Q&A on Nuclear Proliferation

(1) The plutonium required for weapons is different to the plutonium recovered from spent reactor fuel. This coupled with the application of international safeguards effectively prevents civil nuclear technology helping the spread on nuclear weapons provided the country in question has signed the Non Proliferation Treaty (NPT). Doesn't this mean we should make the most of our civil plutonium to assist the fight against global warming? http://www.world-nuclear.org/info/inf15.html

The US Department of Energy (USDoE) notes that:

"Virtually any combination of plutonium isotopes -- the different forms of an element having different numbers of neutrons in their nuclei -- can be used to make a nuclear weapon. Not all combinations, however, are equally convenient or efficient". [1]

USDoE says the explosive yield of a relatively simple first-generation nuclear device made with reactor-grade plutonium would be of the order of one or a few kilotons. While this yield is referred to as the "fizzle yield," a one-kiloton bomb would still have a radius of destruction roughly one-third that of the Hiroshima weapon, making it a potentially fearsome explosive.

France's Commission on Atomic Energy, division of military applications, totally disagrees with statements made by Cogema about reactor-grade plutonium being useless for weapons. And the UK's Royal Society says reactor-grade plutonium is "*a plausible target for determined terrorist groups or states wanting to make nuclear weapons*". [2]

The University of Chicago Study (See Q&A on Nuclear Economics) concludes that *"[t]here is a lack of agreement about whether or not the availability of current reprocessing and enrichment technology under current regulatory mechanisms are increasing non-proliferation risk"*.

The MIT Study on the *Future of Nuclear Power* (See Q&A on Nuclear Economics) says "*…the current non-proliferation regime must be strengthened by both technical and institutional measures with particular attention to the connection between fuel cycle technology and safeguardability. Indeed, if the non-proliferation regime is not strengthened, the option of significant global expansion of nuclear power may be impossible …*"

Since international controls on nuclear proliferation began, Israel, India, Pakistan and North Korea have all obtained nuclear weapons by making use of technology and equipment ostensibly meant for use in civil nuclear programmes. Israel, India and Pakistan did this outside the NPT regime, although they obtained the technology from signatories to the NPT. North Korea was originally a signatory of the NPT, but withdrew in January 2003. Signatories to treaty can come within weeks of acquiring a nuclear arsenal by amassing nuclear weapons useable fuels claiming that these were intended for peaceful purposes before finally withdrawing.

Iran, despite being a signatory to the NPT, established a uranium enrichment programme without informing the IAEA with the help of the Khan network - a global nuclear information network and business which had access to supposedly secret uranium enrichment technology. Using a mixture of legal and illegal transactions involving businesses all over the world, this network exported ultracentrifuge enrichment technology to Libya, North Korea and Iran. So existing controls, legal arrangements and guidelines can and have been circumvented. [3]

Another major weakness of the safeguards system is the impossibility of adequately safeguarding a reprocessing plant used to remove plutonium from spent reactor fuel elements. Ensuring the timely detection

of the diversion of the small amount of plutonium required to make a nuclear weapon in a plant where so much plutonium is handled requires much more precision than is achievable with today's technology. [4]

(2) There would be serious technical difficulties in attempting to make nuclear weapons from the plutonium in MOX fuel. Environmentalists say MOX fuels represent a proliferation risk because the plutonium in the fuel is 'weapons-useable'. But no-one has ever made a bomb from MoX have they? And rigorous IAEA safeguards would prevent this happening anyway wouldn't it?

The IAEA "Safeguards Glossary – 1987 Edition" describes MOX as "*nuclear material that can be used for the manufacture of nuclear explosives components without transmutation or further enrichment …*" It estimates the conversion time for MoX is of the order of 1 to 3 weeks.

The USDoE says:

"*…it is important to understand that fresh MOX fuel remains a material in the most sensitive category because plutonium suitable for use in weapons could be separated from it relatively easily*." [5]

The Proliferation Vulnerability Red Team (PVRT) – a study team from US Weapons Labs – found that to recover plutonium from unirradiated MoX fuel would require only four people providing that they had an appropriate mix of skills. [6]

(3)Nuclear disarmament will give rise to some 150-200 tonnes of weapons-grade plutonium, over half of it in former USSR. Surely using this as fuel for nuclear reactors would be a 'swords to ploughshares' programme, which peace groups should support?

