, and Spain

6/96

Magistrates from Torre Annunziata, Italy, sent Russian presidential candidate Vladimir Zhirinovsky a judicial letter stating that he was under investigation for being part of an international smuggling ring dealing in weapons, plutonium, and osmium. Zhirinovsky aids allegedly acquired the Russian-origin arms from the Russian mafia. Barcelona Bishop Richard Martia Charles, Felice Maniero of Somalia, and Slovene arms dealer Nikolaj Aleksander Oman are also allegedly involved in the smuggling ring. A container holding 30 g of osmium found in a Venice bank's safety deposit box under the name of Oman's son and 3 billion lire in a bank account under Oman's name and that of Italian "criminal" Lorenzo Mazzega were uncovered. Zhirinovsky, despite being photographed in 1994 at Oman's castle in Slovenia, denies knowing the arms dealer. The investigation began when statements from former Italian secret service agent Francesco Elmo led to the discovery of the osmium and the secret bank accounts. The Vatican bank and the Roman Catholic charity "Caritas" were reportedly involved in laundering money for the smuggling ring. An international warrant has been issued by Italian judge Alfredo Ormanni for Oman's arrest.

John Phillips, *Sunday Times*, 6/16/96 (15433). Vladimir Vodusek, *Delo* (Ljubljana), 6/4/96, p. 2; in FBIS-EEU-96-112, 6/4/96 (15433). Luise Hahn, *Kurier*, 6/12/96 (15433). *Sueddeutsche Zeitung*, 6/12/96, p. 7 (15433).

Russia with Slovakia

2/1/96

Christian Democratic Movement (KDH) Deputy Chairman Mikulas Dzurinda revealed an intergovernmental deal in which Slovakia will import nuclear fuel exclusively from Russia. The so-called "Agreement on Assistance in the Completion of the First Two Units of the Mochovce (Nuclear) Power Plant" states that Russian suppliers have a monopoly on providing nuclear fuel to Slovak nuclear reactors.

Martin Kovacic, Narodna Obroda (Bratislava), 2/2/96, pp. 1-2; in FBIS-EEU-96-026, 2/2/96 (14590).

Russia with South Korea

3/27/96*

Because Russia has reportedly been disposing of nuclear waste directly into the Sea of Japan, South Korea will supply Russia with waste disposal equipment. The equipment, valued at $1 million, will include trucks, cranes, containers, and computers. According to an official from the South Korean Foreign Ministry, the aid, requested by Russia, is supposed to have been delivered by 7/96.

Reuter Insurance Briefing, 3/27/96 (15023).

Russia with Ukraine

4/5/96*

The Russian nuclear fuel company TVEL has won a contract, worth about $100 million, to build a nuclear fuel plant in Ukraine; TVEL will produce fuel assemblies for Ukraine's VVER-1000 reactors. After the uranium is enriched in Russia, the new plant will assemble nuclear fuel rods for Ukraine's VVER-1000 reactors. However, Russia must guarantee raw uranium and uranium enrichment prices or the bid will be given to the U.S. Westinghouse Electric Corporation. Under the contract, the plant will be completed in four years. It is expected that the plant will meet Ukraine's demand for fuel assemblies for 11 VVER reactors currently operating in Ukraine, as well two to four reactors under construction.

Post-Soviet Nuclear & Defense Monitor, 4/5/96, p. 14 (15344). Peter Coryn and Ann MacLachlan, *NuclearFuel*, 2/12/96, pp. 6-7 (15629). Matthew Kaminski, *Financial Times*, 2/5/96, p. 2 (14949). Unian (Kiev), 2/2/96; in BBC Monitoring Summary of World Broadcasts, 2/5/96 (15427).

6/25/96*

The Ukrainian State Atomic Committee signed a final agreement on nuclear reactor fuel with Russian fuel suppliers TVEL, Atompromkomplekt, and Atomresurs, backed by the Russian Ministry of Atomic Energy, at a meeting at the South Ukraine

nuclear power plant. Under the agreement, which followed TVEL's victory over ABB and Westinghouse in the 2/96 closed international tendering, Russia will supply Ukraine with nuclear fuel and provide uranium enrichment services at $75/kg of uranium for 10 years. TVEL agreed to be fully responsible for fuel quality and to provide necessary expertise on the fuel's use at Ukrainian power plants.

Peter Coryn, *NuclearFuel*, 6/17/96, pp. 13-14 (15617). I. Osypchuk, *Vseukrainskiye Vedomosti*, 6/11/96, p. 6; in FBIS-SOV-96-117, 6/11/96 (15617). Interfax (Moscow), 6/25/96; in FBIS-SOV-96-124, 6/25/96 (15617).

