remain visions. The same lack of trust inherent in international relations that creates the need prevents visionary solutions. Again, the proponents of nuclear disarmament have not begun to suggest how this sturdy barrier to the realization of their vision and like visions in past centuries could be brought down while maintaining our security and the security of our allies. We all would like to hear and to believe.

Ronald Reagan was a proponent of a non-nuclear vision; he also repeated the motto "trust but verify" and understood that concomitant conditions such as the realization of highly effective active defenses had to precede the vision. If his vision is to be brandished now in his absence, it should be brandished in its entirety.

John S. Foster, Jr., is Chairman of the Board of GKN Aerospace Transparency Systems. He was the Director of the Lawrence Livermore National Laboratory (1961-1965) and then Director of Defense Research and Engineering (1965-1973). An officer of TRW and served on its Board (1973-1994). Served on the President's Foreign Intelligence Advisory Committee (1973-1990) and is a member of the Defense Science Board, which he chaired (1990-1993). Currently consults for the DoD, DoE, U.S. Senate and corporations.

Dr. Keith B. Payne is the Head of Missouri State University's Graduate Department of Defense and Strategic Studies, located in the Washington D.C. metropolitan area. He is the President and co-founder of the National Institute for Public Policy, a non-profit "think tank" established in 1981, and the editor-in-chief of Comparative Strategy,an international journal. He is the author of numerous published books and articles on the subjects of nuclear policy, deterrence and arms control. He contributed heavily to the 2001 Nuclear Posture Review and served in the George W. Bush Administration as Deputy Assistant Secretary of Defense for Forces Policy. He is a member of the Department of State's International Security Advisory Board, chairs the Policy Panel of U.S. Strategic Command's Senior Advisory Group, and co-chairs the Nuclear Strategy Forum. Dr. Payne's forthcoming book is entitled, On Deterrence and Defense: After the Cold War (National Institute Press, 2008).

Footnotes

[1] *See for example, George P. Shultz, William J. Perry, Henry A. Kissinger, and Sam Nunn, "A World Free of Nuclear Weapons," Wall Street Journal, January 4, 2007, p. 15; and, Wolfgang Panofsky, "Nuclear Insecurity: Correcting Washington's Dangerous Posture," Foreign Affairs Vol. 86, No. 5 (September/October 2007).*

[2] *Panofsky, Ibid., p.109-110.*

[3] *Winston Churchill, quoted in a speech by British Prime Minister Margaret Thatcher to a joint meeting of the U.S. Congress, February 20, 1985, available at, http://www.margaretthatcher.org/speeches/displaydocument.*

[4] *General Account Office, Operation Desert Storm: Evaluation of the Air Campaign, GAO/NSIAD-98-134 (Washington D.C.: General Accounting Office, June 1997), p.198.*

[5] *Harold P. Smith, Assistant to the Secretary o*

Nuclear Fuel Banks: A View From the South

Fernando de Souza-Barros

Summary

Recently, at the World Economic Forum of January 2007 in Davos, Switzerland, the director general of the International Atomic Energy Agency, IAEA, Mohamed ElBaradei, called once again the attention of the international community to the mounting challenges to stopping the proliferation of nuclear weapons and the urgent need for a new and stronger security framework. ElBaradei´s proposal of this new framework that could provide nuclear fuel supply worldwide will be briefly described in this note. The key point of the proposal is the multinational control of nuclear fuel production. The long history of proposals of these production centers – here identified as nuclear fuel banks – is not the scope of this note. One of its key aspects is the issue of their centralization versus the Article IV of the Non-Proliferation Treaty granting indigenous nuclear fuel-cycle developments. A gradual regionalization approach that would include these production plants needs be considered since overly centralized production of nuclear fuel would hardly achieve worldwide consensus. This consensus is identified by ElBaradei as a necessary condition for the implementations of a new framework for multinational control of fuel centers. If nuclear-fuel banks could be implemented, despite their unavoidable perils due to the expected increase of nuclear enrichment of Uranium-235, and of nuclear waste, capital costs of nuclear installations would be more rational, security aspects maximized, and their built-in safeguards against proliferation could overcome the limitations of the current practices. Moreover, as pointed out in the original proposal (ElBaradei, 2003a&b), these multinational nuclear installations would benefit countries with economic and technological limitations, eliminating the major justification to start indigenous nuclear programs and the current incentives for the international black-market of nuclear technology. In this note, however, other pressing world demands requiring equally strong and fully committed international cooperation will also be discussed. Unhappily, the political trends that are likely consolidating in the 21st Century are sending the implementation of these initiatives beyond any credible time horizon.

