Stichting Laka
Ketelhuisplein 43
1054 RD Amsterdam
Tel: 020 - 6 168 294
Fax: 020 - 6 892 179
E-mail: info@laka.org
Web: www.laka.org
Giro: 5 780 452

Laka Foundation
Ketelhuisplein 43
1054 RD Amsterdam
The Netherlands
Tel: +31 20 6 168 294
Fax: +31 20 6 892 179
E-mail: info@laka.org
Web: www.laka.org

Published in *Nuclear Monitor*, March 19, 2007

MONOPOLIZING THE FUEL SUPPLY:
THE GNEP, GNPI AND FUEL BANK INITIATIVES

One of the most urgent problems the nuclear community has to 'solve' before a relapse of nuclear energy is possible is the proliferation issue. Nuclear energy makes the nuclear bomb possible in many ways: know-how and skills, materials, technologies, processes and methods. The difference lies only in the intention.
One of the ways the nuclear society wants to 'solve' this is to monopolize the nuclear infrastructure and technology and restrict access to nuclear fuel. Internationally several initiatives are currently being developed.

But all these initiatives are undermining Article IV of the Non proliferation Treaty-- and with that the entire NPT, because Article IV is the 'carrot' in the NPT-'stick'.
Even if proposals to limit the accessibility of technology and nuclear fuel could somehow be brought into force, it would still not result in eliminating the proliferation risks associated with a (foreseen) large expansion of nuclear power.

Some of the global (potentially armed) conflicts in recent years (Iraq, North-Korea and currently Iran), are a direct result of nuclear power programs. Proliferation of nuclear technology is a major problem and control is not able to solve that problem, as ElBaradei IAEA Director-General stated in 2004: *"The technical barriers to mastering the essential steps of uranium enrichment – and to designing nuclear weapons – have eroded over time, which inevitably leads to the conclusion that the control of technology, in and of itself, is not an adequate barrier against further proliferation".*

Enrichment
Enriched uranium fuel is required by almost all nuclear reactors in use around the world today. However, as we all know, enriched uranium is also used in nuclear weapons. The difference between bomb fuel and reactor fuel is the level of enrichment.

Because the technology used to enrich uranium to the levels used to fuel power plants is essentially the same as the technology required to produce highly enriched uranium for nuclear weapons -- the difference lies mostly in the time required to enrich the fuel -- any technology used to enrich uranium fuel for power plants is inherently "dual-use." Since Article IV of the nuclear Non-Proliferation Treaty ensures access to peaceful uses of nuclear technology for non-nuclear weapon states, the technology for uranium enrichment must be permitted to all states under the current nonproliferation regime. Countries like Iran could therefore, in principle, develop their enrichment technology up to a certain point under the cover of a "peaceful" nuclear energy program before dismissing the peaceful-use pretense and rapidly developing nuclear weapons -- a scenario often described as a "break out."

Following India's nuclear test of 1974, concerns about such a "break-out" scenario led many states that possessed enrichment technology to band together to form the Nuclear Suppliers Group (NSG-currently about 45 member states) and create stringent rules for themselves to prevent the transfer of sensitive (enrichment) technology. The 2006 US-India nuclear agreement breaks those rules: India is not a signer of the NPT and thus does not comply under the rules of the NSG and should

therefore be excluded from nuclear dual-use technology transfer. It was feared that the US-India agreement would set a precedent, and indeed recently Russia signed an agreement with India for the construction of nuclear reactors and China may also seek similar exemptions for Pakistan.

Since developing, maintaining, and operating enrichment facilities is quite expensive, for decades recipient states were mostly content to buy their fuel from NSG members. However, recent events -- including the attacks of Sept. 11, 2001, the revelation of A.Q. Khan's black market trade in nuclear technology, North Korea's nuclear test, and suspicions about Iran's nuclear ambitions -- have raised worries that a future political crisis could interrupt the steady supply of nuclear fuel. This, further, has led to concerns that more countries will pursue enrichment technologies themselves, to ensure a continued supply of fuel.

