

**Princeton University
Woodrow Wilson School of Public and International Affairs
Graduate Program**

POLICY WORKSHOP 591f

**Stemming Proliferation of Enrichment & Reprocessing Plants
(WWS-591f, Fall 2005)**

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**Sessions: Mondays, 1:00-4:00 PM
Room ??, Robertson Hall**

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Background

Claiming that it wishes to produce low-enriched uranium (LEU) containing about 4 percent chain-reacting U-235 fuel for nuclear-power reactors, Iran appears determined to build a centrifuge enrichment plant that will be inherently capable to also produce weapon-grade uranium containing more than 90% U-235 for nuclear weapons.

Iran's 18-year clandestine enrichment efforts – which were exposed to the world in August 2002 by the National Council of Resistance of Iran and subsequently unraveled by the International Atomic Energy Agency (IAEA)¹ – have focused attention on the fact that Article IV of the Nonproliferation Treaty (NPT) gives non-weapon-state parties “the inalienable right” to enjoy the benefits of the peaceful uses of nuclear energy. Although the Iranians interpret Article IV as entitling them to build enrichment and other sensitive “fuel cycle” facilities as long as those facilities are placed under IAEA verification, no such right is explicitly contained in the NPT.

An enrichment capability would give a party with an ostensibly peaceful enrichment program the options of either: (a) using the technology mastered in its overt enrichment program to build a parallel covert program, or (b) using the NPT's withdrawal clause to terminate IAEA safeguards and enrich either natural uranium (0.7 % U-235) or already produced LEU to weapons-grade for use in nuclear weapons.

Reprocessing plants, which are used to separate plutonium out of spent nuclear fuel, create a similar problem. On the one hand, plutonium separated from spent fuel can be mixed with uranium and recycled as fuel for nuclear power reactors. On the other hand, the recovered plutonium can be used to make nuclear weapons. Fortunately, plutonium recycle is not economical. However, a number of countries are pursuing it

¹ See the series of IAEA reports at www.iaea.org/NewsCenter/Focus/IaeaIran/index.shtml. For commercial satellite images and analysis see also www.isis-online.org/publications/iran/index.html.

anyway as an alternative to confronting local “not in my back yard” (NIMBY) opposition to the siting of interim spent-fuel storage facilities or underground spent-fuel repositories.

Thus far, among the non-nuclear-weapon states, only Japan has both enrichment and reprocessing facilities. However, Brazil, the Netherlands, Germany and South Africa have enrichment facilities. (Brazil’s program was originally started to provide fuel for its naval-reactor and now-abandoned nuclear-weapons program. South Africa’s provided weapon-grade uranium for its now-abandoned nuclear-weapons program as well as its nuclear-power program.)

Various proposals for curbing the spread of fuel cycle capabilities under national control have been put forward since the beginning of the nuclear era, starting with the 1946 Acheson-Lilienthal report, but none so far has gained wide international support. In February 2004, President Bush proposed a plan that, with a few exceptions, would prohibit fuel cycle capabilities “to any state that does not already possess full-scale, functioning enrichment and reprocessing plants,” (e.g., Iran). In exchange, states that do not have enrichment plants would be guaranteed reliable access to civilian reactor fuel by states that do.² The proposal was widely attacked as making the NPT regime, which reserves the right to possess nuclear weapons to five states (the U.S., Russia, U.K., France and China³) even more discriminatory. To buy some time for international consideration of new approaches and to address concerns about discrimination, IAEA Director General Mohamed ElBaradei proposed a five-year moratorium on construction of new enrichment and reprocessing facilities that would apply to all countries regardless of whether they already possessed such facilities. But this proposal has been criticized by a number of countries, including some with existing facilities that have plans for new or replacement capacities (e.g., the U.S., France, Japan).⁴

ElBaradei also proposed and convened an expert committee to study once again and report on the idea of multinational fuel-cycle facilities as an alternative to national facilities.⁵ This proposal too has been criticized, including by the U.S. and also by URENCO, an existing multi-national (British-Dutch-German) enrichment company.⁶

With the May 2005 NPT Review Conference unable to resolve the issue and the North Korean and Iranian nuclear standoffs persisting, the global nonproliferation regime is in danger of unraveling.

The Task

² The White House, “Fact Sheet: Strengthening International Efforts Against WMD Proliferation,” February 11, 2004, at www.whitehouse.gov/news/releases/2004/02/20040211-5.html

³ Israel, India, Pakistan and North Korea are not parties to the NPT.

⁴ See e.g. “Japan cool to Elbaradei proposal for fissile material moratorium” by Mark Hibbs, *Nuclear Fuel*, April 25, 2005, available via LexisNexis.

⁵ See *Multilateral approaches to the nuclear fuel cycle: Expert group report submitted to the Director General of the International Atomic Energy Agency*, IAEA, INFCIRC 640, 2005, available on the www.iaea.org.

⁶ “Skepticism of MNAs” by Dan Horner, *Nuclear Fuel*, April 25, 2005.