Introduction

The North Korean test of a nuclear device and the recent success of the nuclear enrichment program in Iran brought a new impetus to the proposals for new ways to establish effi-

cient worldwide control of nuclear fuel enrichment and spent fuel reprocessing. Overall, these achievements reinforce a new trend in the acquisition and deployment of small but politically relevant nuclear arsenals, namely that they are unrelated to any high-level threshold of technological developments.

The initial discussions of international nuclear fuels centers date back to 1940´s with the 1946 Acheson-Lilienthal report (see Scheinman, 2007, for historical details). However, in that same year, a US Atomic Energy Act and the start of the Cold War blocked concrete international initiatives until the 1960´s. One should note that the Atoms for Peace policy for international cooperation was proposed by the US in 1954. This policy fostered research centers on nuclear technology in countries of the Western block conditioned on a bilateral agreement basis: the research reactors commissioned in these centers would have their highly enriched U-235 supplied by the US.

The 1968 nuclear non-proliferation treaty, NPT, preserved the Cold War scenario with the official recognition of the nuclear arsenals of five nations, but granting that non-nuclear nations have the right to develop nuclear technologies for peaceful applications (Article IV). Since the advent of the NPT, however, five other nations have developed the complete fuel cycle technology – and now have nuclear arsenals – and about forty other nations can acquire this capability if they wanted to make that political decision.

Currently, two major approaches for the implementation of these nuclear fuel centers are gaining the attention of the international community: the US proposal for a Global Nuclear Energy Partnership (GNEP) and the Multinational Control of Nuclear Facilities – here recognized as ElBaradei´s proposal.

GNEP´s guidelines are: (i) promoting the international use of nuclear energy with proliferation-resistant recycling of spent fuel and the development of advanced reactors; and (ii) the establishment of a consortium of nuclear facilities capable of delivering cost-effective nuclear fuel and providing assurances of supplies to nations willing to discard indigenous nuclear-fuel production. These proposals were discussed – among several others – in a recent meeting at the IAEA headquarters in Vienna. The proposal of May 2006 made by six nuclear suppliers to establish a mechanism to ensure fuel reserves under the IAEA conforms with the GNEP i.e., eligible countries would renounce fuel-cycle activities (Meier, 2006). However, the reports on these discussions also disclose that various countries, including Argentina, Australia, Brazil, and South Africa, have expressed their intent to have their own nuclear fuel production (Pomper, 2006).

ElBaradei´s guidelines shall be described in the next section. Briefly, the stepwise implementation of multilateral control of nuclear fuel production does not proscribe states from having nuclear capabilities, upholding the Article IV of the NPT (see Schelman, 2007).

The background elements for multilateral nuclear suppliers

On October 16th, 2003, ElBaradei published an op-ed in *The Economist* entitled "Towards a Safer World" (ElBaradei, 2003a). The candid appraisal of present-day nuclear affairs made by the director general of the IAEA had a great impact. Although stressing the importance for states' adherence to the obligations of the Nuclear Proliferation Treaty, NPT, ElBaradei recognized that only a new legal framework would meet the nuclear treats and realities of the 21st century. This assessment was based on the following considerations: "(a) the present nuclear-arms-control regime is looking battered; (b) any reform of that regime must begin by conceiving a framework of collective security that does not rely on nuclear deterrence; (c) the technical barriers to designing weapons and to mastering the processing steps have eroded with time." It must be acknowledged that at present there are no major impediments to acquiring the basic know-how to process spent nuclear fuel and manufacture crude weapons, the only requirement being that of making it a national priority (Souza-Barros, 2006). The objectives of ElBaradei's guidelines can be summarized as follows (ElBaradei, 2005): (a) to limit the processing of weapon-usable material (separated plutonium and high-enriched uranium) to facilities under multinational control; (b) to insure that nuclear-energy systems that are deployed, by design, avoid the use of materials that may be applied directly to making nuclear weapons; (c) to place spent fuel and radioactive waste under multinational management.

The first institutional assessment of ElBaradei's proposed guidelines took place in February 2004 at the IAEA headquarters. It was an international seminar on "innovative approaches to nuclear non-proliferation and the nuclear fuel cycle" (Rapporteur´s Report, 2004). In the open session ElBaradei reaffirmed his view that urgent action and stronger laws are needed to close serious gaps in controls on exports of sensitive nuclear material and equipment. He also emphasized that "it is time to limit the processing of weapon-usable material (separated plutonium and high-enriched uranium) in civilian nuclear programs, as well as the production of new material through reprocessing and enrichment, by agreeing to restrict these operations exclusively to facilities under multinational control".