Proposals for the disposition of massive stocks of weapons-usable plutonium are ill conceived. Using plutonium from bombs as fuel for nuclear power reactors invites theft by terrorists or rouge states. If realized, the proposal would help establish a dangerous plutonium processing infrastructure in the US and Russia, open up the risky transportation of weapons-grade materials around the globe and risk aggravating the consequences of a reactor accident.

Although the goal of nuclear disarmament and dismantling nuclear warheads is laudable, the MOX approach would take decades to complete, require billions of taxpayers dollars in subsidies to electrical utility companies, and promote plutonium fuel industries in other countries. MOX use has a large and powerful constituency that exaggerates the benefits and conceals the dangers of using plutonium as fuel to generate electricity. Instead, plutonium should be immobilized in one of several possible ways, for example by combining it with highly radioactive waste in the form of glass logs (a method called "vitrification"). [7]

(4) Couldn't weapons plutonium be used up relatively quickly in European reactors which have a well-developed MOX capacity?

In September 2000, the US and Russia signed an agreement to each remove 34 tonnes of their plutonium stockpile and to 'dispose' of it. This agreement has now become virtually redundant for various reasons. If it had been implemented the agreement would have reduced the Russian military stockpile from 137 tonnes to 103 tonnes between 2010 and 2018. Similarly the American stockpile would fall from 100 tonnes to 66 tonnes by 2018. Hardly a speedy disarmament process. [8]

(5) In theory plutonium recycling could help extract 150 times more energy from a given quantity of uranium compared to the use of uranium without reprocessing. Although practicalities prevent achievement of this theoretical maximum, plutonium nevertheless represents a substantial source of carbon-free energy. Shouldn't we should be making the most of it?

It is likely that, if there is to be a global expansion of nuclear power, the industry will attempt to develop fast reactors, which can be fuelled with weapons-useable plutonium, and create more plutonium in the process. In theory this could lengthen the life of uranium resources to 2,500 years. [9] This 'plutonium economy' would require more reprocessing and more transports of plutonium and mixed uranium and plutonium oxide

(MOX) fuel around the globe. This will present a serious threat to efforts to control the spread of nuclear weapons and prevent nuclear terrorism. The United Nations Intergovernmental Panel on Climate Change (IPCC) said the security threat of trying to tackle climate change with a global fast reactor programme "would be colossal" [10]

(6) At the moment, with uranium prices low there is no impetus to develop fast reactors which can convert non-fissile uranium into plutonium. But if prices rise, fast reactors will be developed won't they?

Fast Reactors have been a disaster world-wide - economic realities, problems associated with reprocessing (separating plutonium from spent nuclear fuel), concerns over nuclear proliferation, serious technical problems and the risk of catastrophic accident have all come together to stop the development and construction of commercial scale fast breeder reactors.

One major difficulty with fast reactors is that they use liquid metal as a coolant – usually liquid sodium, which explodes on contact with air. Currently, only one commercial scale fast reactor in the world is operating - the Beloyarsk BN-600 in Russia - despite numerous sodium fires. India is only intermittently operating its Fast Breeder Test Reactor (FBTR) at Kalpakkam. The UK closed down its Prototype Fast Reactor at Dounreay in Scotland in 1994. The French closed down their Superphénix Fast Reactor in 1996 after it had achieved an average capacity factor of less than 7% over eleven years' of operation. It had repeated shutdowns, the longest of which lasted four years. Japan's fast reactor has been shut since a leak of liquid sodium coolant in 1995. The US Government announced the permanent closure of its Fast Flux Test Facility in December 2001 having been on stand-by ever since former Energy Secretary Hazel O'Leary attempted to shut it down in 1992, wasting over $400
million. [11]

There is an international collaboration research and development project on a so-called 'Generation IV' reactors. One of the reactor types this programme is attempting to revive is the fast reactor, but this is not expected to come to commercial fruition for at least 15 to 20 years. In fact, former UK Energy Minister Brian Wilson, has said he doesn't expect Generation IV reactors to be deployed until 2030 – far too late to make any impact whatsoever on climate change. [12]

(7) There is some confusion over a 1962 test by the US using what was then described as 'reactor-grade' plutonium. It is thought that the plutonium used in that test was a much higher quality than plutonium, which would be described as 'reactor-grade' today. Doesn't this mean that it would be impossible to make a bomb out of plutonium separated from used reactor fuel or fresh MOX?