GNPI

Many hope that this clear proliferation danger (the spreading of enrichment technology) can be addressed by giving states that currently forego indigenous enrichment capabilities incentives to continue doing so, by strengthening guarantees that supplier states will not cut off fuel shipments for political reasons. "Multilateralization" of certain aspects of the fuel cycle may have the potential to address this issue. The city of Angarsk gives the most concrete example of such a proposal to date. Angarsk is a city of about 270,000 in southeastern Siberia, Russia, and the home of the Angarsk Electrolyzing and Chemical Combine, a plant created to enrich uranium for the Soviet nuclear program. Throughout its history, the plant has been a restricted area - closed to all foreign visitors. On November 28, 2006, however, the Russian news agency ITAR-TASS reported that the Russian government had decided to remove the Angarsk plant from its list of restricted areas. Soon, according to the report, Angarsk will become the site of the world's first "international uranium enrichment center" (IUEC). The aim of the center is to provide a guaranteed supply of uranium fuel for countries which do not enrich uranium themselves, including for countries under international sanctions such as Iran, India and others. In February it was announced that Russia and Japan were close to signing an agreement allowing Japanese reprocessed uranium to be sent to Russia for enrichment. Although Japan has an enrichment plant, the plant's capacity is only a fraction of Japan's total demand. Furthermore, Angarsk is re-enriching Urenco's depleted uranium to natural levels. Many see this as dumping nuclear waste in Russia.

Interested states will (in theory) be able to ensure their access to nuclear fuel from the Angarsk IUEC by meeting "established non-proliferation requirements" in exchange for assured access to the fuel produced by the center. Russia envisions its IUEC will have "equal, non-discriminatory membership for all," "transparency," and "involvement of the IAEA in [the fuel center's] activities," but otherwise the details of the arrangement remain vague. In any case, Russia will retain exclusive control of all sensitive enrichment technology, so the exact nature of "membership" remains an open question. It could mean anything from a contractual relationship to some role in physically managing the facility. It is also unclear how such a facility, situated in Russian territory, will provide any further assurance that nuclear fuel shipments will not be interrupted.

The IUEC in Angarsk is the first specific proposal resulting from Russian President Vladimir Putin's Global Nuclear Power Infrastructure (GNPI), an initiative announced on January 25, 2006, that aims at establishing a network of international centers (it is unclear whether they will all be based in Russia) to provide nuclear fuel cycle services, including uranium enrichment, on a non-discriminatory basis and under the supervision of the IAEA. GNPI is one of two major "multilateral" fuel cycle initiatives in development today; the other is the United States' Global Nuclear Energy Partnership (GNEP).

GNEP

Unveiled by the Bush administration February 2006, the Global Nuclear Energy Partnership (GNEP) is advocated by the US through which the country (and international partners) would develop a fuel services program to supply developing nations with reliable access to nuclear fuel in

exchange for a commitment to forego the development of uranium enrichment and plutonium reprocessing technologies. The proposal set off strong protests in anti-nuclear and non-proliferation camps, because it reintroduced the reprocessing of spent reactor fuel to the U.S. nuclear landscape.

Although much attention so far is focused on reprocessing as an important issue of the GNEP-initiative, monopolizing nuclear infrastructure (and supplying fuel) is an important incentive of the program. (for more on GNEP see *Nuclear Monitor* 642)
In January 2007, 11 communities (all in the US) have been awarded a total of US$16 million in study grants by the U.S. Department of Energy to be used to determine if they would be suitable sites for the GNEP.

Welcoming local and regional authorities are just part of what senior Harvard nuclear researcher Matthew Bunn describes as a large and "unwieldy coalition" that has kept the GNEP proposal afloat despite serious questions about its technical feasibility, concerns over its potential to spread nuclear weapons material, doubts that nuclear "have-not" nations will submit to a Western fuel and technology monopoly and a lack of funding from Congress. That coalition includes the national nuclear labs, which see the potential for billions in research funding, and some players in the industry, who hope for lucrative contracts as part of GNEP and the general growth of the nuclear power industry that they expect will accompany it.

GNEP is instituting a global two-tier fuel cycle regime in which (1) only fully trustworthy states (which in the current political situation means: allies of the U.S.) will be able to operate enrichment and reprocessing facilities, and all other countries will be guaranteed access to nuclear fuel and reactors in exchange for their commitment not to pursue development of fuel cycle facilities of their own; and (2) developing "proliferation-resistant" reprocessing and fuel recycle technologies that, unlike the conventional PUREX process, do not produce "separated plutonium." (see box: "*Proliferation-resistant reprocessing*")

Essentially, GNEP would be a more complete sharing of technology among a very limited set of partners, while GNPI would be a very limited sharing of responsibility with any interested countries. Both, however, promise to supply nuclear fuel to all countries which agree to forego pursuit of enrichment capabilities.

