

## **LONDON CONFERENCE SUMMARY**

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On November 3-4, 2011, NPEC conducted a two-day conference at the Legatum Institute in London entitled "Reassessing Nuclear Nonproliferation's Key Premises." The objective was to bring new thinking to a subject that was both vitally important and on which policy thinking had been stale for many years. The conference approach was to bring together experienced scholars and former and serving senior national and international officials and younger scholars. And the conference format maximized effective interaction by having brief presentations of papers, usually by three presenters, followed by extended and vigorous round-table exchanges.

### **A. RISK OF A PROLIFERATED WORLD**

For years it has become fashionable to decry President John Kennedy's expression of concern about as many as twenty-five nuclear weapons states as overly pessimistic and to argue that nonproliferation is really a matter of dealing with very few would-be nuclear weapon states, perhaps only two, North Korea and Iran (of course, North Korea has since crossed the nuclear threshold). Another school of academic thinking on proliferation argues that even if the bomb spread to larger numbers of countries, that would on the whole have a beneficial effect on reducing conflict. One had to revisit the question of whether there is a risk of further proliferation, and if so, could we count on managing the consequences, in particular on nuclear deterrence among the many pairs of nuclear weapons countries continuing to hold. In short, do we need to worry about proliferation?

These matters were taken up by a distinguished panel under the heading, "The Security Challenges Ahead: Will Nuclear Deterrence Work Indefinitely if the Bomb Spreads?" They were also the subject of a Dinner Keynote Address by François Heisbourg, Chairman of the International Institute for Strategic Studies. The panelists were Ambassador Rolf Ekeus, a former senior Swedish diplomat active on nuclear issues and a former chairman of Stockholm International Peace Research Institute; Sir Lawrence Freedman, Professor of War Studies, King's College London, and an advisor to the former prime minister; and Matthew Kroenig, an Assistant Professor of Government at Georgetown University, now at the Council on Foreign Relations, who presented a critical roundup on academic "Proliferation Optimism."

In the background of all these discussions of nonproliferation is Iran's apparent progress toward a nuclear weapons capability. The panel made clear that a great deal more is at stake than a nuclear-armed Iran. Strong opinions were expressed that an Iranian bomb would not only provoke Israel, but also major Arab countries, and Turkey, as well, and would almost inevitably lead to further spread of nuclear weapons in the Middle East. At that point the world would be stepping into completely unknown and dangerous territory with outcomes that none of the participants could confidently predict. The consequences are even more unpredictable if bombs explode in anger. It is conceivable that the shock of this might lead to a drawing back from nuclear weapons, but it could also lead to a breakdown in the international system and a reversion to a Hobbesian world.

## **B. PROLIFERATION POTENTIAL OF NUCLEAR POWER**

The example of Iran serves as a useful introduction to the questions taken up by the panel entitled: “Nuclear Power and Nuclear Bombs: Assessing the Proliferation Risks.” Iran seems to be following the course taken by other post-NPT bomb makers: Israel, India, Pakistan, South Africa, North Korea, Iraq, and Libya. Each of them lied about their intentions and described their program as solely for peaceful purposes, with the goal of developing nuclear power. Without revealing their intentions, these countries trained personnel, acquired materials, and imported dual-use equipment that could plausibly have non-weapons uses. They kept their nuclear activities secret and foiled international export controls.

Presently, all non-nuclear weapons countries are members of the Nuclear Nonproliferation Treaty and have promised not to acquire nuclear weapons. We can’t exclude the possibility of cheating—some countries have already cheated—which is why there is a system of international inspection operated by the International Atomic Energy Agency. The idea is that the knowledge that the Agency would provide “timely” warning of any diversion would deter any would-be proliferator from going forward. There are a number of problems with this arrangement. In fact it is the very arrangement that the 1946 Acheson-Lilienthal Report, the first serious examination of how to exploit nuclear energy without spreading nuclear weapons, said could not possibly work. The Report’s proposals for international ownership of the dangerous nuclear activities, the ones most closely related to bomb making, proved unworkable in the face of Soviet intransigence. A few years later the United States reversed course to launch Atoms for Peace, which liberally spread nuclear technology and materials throughout the globe. Aside from some tightening up, we have been in that mode ever since.