Based on the conclusions of the 2004's seminar, the IAEA appointed an expert group to appraise existing proposals (Multilateral Nuclear Approaches, MNAs). The MNA report (IAEA INFCIRC/640) emphasized that the dominant guide-

lines in the conception of multinational fuel banks should be (i) assurance of non-proliferation; and (ii) assurance of supply and services. A time consideration in INFCIRC/640 is the need for "devising effective mechanisms for assurances of supply of material and services, commercially competitive, free of monopolies, of political constraints, and including backup sources of supply".1 As discussed below, one way of addressing these supply assurances is to have a network of nuclear-fuel banks.

The current status of multilateral nuclear approaches

Last September 2006 a special meeting was held in the Vienna Agency to appraise recent alternative approaches for nuclear fuel supply (Pomper, 2006). The present status of ElBaradei´s proposal is such that the discussion on feasible mechanisms for the new framework still awaits the legitimacy that can only be granted by a forum of all nations. The many constraints for multilateral nuclear partnerships that should be focused in this forum are beyond the scope of this note and can be found elsewhere (Buckley, 2006, Braun, 2006; Dhanapala, 2003; Scheinman, 1981). There also exist difficult technical questions that must be faced(Braun, 2006). For instance, the actual diversity of nuclear reactors raises the valid question of what can be regarded as a viable supply of enriched material. It might be concluded that the ultimate viable supply could only be low enriched Uranium (LEU) in either UF6 or UO2 forms. What would constitute practical assurances of obtaining this material? Should IAEA manage supply assurance programs? Is there a consensus on the role of the IAEA in these partnerships? Some nations might argue for an exclusive role of IAEA for verifying that plant operations are conducted according to the established new framework. Under the present state of world affairs, it seems that the simplest alternative to assure back-up sources of nuclear supplies is to again emulate the corporate world and consider incentives leading to the formation of a network of nuclear-fuel banks worldwide. Nuclear fuel banks based upon independent nuclear partnerships in different regions of the world would then assure the existence of back-up supplies to nations in regions having political conflicts. Another requirement for a truly international partnership is for states to share technical knowledge. This procedure is relevant to the search of consensual and viable solutions to nuclear issues, in particular the question of nuclear waste for which shared expertise will be badly needed in order to reach verifiable choices of storage locations. If spent fuel reprocessing is a technical requirement for the partnership, the negotiations of the strict regulatory regime should take into account that the installations in the host country shall have international staff and shared management. The limitations of uranium supplies should also lead to the development of shared utilities using efficient new-technology reactors.

Pressing demands in world affairs

Although providing adequate energy while limiting the risk of weapons production remains a major concern, there are other pressing world needs. These can only be met by multinational initiatives and commitments comparable to those that are contemplated for ElBaradei´s proposal. The choice of these demands, which have worldwide implications – hunger, climate change and HIV/AIDS pandemic – is to call attention to the fact that their effects upon populations differ enormously. They are far more severe for those living in the underdeveloped world. This asymmetry makes more difficult the engagement of rich nations to fully commit themselves to international cooperation in order to overcome suffering and disaster in the poor nations. The relevant features that characterize these world tragedies are given below (for a review see Swaminathan, 2006).

To face hunger that afflicts nearly one billion people on the planet there are humanitarian initiatives for providing food supplies to mitigate its terrible consequences. This practice is recognized as the only viable initiative to help inhabitants of the remote corners of the planet. What is not well known is the effect of the unregulated trade of food commodities among poor nations. Swaminathan points out that (quoting) "in many poor nations, 50 percent or more of the population depend upon agriculture for their livelihood security." Thus unregulated trade between rich and predominantly agricultural countries (quoting Swaminathan) "causes serious social consequences for the loss of livelihoods in villages and leads to the unplanned migration to towns and cities resulting in the proliferation of urban slums".

All countries are affected by climate change, but the poorest countries will suffer most due to their precarious living conditions. The ever increasing greenhouse gas emission into the atmosphere (IPCC, 2007) and the reports of devastation due to big storms on urban areas of countries with precarious infrastructure are daily features in the media. Since 1997, however, there has been a legal instrument setting limits to greenhouse gas emissions - the root cause of these atmospheric disturbances: the Framework Convention on Climate Change, negotiated by over 100 countries. The Kyoto Protocol, in 1992, follows this framework. Unfortunately, the Kyoto Protocol is yet to be implemented in spite of the growing awareness of the danger due to the lack of motivation among the industrialized nations. At the open session of the World Climate Conference held in Nairobi last November 2006, the then United Nations Secretary-General, Kofi Annan, stated "It is increasingly clear that it will cost far less to cut emissions

now than to deal with the consequences later", and concluding that "Global climate change must take its place alongside those threats — conflict, poverty, the proliferation of deadly weapons — that have traditionally monopolized first-order political attention."