The USDoE couldn't be much clearer:-

"*Virtually any combination of plutonium isotopes … can be used to make a nuclear weapon*" [13]

(8) Surely ElBaradei's idea of "internationalising" fissile materials production – placing uranium enrichment under United Nation's control – would be worth the risk. Given the huge rise in global energy demand, isn't the West obliged to help developing nations produce low carbon electricity?

A major challenge to nuclear proliferation controls is the spread of uranium enrichment technology for enriching uranium in the isotope uranium-235. Nothing better illustrates how, so-called, peaceful nuclear technology can be used for military purposes than the activities of the Khan network. Abdul Qaadeer Khan was able to build a global nuclear information network and business which had access to supposedly secret uranium enrichment technology. Using a mixture of legal and illegal transactions involving businesses all over the world, ultracentrifuge enrichment technology was exported to Libya, North Korea and Iran. [14] Iran, for example, despite being a signatory to the NPT, established a uranium enrichment programme without informing the IAEA. So existing controls, legal arrangements and guidelines failed to stop the export of sensitive nuclear technology.

By trying to reduce the number of states operating sensitive facilities, such as uranium enrichment, but at the same time proposing a system whereby the nuclear materials would be supplied to countries within the

multilateral arrangement, the IAEA would be laying the foundations for more proliferation. The initiative to supply countries with nuclear fuel and take back the waste would increase commerce in dangerous materials and add to the environmental, proliferation and security risks posed by nuclear energy. [15]

Of course the West is obliged to help developing nations produce low carbon electricity, but the should be based on a sustainable energy system not a system which is going to exacerbate nuclear proliferation problems, as well as environmental ones.

[1] U.S. Department of Energy, Nonproliferation and Arms control Assessment of Weapons-Usable Fissile Material Storage and Excess Plutonium Disposition Alternatives, (1997), 37, excerpted in http://www.ccnr.org/plute.html
[2] "How to simplify the plutonium problem" by Frank N. von Hippel, Nature Vol394 30th July 1998.
[3]Joop Boer, Henk van der Keur, Karel Koster, Frank Slijper, A.Q. Khan, Urenco and the proliferation of nuclear weapons technology: The symbiotic relation between nuclear energy and nuclear weapons,. Greenpeace International May 2004.
http://www.greenpeace.org/international/press/reports/a-q-khan-urenco-and-the-prol
[4] Miller, M. M., Are IAEA Safeguards on Plutonium Bulk-Handling Facilities Effective?, Nuclear Control Institute, Washington, DC., August 1990. http://www.nci.org/k-m/mmsgrds.htm
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[5] U.S. Department of Energy, Nonproliferation and Arms control Assessment of Weapons-Usable Fissile Material Storage and Excess Plutonium Disposition Alternatives, (1997), page 84
[6] PVRT report. Extracts available at http://www.ccnr.org/plute_sandia.html
[7] See Plutonium Disposal, Nuclear Control Institute, http://www.nci.org/
[8] ibid
[9] UN 5th June 2006 http://www.un.org/apps/news/story.asp?NewsID=18741&Cr=uranium&Cr1=
[10] IPCC working group II (1995) Impacts, Adaptions and Mitigation of Climate Change : Scientific-Technical Analyses. Climate Change 1995 IPCC working group II.
http://archive.greenpeace.org/comms/no.nukes/nenstcc.html
[11] Nuclear Control Institute Press Release, 20th December 2001, 'Closure of DOE's Fast Flux Test Facility is a long-overdue de sentence for US Plutonium Breeder Reactor Program'. www.nci.org
[12] The Observer, December 8, 2002, 'Britain enters new nuclear age' by Oliver Morgan
http://environment.guardian.co.uk/energy/story/0,,1847995,00.html
[13] see ref [1]
[14] Joop Boer, Henk van der Keur, Karel Koster, Frank Slijper, A.Q. Khan, Urenco and the proliferation of nuclear weapons technology: The symbiotic relation between nuclear energy and nuclear weapons,. Greenpeace International May 2004.
http://www.greenpeace.org/international/press/reports/a-q-khan-urenco-and-the-prol
[15] The Real Face of the IAEA Multilateral Approaches: The proliferation of nuclear weapon material & environmental contamination. Greenpeace International Briefing, 26th September 2005
http://www.greenpeace.org/international/press/reports/IAEAmultilateralnuclearapproachreport