The problems with relying on inspections under the NPT is that once a country gets nuclear explosive material in bomb quantities, or the production capacity to produce it quickly, the IAEA inspection system cannot be counted on to react quickly enough to a diversion to weapons. And while the Treaty prohibits non-nuclear signatories from making weapons, it does not define how close they can get. In fact the Treaty speaks of the “inalienable right” of countries to nuclear technology for peaceful uses. But peaceful uses and military ones overlap to a large extent. A number of countries, Iran being the prime example, have exploited this ambiguity and have claimed to be within the letter of the law while conducting highly suspicious activities.

The panel presenters were Susan Voss, a nuclear intelligence specialist with Global Nuclear Network Analysis, formerly with the Los Alamos National Laboratory; Victor Gilinsky, an energy consultant and former commissioner of the US Nuclear Regulatory Commission; and John Rawls, Vice President of General Atomics, who outlined a conceptual new design for a “proliferation resistant” reactor as an alternative to the currently used light water reactors, or LWRs.

The conventional view today is that the LWRs by themselves do not pose a serious proliferation problem, which problems arise when these are coupled with commercial enrichment or reprocessing facilities. Uranium enrichment facilities, especially those relying on centrifuge technology to provide low enrichment LWR fuel, could be used to produce highly enriched

uranium for bombs; and facilities for reprocessing spent LWR fuel to extract the plutonium it contains could be used as a source of plutonium for weapons.

Since the mid-1970s nonproliferation policy has consisted largely of finding ways to restrict access to such facilities in all but a small number of countries, and to increase inspection of them where they exist in non-nuclear states. So far these policies have met with mixed success, one of the difficulties being that the NPT includes a provision granting parties the “inalienable right” to “develop research, production and use of nuclear energy for peaceful purposes without discrimination.” While the provision restricts this right to activities “in conformity with articles I and II,” which prohibit the acquisition of nuclear weapons, the inconsistency has never been satisfactorily resolved.

Proponents of these non-proliferation policies have generally been at pains to insist that there are no proliferation objections to LWRs themselves so long as currently non-nuclear countries agreed not to acquire enrichment or reprocessing facilities. The United States, for example, has said that it had no objections to such an arrangement even in Iran.

The difficulty with this conventional view is that LWRs, even by themselves, are not nearly so benign a proposition as they have been made out to be. It has been known since the late 1970 that it is possible to build a small clandestine reprocessing plant employing widely available off-the-shelf industrial equipment to quickly reprocess spent fuel elements in militarily significant quantities. The Oak Ridge National Laboratory published such a simple design. And with the recent spread of centrifuge technology one cannot rule out a clandestine enrichment plant. An LWR program offers a number of advantages for realizing such a clandestine undertaking. What it comes down to is that if a country is so inclined even an LWR program by itself brings it very much closer to weapons.

### **C. CAN UPGRADED SAFEGUARDS HANDLE THE RISKS?**

This presents a serious quandary for US nuclear policy, which is directed at expanding nuclear power use throughout the world and promoting sales of US nuclear technology. One of the frequently proposed measures for ameliorating the proliferation risks of a world with many more nuclear power plants is to strengthen the IAEA safeguards system. A conference panel addressed the problems in scaling up this system: “Will Scaling Up IAEA Safeguards Operations Assure Better Verification: An Organizational, Operational Assessment.” The panel provided an extraordinary opportunity to examine this question. The presenters were Pierre Goldschmidt, former Deputy Director General and Head of the Department of Safeguards at the IAEA, and now at the Carnegie Endowment for International Peace; Olli Heinonen, former Deputy Director General and Head of the Department of Safeguards at the IAEA, now at Harvard University; and Patrick Roberts, Assistant Professor Of Public Administration in the School of Public and International Affairs at Virginia Tech, who presented a critical paper to start off the discussion.

Several important points emerged. IAEA safeguards officials believe that they do not have sufficient legal authority to do their job. The IAEA’s 1957 Statute the Agency inspectors “shall have access at all times to all places and data and to any person . . . to determine whether there is compliance with the undertaking against use in furtherance of any military purpose.” But in

practice, as reflected in the agreements between the Agency and individual countries, the Agency's inspection rights are sharply circumscribed.

The IAEA system is based in the first instance on reports by countries of their material holdings, and it is against these reports that the Agency inspects. A number of countries lack systems of control that are sufficiently independent of the nuclear operators and this has led to reporting failures. The Agency needs more cooperation from these countries in order to carry out its job, a situation that underlines the degree to which the Agency relies on its members' data, which is restricted to information about facilities identified by the member state. In view of the possibility of clandestine facilities, the Agency has sought to get its member states to accept voluntarily an Additional Protocol that expands its inspection rights.