Against this real-world background, the policy workshop starts with the premise that the U.S. National Security Advisor has directed that an interagency task force develop a strategy for discouraging the spread of enrichment and other sensitive fuel cycle capabilities to additional countries. The task force is instructed to examine approaches applicable globally, country-specific approaches applicable to individual cases, and a combination of the two. The findings and recommendations of the task force will be presented to senior U.S. Government officials and representatives of the IAEA and other concerned governments at the conclusion of the workshop. Einhorn (formerly Assistant Secretary of State for Nonproliferation) and von Hippel (formerly Assistant Director for National Security in the White House Office of Science and Technology Policy) will assume the roles of senior USG officials in providing guidance to task force members

Initial briefings and background readings will be provided during weeks 1-4. Workshop participants are urged to do as much reading as possible in advance. There may also be day trips for meetings with key experts in the foreign missions to the U.N. and officials and analysts in Washington and New York. Each task force member will research and write a 4-5,000 word well-referenced background paper on one of the key components of the overall problem to be presented using Powerpoint to the rest of the group during weeks 5 and 6. Among these components are:

- 1) Global uranium-enrichment supply and demand, taking into account other sources of fuel such as excess weapons materials, plans for new facilities, and likely growth of nuclear energy worldwide and by country over the next 25 years and how it will affect the demand for additional fuel cycle capabilities;
- 2) The “back end” of the fuel cycle. It is a proliferation problem to leave spent fuel, which contains large quantities of plutonium indefinitely in large numbers of countries. Also, anti-nuclear movements have made it difficult to site interim spent-fuel storage. This has given rise to interest in international solutions and reprocessing and plutonium recycle, which makes plutonium more accessible.
- 3) The effectiveness of current and possible future IAEA verification measures in providing assurance that enrichment and reprocessing facilities are not being used for nuclear weapons purposes and in detecting possible clandestine facilities.
- 4) The effectiveness of measures to deny transfers of equipment, material, and technology (the Nuclear Suppliers Group, Proliferation Security Initiative, United Nations Security Council resolution 1540) in slowing or blocking acquisition of enrichment and reprocessing capabilities, and the potential of future private suppliers’ networks of the type developed by A.Q. Khan for bypassing these controls.
- 5) Approaches involving multilateral fuel supply guarantees and favorable pricing of fuel cycle services to encourage countries to forgo national fuel cycle capabilities.
- 6) Alternative approaches to multinational ownership and operation of fuel-cycle facilities as an alternative to national control of fuel cycle facilities.

- 7) Iran's motives for acquiring enrichment and other fuel cycle capabilities and prospects for persuading Iran to give up indigenous capabilities.
- 8) Brazil's enrichment program, whether it is prepared to defer, abandon, or modify its program in response to international concerns and the complications associated with its naval-reactor program.
- 9) Japan's fuel cycle plans and whether it is willing to adjust those plans as part of global efforts to develop new approaches to the fuel cycle.
- 10) U.S. fuel cycle plans, including industry attitudes toward the proposal for a 5-year moratorium on new facilities.
- 11) Attitudes of other advanced countries toward international fuel cycle arrangements and moratorium proposals, including the Russia, France, the UK, Canada, and Australia. (Canada and Australia are the world's leading suppliers of natural uranium and have both toyed with the idea of acquiring enrichment plants to add value to their exports.)

During break week groups of three to five task force members will travel to various foreign destinations (e.g. Tokyo, Brasilia, Vienna -- and Teheran if visas can be obtained) that would enable them to conduct interviews and gather information relevant to their study.

Weeks 7-12 would be devoted to a collective effort by the task force to develop a coherent joint report (10-20 pages plus appendices) and a Powerpoint presentation for use in briefing key target audiences.

At the end of the workshop, the entire task force will travel to Washington to present its findings and recommendations to relevant audiences, particularly senior U.S. Government officials at the National Security Council and the State and Energy Departments.

Student taskforce members

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[Joey Bristol, MPA2, jbristol@Princeton.EDU -- spending 2005-6 in China?]

Readings.

Background: All students are urged to buy a copy of *Deadly Arsenals: Nuclear, Biological and Chemical Threats, 2nd edition* by Joseph Cirincione, Jon B. Wolfsthal and Miriam Rajkumar (Carnegie Endowment, 2005) order from www.carnegieendowment.org/npp/. Read quickly the nuclear parts of chapters:

- 1 "Global trends"
 2. "The international nonproliferation regime"
 3. "Nuclear weapons and materials"
 - 12, "Pakistan"
 15. "Iran"
 16. "Libya"
 19. "Argentina"
 20. "Brazil"
 21. "South Africa" and
- Appendix A. "The Treaty on the Non-proliferation of Nuclear Weapons"
Appendix D. "Nuclear supplier organizations."

Uranium Enrichment and Nuclear Weapon Proliferation by Allan S. Krass, Peter Boskma, Boelie Elzen and Wim A. Smit (Taylor and Francis/ Stockholm International Peace Research Institute, 1983, out of print, sections will be scanned). See especially chapter 2.IV. "Incentives and motivations," pp. 27-40; Chapter 3, "Options for control," pp. 41-80; chapter 4. "Conclusions and recommendations," pp. 81-91; chapter 7. "A history of non-proliferation efforts" (pp. 193-210).

