NUCLEAR WEAPONS AND 'GENERATION FOUR' REACTORS

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"There is no proliferation proof nuclear fuel cycle. The dual use risk of nuclear materials and technology and in civil and military applications cannot be eliminated."
− UK Royal Society, 2011, 'Fuel cycle stewardship in a nuclear renaissance'

All existing and proposed nuclear power concepts pose WMD proliferation risks. History gives us some indication of the seriousness of this problem. Over 20 countries have used their 'peaceful' nuclear facilities to progress weapons ambitions and five countries developed nuclear weapons under cover of a civil program.

The US National Intelligence Council warns that the spread of nuclear technologies and expertise "is generating concerns about the potential emergence of new nuclear weapon states and the acquisition of nuclear materials by terrorist groups." The US State Department notes that the spread of nuclear power "inevitably increases the risks of proliferation".

Thorium

There are several proliferation risks associated with thorium:

- Irradiation of thorium (indirectly) produces uranium-233, a fissile material which can be used in nuclear weapons.
- Thorium fuelled reactors could also be used to irradiate uranium to produce weapon grade plutonium.
- The use of highly-enriched uranium (HEU) or plutonium to initiate a thorium-232/uranium-233 reaction, or proposed systems using thorium in conjunction with HEU or plutonium as fuel, present further risks of diversion of HEU or plutonium for weapons production as well as providing a rationale for the ongoing operation of dual-use enrichment and reprocessing plants.

The US has successfully tested weapons using uranium-233 (and France may have too). India's thorium program must have a WMD component – as evidenced by India's refusal to allow IAEA safeguards to apply to its thorium program.

Fusion

Fusion power has yet to generate a single Watt of useful electricity but it has already contributed to proliferation problems. According to Khidhir Hamza, a senior nuclear scientist involved in Iraq's weapons program in the 1980s: "Iraq took full advantage of the IAEA's recommendation in the mid 1980s to start a plasma physics program for "peaceful" fusion research. We thought that buying a plasma focus device ... would provide an excellent cover for buying and learning about fast electronics technology, which could be used to trigger atomic bombs."

Integral fast reactors

If built, integral fast reactors (IFRs) would be fuelled with a metallic alloy with liquid sodium as the coolant. 'Fast' because they would use unmoderated neutrons (as with fast breeder reactors). 'Integral' because they would operate in conjunction with onsite 'pyroprocessing' to separate plutonium and other long-lived radioisotopes and to re-irradiate (both as an additional energy source and to convert long-lived waste products into shorter-lived wastes).

IFRs could breed their own fuel (plutonium) and thus there would be less global demand for uranium mining with its attendant problems, and less demand for uranium enrichment plants. Another advantage is that the main fuel source for IFRs could be large, existing, global stockpiles of depleted uranium. Depleted uranium is a public health and environmental problem and its use in munitions is objectionable.

Pyroprocessing technology would be used - it would not separate pure plutonium suitable for direct use in nuclear weapons, but would keep the plutonium mixed with other long-lived radioisotopes such that it could not be used directly in weapons. Recycling of plutonium would generate low-carbon energy and get rid of the plutonium with its attendant proliferation risks. These advantages could potentially be achieved with conventional reprocessing and plutonium use in MOX (uranium/plutonium oxide) reactors or fast neutron reactors. IFRs would offer one further potential advantage − transmutation of long-lived waste radioisotopes to convert them into shorter-lived waste products.

In short, IFRs could produce lots of greenhouse friendly energy and while they're at it they could 'eat' nuclear waste and fissile materials which might otherwise find their way into nuclear weapons. Too good to be true? Sadly, yes. Nuclear engineer Dave Lochbaum writes: "The IFR looks good on paper. So good, in fact, that we should leave it on paper. For it only gets ugly in moving from blueprint to backyard."

As with conventional reactors, IFRs could be used to produce weapon grade plutonium by irradiating uranium. Conventional 'PUREX' reprocessing could be used to separate the plutonium. George Stanford, who worked on an IFR R&D program in the US, notes that proliferators "could do [with IFRs] what they could do with any other reactor − operate it on a special cycle to produce good quality weapons material."

The fissile material required for the initial IFR fuel loading would ideally come from civil and military stockpiles − but that fissile material requirement could also be used to justify the ongoing operation of existing enrichment and reprocessing plants and to justify the construction of new ones.

IFR advocates propose using them to draw down global stockpiles of fissile material, whether derived from nuclear research, power or WMD programs. However, IFRs have no need for outside sources of fissile material beyond their initial fuel load. Whether they are used to irradiate outside sources of fissile material to any significant extent would depend on a confluence of commercial, political and military interests.

History shows that non-proliferation objectives receive low priority. Conventional reprocessing with the use of separated plutonium as fuel (in breeders or MOX reactors) has the same potential to drawn down fissile material stockpiles, but the separation of plutonium has greatly outstripped its re-use in breeders or MOX reactors resulting in stockpiles of separated plutonium growing at about five tonnes annually.

In theory, conventional reprocessing could reduce proliferation risks; in practice it has increased proliferation risks. That's a lesson worth keeping in mind when assessing the claims of IFR advocates.

IFR advocate Tom Blees argues that: "Privatized nuclear power should be outlawed worldwide, with complete international control of not only the entire fuel cycle but also the engineering, construction, and operation of all nuclear power plants. Only in this way will safety and proliferation issues be satisfactorily dealt with. Anything short of that opens up a Pandora's box of inevitable problems." He also argues that: "The shadowy threat of nuclear proliferation and terrorism virtually requires us to either internationalize or ban nuclear power."

Those comments are welcome acknowledgements of very serious problems, but they are quickly forgotten in the enthusiasm to build as many IFRs as possible, as quickly as possible, with or without the reforms advocated by Blees.

IFR advocates acknowledge the need for a rigorous safeguards system. However, the existing safeguards system is inadequate. The former Director General of the International Atomic Energy Agency, Dr. Mohamed El Baradei, notes that the IAEA's safeguards system "clearly needs reinforcement" yet efforts to improve the system have been "half-hearted" and it operates on a "shoestring budget".

So what are IFR advocates (such as Adelaide Uni's Prof. Barry Brook) doing to help strengthen the safeguards system? Nothing. They are quick to attack NGOs that have worked on safeguards for decades, but very slow to get off their backsides to do anything constructive to help fix the problems.

More information

- Nuclear Power and Weapons: www.nuclear.foe.org.au/power-weapons
- Debate on IFRs: skirsch.com/politics/globalwarming/ifrUCSresponse.pdf
- Safeguards: www.nuclear.foe.org.au/safeguards
- Fusion: Daniel Jassby, 19 April 2017, 'Fusion reactors: Not what they're cracked up to be', Bulletin of the Atomic Scientists, http://thebulletin.org/fusion-reactors-not-what-they%E2%80%99re-cracked-be10699