The IAEA inspection system promises confidentiality to the inspected states. This extends to internal evaluations of the effectiveness of the safeguards system. It is also true that the Agency's ruling body, the Board of Governors, has not sufficiently pressed the IAEA staff to react to infractions and to make realistic assessments of inspection effectiveness. This makes it difficult for outsiders to place confidence in the IAEA's broad assurances about the absence of diversions. Altogether the system needs a great deal more openness and transparency.

The usual suggestions for upgrading the IAEA system focus on increasing the Agency's resources. But however much the IAEA inspection system is improved, such improvement will not help unless the international community responds adequately and promptly to non-compliances. The failure to do so is now the weakest link in the nonproliferation regime. If we want an effective system, generic procedures need to be instituted, standard responses to be applied to any state found to be in violation of its obligations irrespective of its connection with other states. And such procedures need to be agreed upon now, before the next incident. For the system to work it would need the firm backing of the Security Council, which should adopt a legally-binding resolution on responses to NPT and IAEA violations.

The NPT allows withdrawals from the Treaty on 90 days notice. The Security Council should declare that a state cannot withdraw from its NPT obligation when its violations have not been resolved, and without returning all materials and equipment that it received on the basis of assurances that were tied to the NPT.

Finally, because the members' NPT-related country-wide safeguards agreements lapse with any withdrawal from the Treaty, the Board of Governors should urge all states, at a minimum those with enrichment and reprocessing facilities, to conclude facility-specific agreements with the IAEA to ensure the permanency of safeguards. The totality of the changes and agreements discussed here would not be easy to obtain, but they are required for a minimally effective safeguards system.

#### **D. CAN RESTRICTING ENRICHMENT AND REPROCESSING WORK?**

Of course it would be most desirable if the number of enrichment and reprocessing facilities were themselves limited. The United States recently executed an agreement for peaceful cooperation in nuclear energy, a so-called Section 123 agreement, with the United Arab Emirates,

under which the UAE agreed not to acquire such facilities. This is now the “Golden Standard” for 123 agreements. Whether this will become a model agreement or whether other countries will balk at these conditions remains an important question.

A conference panel address the broad issue: “As Nuclear Power Technology Spreads, How Successful Might Our Efforts to Get Others to Forego Making Nuclear Fuel Be?” The conference was exceptionally fortunate to have the active participation of Ambassador Hamad AlKaabi, UAE Ambassador to the IAEA, especially on this issue. Other presenters were Scott Kemp, a centrifuge expert from Princeton University, and Richard Cleary, from the American Enterprise Institute, who started things off by presenting a history of efforts to persuade countries to forego acquiring fuel facilities, and the mixed success of these efforts.

Probably the most discussed option for reducing incentives for countries to acquire their own enrichment and reprocessing is a so-called fuel bank that would guarantee access to uranium fuel. The general view of the group was that this proposal, despite having been discussed for decades, made little sense. There is a thriving uranium market and there was no difficulty in obtaining uranium for any state complying with international rules. If a state wants even more assurance it can stockpile uranium fuel at reasonable cost. On the other hand, if a country was in violation of international rules, especially with regard to acquisition of nuclear weapons, and subject to sanctions from the international community it would be odd to exempt uranium from these restrictions. In short, the fuel bank idea is a solution in search of a problem.

Turning to the specific technologies of concern, while reprocessing facilities as a source of plutonium for bombs definitely remain in this category, the rapid advances and spread of centrifuge technology, including on the nuclear black market, has made this centrifuge enrichment the chief proliferation concern. Whereas the earlier gaseous diffusion enrichment plants—such as those in the United States and France—were intrinsically large and used very large amounts of electric power, the centrifuge plants lend themselves to small scale operation and use little electric power. They are also highly flexible and an overt plant could with relative ease and speed shift from producing low enriched uranium fuel for reactors to producing highly enriched uranium for bombs. HEU is easier to handle than plutonium and can be used in much simpler bombs.

As became evident from revelations about black-market transfers, centrifuge manufacturing can be accomplished in many countries with modest industrial capabilities. It is therefore difficult to contain the technology by export controls. The critical factor in developing a centrifuge facility adequate for military use seems not to be the technical capability of a country, but rather a combination of its motivation and organizational capacity. The prospects for controlling access to this technology are not good. Especially worrisome is that small centrifuge plants would be easy to hide, especially in the shadow of a nuclear power program.

