European Nuclear Society
High Scientific Council
ENS-HSC

Position paper on nuclear proliferation issues[1]

Preventing nuclear proliferation: a duty for the nuclear community

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The production of electricity from nuclear power plants is widely seen today as having an increasing role to play in meeting global energy requirements in a sustainable manner.

Conscious of the inherently sensitive nature of nuclear technology and materials the ENS-HSC is well aware that a severe safety, security, environmental or proliferation mishap stemming from nuclear energy anywhere in the world would undermine the potential for nuclear energy to contribute to the global energy supply and the minimization of harmful carbon emissions.

While the safety of nuclear power plants has continuously improved over the last three decades, the same degree of success cannot be claimed when it comes to the achievements of the international community in stemming the risk of nuclear weapons proliferation.

This unfortunate situation is due to both technical and political reasons.

Technological evolution

The core of a nuclear fission explosive device is either plutonium metal (preferably with a high proportion of Pu-239) or high-enriched uranium (typically with a percentage of the fissile isotope U-235 around 90% or more) also under metallic form.

The International Atomic Energy Agency (IAEA) considers that a "significant quantity" of fissile material needed to produce a fission device is 8 kg Pu-239 or 25 kg U-235 in the form of high-enriched uranium (HEU)[2]. These numbers are

[1] Prepared by Pierre Goldschmidt with the help of Bernard Bonin
[2] HEU means uranium enriched to 20% U-235 or more.

considered to be significantly higher than what would actually be required for a state with sufficient technical capabilities.[3]

The plutonium route consists in irradiating uranium fuel in a nuclear reactor, preferably during a short period of time in order to produce rather pure Pu-239. To give an order of magnitude, the spent fuel discharged annually from an electrical 1000 MWe light water reactor (LWR) typically contains around 200 kg Pu or more. However commercial spent fuel, irradiated at high burnups[4] will generate poor quality plutonium for a nuclear weapon even if it could still be suitable for manufacturing a low yield nuclear device.

Irradiated fuel unloaded from the reactor can then be processed in a radiochemical facility where the plutonium is separated from the uranium and the highly radioactive fission products.

In the early 1970s when the Non-Proliferation Treaty (NPT)[5] and IAEA Comprehensive Safeguards Agreements[6] entered into force, it was considered almost impossible for any non-nuclear-weapons state (NNWS) to construct and operate an undeclared nuclear power plant[7] or an undeclared plutonium separation facility. Therefore IAEA safeguards were designed for the exclusive purpose of verifying that all source or special fissionable material in a State are "not diverted to nuclear weapons or other nuclear explosive devices."

This approach is, to a large extent, still valid today although a number of countries have been reported by the IAEA as having undertaken small scale undeclared nuclear fuel irradiation and processing experiments.[8]

Looking to the longer term, a major non-proliferation challenge will be the likely development of fast breeder reactors based on a policy of closed fuel cycle and plutonium recycling. To address this eventuality work is ongoing to develop reprocessing and MOX fuel facilities where uranium, plutonium and minor actinides would be processed jointly in order to avoid the production of separated plutonium.

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[3] Thomas Cochran and Christopher Paine, NRDC, April 13, 1995. http://www.nrdc.org/nuclear/fissionw/fissionweapons.pdf

[4] Burn-ups of 50 GWd/t are common today for spent fuel unloaded after four years in the core of commercial LWRs. At burn-ups above 30 GWd/t, the plutonium in spent fuel contains around 60% Pu-239 or less, and some 25% of Pu-240 which is a non-fissile isotope.

[5] Treaty on the Non-Proliferation of Nuclear Weapons, IAEA INFCIRC/140, 22 April 1970.

[6] IAEA INFCIRC/153 (Corrected)

[7] Whether Syria has attempted, few years ago, to build an undeclared research reactor at Dair Alzour with the help of North Korea remains to be confirmed (IAEA/GOV/2010/11).