Russia with United States

2/20/96*

Convex Computer Corporation (a subsidiary of the U.S. firm Hewlett-Packard) wants to send three supercomputers, worth an estimated $8 million, to Russia. If the deal is approved by the U.S. Department of Commerce, two computers will be sent to the Russian nuclear weapons laboratories in Arzamas-16 and one computer to the nuclear laboratory at Chelyabinsk-70. All three of the computers operate faster than any computer currently in Russia. The two computers for Arzamas-16, worth $1.5 and $2.6 million, operate at 1,600 and 1,800 million operations per second (MOPS), while the computer for Chelyabinsk-70, worth $3.8 million, operates at 4,500 MOPS. Some officials are concerned that these supercomputers may be used to further develop Russia's nuclear arsenal. However, Convex maintains that the supercomputers will only be used for peaceful research. In addition, an inspection procedure will reportedly prevent Russia from using the computers for military-related research. Convex has argued that the supercomputers are needed to carry out existing U.S. Department of Energy (DOE) contracts that authorize cooperation between Russian and U.S. nuclear weapon laboratories.

Risk Report, 3/96, pp. 1, 12 (14945). Gary Milhollin, *New York Times*, 2/20/96, p. A15 (14945).

2/22/96

Director General of Teksnabexport Albert Shishkin said that in 1996, Russia will ship 360 MT of LEU blended down from 12 MT of weapons grade uranium to the U.S. Enrichment Corporation (USEC). The shipments are in accordance with the 1/94 USEC-Teksnabexport agreement, which stipulates that Russia supply LEU blended down from highly enriched uranium (HEU) to USEC for 20 years. According to USEC reports, the first 1996 shipment is scheduled to leave Russia in 2/96; the 1996 LEU total is expected to be 371 MT. According to U.S. Department of Energy spokesman Michael Newlin, it is expected that 12 MT of HEU will be sold to the U.S. in 1996.

Segodnya, 4/18/96, p. 1 (15061). Michael Knapik, *NuclearFuel*, 2/12/96, p. 9 (15402). Interfax (Moscow), 2/22/96; in FBIS-SOV-96-037, 2/22/96 (15402). *Kommersant-Daily*, 2/23/96, p. 4; in WPS, 2/28/96, p. 4 (14536).

4/96*

The U.S. has received shipments of LEU blended down from 8.7 MT of Russian HEU and will receive additional LEU blended down from 9.4 MT of Russian HEU by the end of 1996.

Craig Cerniello, *Arms Control Today*, 4/96, p. 20 (15485).

6/96*

The U.S. State Department announced that the U.S. is no longer maintaining its policy of denying license applications for the export of defense-related items and services to Russia. Russia will be removed from the list of prohibited destinations in section 126.1 of the International Traffic in Arms Regulations. Every case of defense-related exports to Russia will be considered "on a case-by-case basis with a presumption of approval."

The Export Practitioner, 6/96, p. 21 (15411).

6/96*

The Russian Joint Institute for Nuclear Research in Dubna is facing severe financial difficulties and physicists are leaving the center in order to make a living. Many scientists have emigrated to the U.S. and elsewhere in the West, while those who remain in Dubna are trying to find jobs in the private sector.

Aleksandr Dobrovolski, *Argumenti i Fakti*, 6/96, p. 4 (15202).

6/96

U.S. researchers at Lawrence Livermore National Laboratory developed key elements for the Advanced Recovery and Integrated Extraction System (ARIES), which will be shared with Russia to facilitate mutual nuclear stockpile reductions. The basic system includes five steps that remove plutonium from the "pits" of nuclear weapons and repackages it as an oxide powder or a metal ingot for eventual disposal. By destroying the pits, this process reduces the number of stockpiled nuclear weapon pits, and reduces the waste caused by dismantlement.

Science & Technology Review, 6/96, p. 2 (15347).

SLOVAKIA

Slovakia with Austria and Germany

5/29/96

German police arrested a 49-year-old Slovakian nuclear engineer in Ulm, Germany, where the suspect was storing 2.77 kg of low-enriched uranium (LEU) packaged in lead containers in a safe deposit box of a local bank. It is suspected that the smuggler, in concert with two accomplices, brought the uranium from the former Soviet Union to Germany intending to sell it later to an unidentified Austrian customer for about $1 million. The confiscated material, which was analyzed at the European Institute for Transuranium in Karlsruhe, Germany, consisted of 1.737 kg of natural uranium oxide powder and 946 g of 4.3 percent enriched uranium fuel pellets. An additional technical analysis will be required to determine definitively whether the material is suitable for weapons use. According to Interpol representatives, the uranium fuel pellets were intended for use in VVER-1000 type reactors. Investigators are more certain about the ex-Soviet origin of the fuel pellets portion of the contraband than about the origin of the contraband's remaining part. German police were tipped off to the deal by their Austrian counterparts, who discovered that the Slovakian national intended to sell the nuclear material as weapons grade uranium. The belief that the source of the uranium was the former Soviet Union was supported by evidence that the suspect had spent time

there.