## **E. CYBER ATTACKS AS TOOLS AND THREATS**

With heavy press coverage of the Stuxnet “worm” that infiltrated the computer systems of the Iranian centrifuge operation, and caused individual centrifuges to speed up and destroy themselves, and the allegations that this was designed and inserted by the United States and

Israel, the conference brought together a panel of intelligence, terrorism, and computer experts to discuss the significance of cyber attacks on nuclear facilities. (More generally, the US Department of Defense has created a Cyberspace Command, putting cyberspace on the same basis as land, sea, air, and space as theaters of war.) The panel was entitled, “Cyber Attacks against Nuclear Plants: How Plausible a Terrorist or Counter-proliferation Tool?” The participants were Emily Frye, of the MITRE Corporation; John Lauder, Arete Associates, a former director of the CIA Nonproliferation Center; Brian Jenkins, a terrorism expert from the RAND Corporation; and Stephen Lukasik, Center for Science, Technology and Security Policy (AAAS), a former director of ARPA, US Dept. of Defense, and (without exaggeration) one of the founders of the internet.

The first thing that stands out is that it is a new area with little precedents. Simple questions have no obvious answers. For example, are such attacks acts of war? If not, are they actionable in courts of law? Are they effective? The consensus on the Stuxnet attacks seemed to be that they caused some damage but did not significantly slow down the centrifuge effort. As to the effectiveness of future such attacks, there were two views. One is that computer capabilities, at least judged by chip memory capacity, have been doubling every eighteen months so that we can expect that future viruses will rapidly increase in their virulence. Another view is that computer viruses are software that is labor intensive and whose capabilities increase more slowly. Still the extent of the threat remains an open question. Do we have accurate assessment of nuclear facility, and broad infrastructure, vulnerabilities? Is disconnecting industrial control systems a feasible option (the Stuxnet worm was apparently inserted into the Iranian system by means of memory sticks)? Will the threat of retaliation work to deter such attacks by states? In short, possible cyber attacks on nuclear facilities appear to be a subject worthy of study in connection with proliferation, but at present there are more questions than answers.

## **F. SUMMING UP**

To sum up, how to exploit nuclear energy without spreading the bomb has been a dilemma from the beginning of the nuclear age during World War II. In the years since then there have been two pivotal high-level analyses of the problem. The first of these, the 1946 Acheson-Lilienthal Report, said that nuclear energy for power and nuclear energy for weapons were “in much of their course interchangeable and interdependent.” The Report proposal for international control of nuclear energy failed, but it contained the powerful insight that gaining the benefits of the new energy source without spreading the Bomb was no simple matter—it could only be done safely under strict international rules backed up by military force. “No system of inspection,” the Report concluded, “could afford any reasonable security against the diversion of such materials to the purposes of war.”

A few years later the United States discarded that insight and reversed course to launch Atoms for Peace to spread nuclear technology worldwide with minimal oversight. Aside from occasional modest adjustment, we have been on that Atoms for Peace course ever since. For example, the IAEA web page proudly describes the Agency as the world’s center of cooperation in the nuclear field: “It was set up in 1957 as the world’s ‘Atoms for Peace’ organization within the United Nations family.”

India's 1974 bomb using technology covered by "peaceful uses" promises rang alarm bells about widespread access to nuclear explosives—plutonium and highly enriched uranium—and the capabilities to produce them. It became clear that there had to be restrictions on reprocessing and enrichment. Could this be done in trouble spots on an ad hoc basis? A 1976 high level study commissioned by US President Gerald Ford, the second of the major historical studies on the relation between nuclear energy for power and for weapons, concluded that to provide an adequate safety margin against possible diversion to military use there had to be a thorough going change in the way nuclear energy was exploited. President Ford urged that nuclear power should proceed on the basis of a "once-through" fuel cycle, that is, without reprocessing spent fuel to extract plutonium until there is sound reason to conclude that the world community can effectively overcome the associated risks of proliferation. This policy was then adopted as US policy by his successor, Jimmy Carter, but internationally it ran into considerable resistance from nuclear industry and nuclear bureaucracies.

Since then we have come to understand—as described in the conference sessions—that even if a line were drawn at commercial reprocessing that still leaves nuclear power vulnerable to diversion to military use because of the possibility of small clandestine reprocessing, which many countries would be capable of. But of course even that line has not held. Moreover, the advent of easily exploited centrifuge technology has upended the value of the once-through fuel cycle as a bar to proliferation. It appears from the conference discussions that we are at a point where we need to circumscribe nuclear power once more to regain a reasonable safety margin against diversion to weapons. Whether such measures would be compatible with expansion of nuclear energy use remains an open question.