[8] Including most recently: Iran (IAEA GOV/2003/75), South Korea (IAEA GOV/2004/84) and Egypt (IAEA GOV/2005/9).

The other proliferation route consists in producing high-enriched uranium. Here again, in the early 1970s it was considered unlikely that any NPT-NNWS could construct without external help and secretly operate a gas diffusion enrichment plant, due to its size and huge electricity consumption. This has changed with the development and continuous technological progress made in enriching uranium by centrifugation. A small centrifuge enrichment plant is very compact, uses very little electricity and can therefore be hidden in almost any undeclared location. Laser enrichment, although not yet considered commercially competitive, is another possible route to produce undeclared HEU[9].

In most cases the states having undertaken undeclared enrichment activities have benefitted from external help. This shows how important it is to efficiently control the export of dual use material and technology.

Structural and political responses

As is well known, in most cases "prevention is better than cure". Prevention constitutes the very basis of nuclear safety. This precautionary principle should also apply in order to minimize nuclear proliferation risks.

Effective deterrence requires convincing others that the cost of taking an action one wishes to prevent is far greater than any benefits. However, once such an action has been committed, such as North Korea testing a nuclear device, reversing the situation is much more difficult (if at all possible) than preventing it in the first place.

Hence the necessity for any state undertaking a nuclear programme to know for sure that:

1. the IAEA Secretariat is able to promptly detect undeclared nuclear material and activities;
2. cases of non-compliance with safeguards agreements will be duly reported by the IAEA Secretariat to the Board of Governors and by the latter to the UN Security Council (UNSC), and
3. the UNSC will act effectively and without delay when a non-compliant state fails to fully and proactively cooperate with the IAEA and to take the corrective actions required by the IAEA Board.

[9] During the 1980s and early 1990s Iraq invested considerable resources to produce HEU by using the Electro-Magnetic Isotope Separation (EMIS) process. It also undertook R&D activities on centrifuge and Laser Isotope Separation processes. Undeclared uranium enrichment experiments using the laser process have also been reported most recently in Iran (IAEA GOV/2003/75) and South Korea (GOV/2004/84).

The first condition can only be met in a state that has ratified the so-called Additional Protocol[10] to its safeguards agreement.

The second condition requires the IAEA Secretariat to promptly report to the Board as "non-compliance" any significant safeguards violation. The Board, which is a political body, should make it clear that it will not delay reporting cases of non-compliance to the UNSC if a state does not fully and proactively cooperate with the Agency to resolve any outstanding question or inconsistency. In such a case, it is well known from experience that the Agency will need, temporarily, additional verification rights. Only the UNSC, by adopting a legally binding Chapter VII resolution, is in a position to provide those rights to the Agency, the IAEA Board cannot.

One of the greatest difficulties in deterring states from violating their non-proliferation undertakings and ignoring legally binding UNSC resolutions is their hope that for geopolitical or economic reasons at least one of the five veto-wielding member of the Security Council[11] will oppose the adoption of effective sanctions.

It has therefore been recommended[12] that, to guarantee prompt action, the UNSC should adopt a generic (i.e. not state specific) Chapter VII resolution providing that upon request by the Agency the UNSC would automatically adopt a specific legally binding resolution requiring the non-compliant State: a) to **temporarily** grant to the Agency extended access rights; and b) if it does not fully implement these extended verification rights, to temporarily suspend all sensitive fuel-cycle related activities.
This generic resolution should also provide that if the non-compliant State persists in its refusal to comply with IAEA and UNSC resolutions, the UNSC would require all member states to immediately suspend all military cooperation.[13]

For its part, the ENS-HSC supports the recommendations made by the UNSC in Resolution 1887[14] and in particular in paragraphs 18, 19 and 20[15].