EMP (Munich), 6/7/96 (15593). Mark Hibbs, *Nucleonics Week*, 6/13/96, pp. 2-3 (15593). U.S. Department of Energy's *Monthly Status Report: Illicit Trafficking of Nuclear Materials*, 6/96, p. 3 (15593).

SOUTH AFRICA

Internal Developments

2/23/96*

According to a report by RAND's National Defense Research Institute, using current fissile material stocks, South Africa could build 47 nuclear weapons. By the mid-1990s, it is anticipated that South Africa will possess enough fissile material to build 67 bombs per year.

Brain Chow, Richard Speier, and Gregory Jones, *The Proposed Fissile-Material Production Cutoff; Next Steps* (Santa Monica, Calif.: RAND, 1995), pp. 9, 13.

3/2/96*

South Africa's Atomic Energy Corporation (AEC) announced that it was unable to locate 2 MT of depleted uranium at the Pelindaba nuclear facility. During a press conference, AEC Chief Executive Officer Waldo Stumpf stated that the loss had been discovered while conducting an inventory, and speculated that the uranium may have been inadvertently buried within a nuclear condenser on Pelindaba's "Radiation Hill."

SABC SAfm Radio (Johannesburg), 3/2/96; in BBC Monitoring Service, 3/12/96 (14888).

3/20/96

South African Mineral and Energy Affairs Minister Pik Botha announced that the dismantlement of the uranium enrichment plants at Pelindaba will be nearly complete by 3/99. Botha indicated that the majority of the work at the AEC facility would be finished by 3/99, but that decontaminating the equipment might take an additional one or two years.

SAPA (Johannesburg), 3/20/96; in BBC Monitoring Service, 3/20/96 (14883).

South Africa with France

2/29/96

South Africa and France signed an agreement to cooperate on the development of South Africa's molecular laser isotope separation (MLIS) process. According to South Africa's Mineral and Energy Affairs Minister Pik Botha, the French company Cogema will invest $21.5 million in the South African technology, subject to "intergovernmental agreements being reached on nuclear cooperation and trade." According to Cogema Vice President for R&D Louis Patarin, South Africa's AEC has projected an annual budget of $13 million, and Cogema will support half of the project's expenditures over a three-year period. Prior to proceeding, however, both the IAEA and EURATOM must be informed about the project due to the "sensitive nature of international cooperation on uranium enrichment technology." Patarin also indicated that the AEC initially approached Cogema with a proposal to build a "micro-pilot" facility to conduct the final phases of the R&D project. The initial goal of the AEC was to construct a facility "capable of a nominal annual throughput of 10,000 SWU."

Ann MacLachlan, *NuclearFuel*, 3/11/96, pp. 4-5 (15256). Lynda Loxton, Reuter, 2/29/96; in Executive News Service, 2/29/96 (15256).

South Africa with:

Iran, 126

South Africa with United States

4/22/96*

U.S. officials are prepared to exchange diplomatic notes to finalize a U.S.-South African nuclear cooperation agreement, following the completion of a review by the South African Parliament.

Kathleen Hart, *NuclearFuel*, 4/22/96, pp. 6-7 (14887).

SOUTH KOREA

Internal Developments

1/96

Korea Electric Power Company (KEPCO) unveiled a new development program outlining South Korean plans to have 27 nuclear power plants in operation by 2010. The plan calls for 19 new units to be built between 1995 and 2010. Twelve of the new units will be based on the 1,000 MW standard Korean pressurized water reactor (PWR) design, which is itself based on Westinghouse's System 80 design. Yonggwang 3 and 4, which started up in 3/95 and 1/96 respectively, and Ulchin 3 and 4, which are currently under construction, account for four of these Korean PWRs. Four of the remaining eight units will be split between Yonggwang and Ulchin; the sites for the final four have not yet been determined. Three new units will be 700 MW pressurized heavy water reactors (PHWR) supplied by Atomic Energy of Canada. Already under construction, these PHWRs will be located at Wolsong. Four new units will be the 1,300 MW Korean Next Generation Reactor (KNGR), Korea's second standard PWR model. The decision to undertake design of a new generation reactor was reportedly made in 1995. These KNGRs will be divided between two sites, only one of which has been determined. It is also possible that two of the Korean PWR units may instead be two 900 MW PHWRs scheduled to go on line in 2005 and 2006. A feasibility study is being conducted prior to a final decision being made on this aspect of the program. The total of 27 units referred to in the program does not include the nuclear power plant at Kori, which is expected to shut down in 2009.