The figures relating to the HIV/AIDS pandemic also highlight the overwhelming contrast of its effects between rich and poor countries (HIV/AIDS, 2006). Over 11000 new HIV infections occurred each day in 2005. More than 95% are in low and middle income countries. About 1500 HIV infections happen in children under 15 years of age. Again there is not yet an international framework to meet the control requisites for HIV, in particular a political commitment to achieve free supplies of anti-retroviral drugs to the needy. One should note that the need for a multilateral enterprise for global HIV vaccine has been addressed as a proposal in June 2003 (Klausner et al., 2003) and that though on a modest commitments were made towards this goal from governments and foundations.

Conclusions

It must be acknowledged that at present there are no major efforts for establishing international cooperation that would bridge the widening gap between poor and rich states. The evidence points to the fact that the political will to face pressing world demands is also absent. The focused international cooperation needed to overcome the present state of affairs shall only come with the realization that these goals are real needs for all nations of the world. Among these goals is the ElBaradei's proposal of a new and stronger security framework for nuclear fuel supply worldwide. The role of nuclear energy in a not too distant future remains an open question. Nuclear energy is already a significant source among industrialized nations. Thus it should not be surprising that countries in the underdeveloped world would also consider the same goal of securing nuclear energy capabilities for future needs. Together with the deterioration of international order, the emergence of new nuclear capabilities in recent years demonstrates the importance of meaningful initiatives that could lead to a new framework for world cooperation.

Acknowledgments

Our appreciation to Dr. Nathan Melamed for critically reviewing the manuscript and contributing supportive comments. We thank Dr. Adele Buckley for providing a new version of her manuscript on a regulatory regime to manage nuclear energy. Professor David Hafemeister has offered timing suggestions and references. The content and conclusions presented herein are the sole responsibility of the author.

References

Braun, Chaim, 2006, Technical Review of Fuel Assurance Proposals, in IAEA Special Event on "New Framework for the Utilization of Nuclear Energy in the 21st Century: Assurance of Supply and Nonproliferation", Vienna, September 20, 2006.

Buckley, Adele, 2006, "Immediate need for a universal verifiable regulatory regime to manage the nuclear energy renaissance, 56th Pugwash Conference, Cairo, Egypt.

Dhanapala, Jayantha, 2003, "The Resurrection of Multilateral Disarmament" INESAP Information Bulletin No. 22, December 2003.

ElBaradei, Mohamed, 2003a, "Time for Reform", IAEA Bulletin 45/1, June 2003.

ElBaradei, Mohamed, 2003b, "Towards a Safer World", Op-Ed published in The Economist, 16 October of 2003.

ElBaradei, Mohamed, 2005, "Nuclear Non-Proliferation and Arms Control: Are We Making Progress?", Carnegie International Non-Proliferation Conference, Washington, DC, November 2005.

HIV/AIDS, 2006, 5th Pugwash Conference at the M S Swaminathan Research Foundation in Chennai, India.

IPCC, 2007, United Nations Intergovernmental Panel on Climate Change,

Klausner, Richard D. et al., 2003, "The Need for a Global HIV Vaccine Enterprise", Science, vol. 300 2036-2039, June 2003.

Meier, Oliver, 2006, "New Analysis: The Growing Nuclear Fuel-Cycle Debate", Arms Control Today, November 2006.

Pomper, Miles A., 2006, "Vienna Meeting Airs New Nuclear Fuel Proposals", Arms Control Today, October 2006

Rapporteur´s Report, 2004, "Seminar on Innovative Approaches to Nuclear Non-Proliferation and the Nuclear Fuel Cycle", IAEA Headquarters, February 2004.

Scheinman, Lawrence, 1981, "Multinational Alternatives and Nuclear Nonproliferation", International Organization, 35,1, Winter 1981.

Scheinman, Lawrence, May 2007, "Equal Opportunity: Historical Challenges and Future Prospects of the Nuclear Fuel Cycle", Arms Control Today,

Souza-Barros, F. de, 2007, "Current Trends in Nuclear Weapon Projects", INESAP Information Bulletin No. 27, December 2006.

Swaminathan, M. S., 2006, "A World In Transition: Towards a Better Common Present", 56th Pugwash Conference on Science and World Affairs, A Region in Transition: Peace and Reform in the Middle East, 11th-15th November 2006, Cairo, Egypt. Pugwash Newsletter Vol. 43, No. 2, pp. 23-28, December 2006.

Fernando de Souza-Barros
Physics Institute / Federal University of Rio de Janeiro
21941-970, Rio de Janeiro, Brazil
e-mail: fsbarros@if.ufrj.br

Footnotes

1 The nuclear fuel cycle supply system that has been announced at the G8 Summit in Russia, July 2006, is not a nuclear partnership envisaged with the new framework. In this scheme, a host country with an enrichment facility would supply the nuclear fuel to client countries.