<u>Different nature of proliferation risks</u>

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[10] IAEA INFCIRC/540 (Corrected).
[11] China, France, the Russian Federation, the United Kingdom and the USA.
[12] Pierre Goldschmidt "Concrete steps to improve the nonproliferation regime", Carnegie Endowment for International Peace, Policy Paper 100, July 2008. http://www.carnegieendowment.org/publications/index.cfm?fa=view&id=22943
[13] a measure that should represent a strong disincentive to defy UNSC resolutions without impacting the well being of ordinary citizens.
[14] S/RES/1887, September 24, 2009.
[15] See Annex

There are two different proliferation risks: proliferation towards states and proliferation towards non-state actors such as terrorist organizations.

It is generally believed that in most cases a state possessing a nuclear arsenal will hesitate to use it in a nuclear aggression launched from its own territory because of inevitable disastrous military, economic and political consequences. These reasons for restraint are not relevant for a terrorist group which objective is to provoke chaos and panic and would feel much more immune to retaliatory measures than a sovereign state. Considering the relative simplicity of manufacturing a rudimentary fission explosive device, the main obstacle that terrorists will have to overcome is the acquisition of enough fissile material. It could reach that goal through illicit trafficking networks possibly with the help of a country such as North Korea, or by seizing by force stockpiles of fissile material in a country where security measures can be defeated.

This is why effective export controls of dual use material and technology, such as those agreed by the Nuclear Supplier Group, are vitally important. It is also why the international initiative to use low-enriched uranium instead of high-enriched uranium in research reactors around the world must be continued and supported.

<u>The European nuclear industry: a responsible stakeholder</u>

The European nuclear industry is committed to the exclusively peaceful use of nuclear energy and to export nuclear facilities and related materials, equipment and technology solely in accordance with relevant national export laws and regulations, Nuclear Suppliers Group guidelines and pertinent United Nations Security Council Resolutions

The ENS-HSC considers that, as a manifestation of their strong commitment to nonproliferation, it is important for the nuclear industry to pay special attention to and promote proliferation-resistant designs and to take IAEA safeguards requirements into account at the design stage.

In the view of the ENS-HSC, the nuclear industry should also ascertain:

- that nuclear equipment, material, and technology and material produced thereof shall be under IAEA safeguards during the entire period of their actual presence in the territory or under the jurisdiction of a customer's state;

- that delivered nuclear material, equipment and technology will be used exclusively at the original location and for the purpose declared unless a change is approved by the vendor;
- that nuclear material transferred to a customer may not be enriched to 20 % ¨U-235 or more;
- that the customer's state has implemented, or has established a firm plan to develop, a State System of Accounting for and Control of nuclear materials which is technically competent, operational, and is provided with adequate authority, resources and independence.

Conclusion

Preventing nuclear proliferation is primarily the responsibility of states but, as major stakeholders, the nuclear industry and scientific community should actively support nuclear disarmament as foreseen in the Non-Proliferation Treaty and measures necessary to strengthen the non-proliferation regime, particularly the international control of the flux of nuclear material and technology.

If the expected expansion of nuclear electricity production worldwide is to succeed, it must take place under strict safety, security and non-proliferation conditions.

ANNEX

United Nations S/RES/1887 (2009)
24 September 2009

The Security Council,

17. *Undertakes* to address without delay any State's notice of withdrawal from the NPT, including the events described in the statement provided by the State pursuant to Article X of the Treaty, while noting ongoing discussions in the course of the NPT review on identifying modalities under which NPT States Parties could collectively respond to notification of withdrawal, and *affirms* that a State remains responsible under international law for violations of the NPT committed prior to its withdrawal;

18. *Encourages* States to require as a condition of nuclear exports that the recipient State agree that, in the event that it should terminate, withdraw from, or be found by the IAEA Board of Governors to be in non-compliance with its IAEA safeguards agreement, the supplier state would have a right to require the return of nuclear material and equipment provided prior to such termination, non-compliance or withdrawal, as well as any special nuclear material produced through the use of such material or equipment;

19. *Encourages* States to consider whether a recipient State has signed and ratified an additional protocol based on the model additional protocol in making nuclear export decisions.