Nuclear Engineering International, 3/96, p. 2 (14667).

4/2/96

South Korea acceded to the Wassenaar Arrangement in Vienna, Austria. Designed to replace COCOM, the Wassenaar Arrangement restricts the export of defense technolo-

gies and dual-use items which could be sent to countries outside of its membership.

Yohnap (Seoul); in FBIS-EAS-96-064, 4/1/96 (14874).

6/25/96

South Korean Atomic Energy Commission Head, Deputy Premier, and Finance and Economy Minister Rha Woong-bae announced that atomic energy projects previously managed now the Ministry of Science and Technology are to be managed by the Ministry of Trade, Industry, and Energy. Responsibility for radioactive waste materials will be transferred from the Science and Technology Ministry's Atomic Energy Research Institute to the Ministry of Trade, Industry, and Energy's Korean Electric Power Corp. (KEPCO). The existing radioactive waste material fund will be replaced by an 84 billion won KEPCO "Atomic Energy Research- Development" fund. Atomic reactor planning will be handled by the Korean Electric Power Technology Co.

Korean Overseas Information Service, 6/26/96 (15526).

SOUTH KOREA WITH:

Argentina and Canada, 112
Australia, Indonesia, and Japan, 123
India, 123
North Korea, 135
Russia, 140

SPAIN

INTERNAL DEVELOPMENTS

4/96*

Spain's Empresion Nacional del Uranio, S.A. (ENUSA) oversees all nuclear fuel cycle development, including the "production, procurement and management of supplies of uranium concentrates, conversion and enrichment services, as well as manufacturing of fuel assemblies" for Spain's nuclear power plants. ENUSA oversees the design and manufacture of boiling water reactor (BWR) and pressurized water reactor (PWR) fuel assemblies. Spain's TENEO owns 60 percent of ENUSA shares, and the Research Center for Energy, Environment, and Technology controls 40 percent. ENUSA's Juzbado fuel fabrication plant has an annual capacity of 200 MT of uranium and could be upgraded to produce an additional 500 MT. With the exception of the 1,066 MWe Trillo-1 PWR, all Spanish nuclear power plants receive their fuel from the Juzbado facility.

Nukem, 4/96, p. 8 (15186).

SPAIN WITH:

Italy, Russia, Slovenia, and Somalia, 140

SPAIN WITH UNITED STATES

5/96*

Edlow International was issued a license by the U.S. Nuclear Regulatory Commission (NRC) to export low-enriched uranium (LEU) to Spain for reactor fuel.

Nuclear Regulatory Commission, 6/96 (15604).

TAIWAN

INTERNAL DEVELOPMENTS

5/96*

Taiwan's Radwaste Administration (RWA) has been renamed the Fuel Cycle & Material Administration (FCMA) and has been assigned new duties including "licensing, regulating and inspecting materials at all stages of the nuclear fuel [cycle]," in addition to controlling other radioactive materials. Taiwan's FCMA will also be responsible for all aspects of any "relevant facilities." RWA Chief S. T. Chiou will remain as director of the FCMA, while C. H. Len, former deputy head of isotope application at the Institute of Nuclear Energy, will become the deputy head of FCMA.

Nuclear Europe Worldscan, 5\96-6\96, p. 29 (15570).

7/1/96

An official of Taiwan's Atomic Energy Council said that Taiwan was planning to reopen the Taiwan Research Reactor for use in scientific experiments, medical equipment manufacture, and nuclear power technology development. The official said that the Atomic Energy Council was trying to obtain $4.1 billion to reopen the reactor, which had been shut down in the late 1980s after suspicions arose that Taiwan was developing nuclear weapons. The Atomic Energy Council must first receive approval from parliament (the Yuan) and the cabinet.

Reuter; in Executive News Service, 7/1/96 (15607).

TAIWAN WITH AUSTRALIA AND UNITED STATES

6/17/96*

Taiwan Power Co. has sought bids from numerous international companies for uranium for the years 1997 to 2004. Taiwan is particularly interested in buying from Australia, and is reportedly seeking 100,000 pounds per year from the U.S.

NuclearFuel, 6/17/96, p. 2 (15529).

TAIWAN WITH:

Bulgaria, Germany, Russia, and Ukraine, 137
China, 119

UKRAINE

INTERNAL DEVELOPMENTS

3/13/96*

A "radioactive supply unit" of cesium-137 was stolen from the Ammonium Phosphate Fertilizer Production Workshop No. 1 at the Pridneprovskiy chemical plant in Dneprodzerzhinsk, Ukraine. An investigation is being conducted by the security service, the Ministry of Internal Affairs, and the Prosecutor General's Office.

Unian (Kiev), 3/13/96; in FBIS-TAC-95-005, 3/13/96 (14926).