Articles. Those not on the web will be put on electronic reserve.

The Future of Nuclear Energy (MIT, 2003), <http://web.mit.edu/nuclearpower/>

"**The gas centrifuge**" by Donald Olander, *Scientific American*, August 1978, pp. 37-43 (scanned copy will be available on electronic reserve).

"**The Reprocessing of Nuclear Fuels,**" William Bebbington, *Scientific American*, December 1976 (scanned copy will be available on electronic reserve).

"**The nuclear non-proliferation regime: back to the future?**" by John Simpson, *Disarmament Forum 2004*, #1, pp. 5-17, http://www.unidir.ch/bdd/fiche-article.php?ref_article=2015

Giving up nuclear weapons: lessons learned from the past, by José Goldemberg, Guest Editorial, based on a presentation to the Sandia National Laboratories Fourteenth International Security Conference, "Strengthening the Nuclear Nonproliferation Regime: Focus on the Civilian Nuclear Fuel Cycle," April 4-6, 2005, Chantilly, Virginia (electronic copy will be available on electronic reserve).

"The NPT and Plutonium," Nuclear Control Institute legal memorandum, 1984, revised 1993 by Eldon Greenberg about the balance between Articles IV and Articles I and II of the NPT, www.nci.org

Presentation by Iran's UN Ambassador Zarif at the Liechtenstein Colloquium on "Iran's Security Challenges and the Region," March, 2005 (copy to be available on electronic reserve).

"Unravelling the AQ Khan Network and Future Proliferation Networks" by David Albright and Corey Hinderstein, *The Washington Quarterly*, Spring 2005
http://www.twq.com/05spring/docs/05spring_albright.pdf

Alternatives to national fuel-cycle facilities:

A Report on the International Control of Atomic Energy prepared for the Secretary of State's Committee on Atomic Energy by a Board of Consultants Chester I. Barnard, J.R. Oppenheimer, Charles A. Thomas, Harry A. Winne, and David E. Lilienthal, chairman, March 16, 1946, <http://www.learnworld.com/ZNW/LWText.Acheson-Lilienthal.html>.

"The Nuclear Fuel Cycle: A challenge for nonproliferation" by Lawrence Scheinman, *Disarmament Diplomacy* 76, March/April 2004,
<http://www.acronym.org.uk/dd/dd76/76ls.htm> (reprint with foreword from "Multinational alternatives and nuclear non-proliferation" in *International Organization* 35, #1 (Winter, 1981), pp. 77-102.

Mohamed ElBaradei "Towards a Safer World," *Economist*, October 16, 2003.
<http://www.iaea.org/NewsCenter/Statements/2003/ebTE20031016.shtml>

President Bush's speech at the National Defense University, February 11, 2004.
<http://www.whitehouse.gov/news/releases/2004/02/print/20040211-4.html>

"The Bush Administration's Forward Strategy for Nonproliferation," John R. Bolton, Address to the American Enterprise Institute, June 24, 2004.
<http://www.state.gov/t/us/rm/37251.htm>

"NPT Article IV: Peaceful Uses of Nuclear Energy," Christopher Ford, Statement to the 2005 Review Conference of the Treaty on the Nonproliferation of Nuclear Weapons, May 18, 2005. <http://www.state.gov/t/vc/rls/rm/46604.htm>

"The Proliferation Challenge of the Nuclear Fuel Cycle in Non-Nuclear Weapon State," Pierre Goldschmidt, Statement of 26 April 2004.
<http://www.iaea.org/PrinterFriendly/NewsCenter/Statements/DDGs/2004/goldschmidt26042004.html>

"The Nuclear Fuel Cycle: Is It Time for a Multilateral Approach?" Tariq Rauf and Fiona Simpson, *Arms Control Today*, Volume 34, Number 10, December 2004,
http://www.armscontrol.org/act/2004_12/Rauf.asp

Multilateral approaches to the nuclear fuel cycle: Expert group report submitted to the Director General of the International Atomic Energy Agency, INFCIRC/640, February 2005, [www.iaea.org/Publications/ Documents/Infcircs/2005/infcirc640.pdf](http://www.iaea.org/Publications/Documents/Infcircs/2005/infcirc640.pdf)

G8 GlenEagles Statement on Nonproliferation, July 8, 2005, see esp. paras 13 & 14, [www.fco.gov.uk/Files/kfile/ PostG8_Gleneagles_CounterProliferation.pdf](http://www.fco.gov.uk/Files/kfile/PostG8_Gleneagles_CounterProliferation.pdf)

“Making the World Safe for Nuclear Energy,” John Deutch, Arnold Kanter, Ernest Moniz, and Daniel Poneman. *Survival*, vol. 46, no. 4, Winter 2004-05, pp. 65-80 (will be put on electronic reserve).