GNEP attempts to address the flip side of NSG members' attempts to keep enrichment technology from spreading: fears among recipient states that such proposals are thinly veiled attempts to revoke their "inalienable right" to peaceful nuclear technology. These fears may even be spurring more countries to pursue nuclear enrichment technology, in hopes that they can achieve significant capability before any new international agreement solidifies and locks them out of the club. Tellingly, all "multilateral" fuel cycle initiatives put forward at a Special Event organized at the IAEA General Conference in 2006 were proposed by actual or potential nuclear suppliers.

Fuel Bank
Unsurprisingly for proposals pushed by current nuclear suppliers, most such initiatives aim to create backup-only supplies that would be available only in the event that the existing market for nuclear fuel fails and thus would not affect prices on the nuclear fuel market. In September 2006, the Nuclear Threat Initiative, a US public charity founded by Ted Turner and former Senator Sam Nunn, pledged US$50 million to the IAEA (on the condition that one or more member states contribute an additional $100 million in funding) to help create a low-enriched uranium stockpile to support nations that make the sovereign choice not to build indigenous nuclear fuel cycle capabilities. Such a stockpile is referred to as the IAEA Nuclear Fuel Bank.

Rather than producing fuel like Russia's IUEC, the fuel bank would simply store a reserve which would assure a back-up supply ("at competitive market prices") for power reactors throughout the

continued on page 6

PROLIFERATION-RESISTANT REPROCESSING

GNEP's promoters paint the program as a nonproliferation initiative. They argue that GNEP will dramatically reduce the threat of proliferation worldwide by instituting a global two-tier fuel cycle regime in which (1) only fully trustworthy states will be permitted to operate enrichment and reprocessing facilities, and all other countries will be guaranteed access to nuclear fuel and reactors in exchange for their commitment not to pursue development of fuel cycle facilities of their own; and (2) developing "proliferation-resistant" reprocessing and fuel recycle technologies that, unlike the conventional PUREX process, do not produce "separated plutonium."

Contradiction

However, there is a fundamental contradiction between these two objectives. If reprocessing facilities are only going to be located in fully trustworthy states that pose no proliferation concerns, then why is it necessary to develop "proliferation-resistant" recycle technologies? And conversely, if the "proliferation-resistant" technologies that are under study have such potential to reduce proliferation and nuclear terrorism risks, then why are they too dangerous to be widely exported?

Countries like South Korea that are already pursuing similar technologies are not likely to understand why they would be asked to give them up under the GNEP regime. The only consistent way to resolve these contradictions is to conclude that no one really believes that the proliferation-resistance of these systems is going to be effective. In fact, it appears that DOE is using the "proliferation-resistance" moniker merely to "brand" GNEP for sale to the public, just like the other banal and oversimplifying adjectives like "clean," "safe" and "secure" which appear in DOE's GNEP promotional materials.

UREX+

The claim that GNEP will advance non-proliferation through the development of "proliferation-resistant" reprocessing technologies that do not produce "separated plutonium" has little justification. In fact, there does not appear to be a common definition of "separated plutonium" in either a formal or an operational sense. DOE has at different times proposed three variants of the UREX+ process, producing Pu+Np, Pu+Np+other minor actinides, or Pu+minor actinides+ lanthanides, as well as the Pu+MAs+Ce-144 product of electrometallurgical treatment ("pyroprocessing") as meeting this definition. Japan has asserted that the mixture of plutonium and uranium to be produced at the Rokkasho Reprocessing Plant (RRP) – a 50%-50% blend – is not separated plutonium. France is claiming that an "integrated recycling plant" that produces conventional MOX fuel as an end-product does not produce "separated plutonium." But these approaches are merely superficial modifications to conventional reprocessing that would have no significant impact on the ability of skilled adversaries to divert or steal weapon-usable material from the nuclear fuel cycle and build nuclear weapons within the accepted IAEA conversion times.

There is little question that a simple blending of plutonium with uranium without introducing a high external radiation barrier, even in the form of a bulky MOX fuel assembly, affords little proliferation resistance relative to separated plutonium, and would not affect the intensity of safeguards applied by the IAEA or physical protection measures called for by international standards.

On the other hand, blending with sufficient quantities of highly radioactive fission products in principle could be effective, but the product and fresh fuel would be so cumbersome and dangerous to handle that the cost and risk of generating nuclear power could increase dramatically. These and other proposals to modify the nuclear fuel cycle to reduce the accessibility of plutonium have been discussed for decades, yet it has been falsely asserted that the Carter moratorium on reprocessing was instituted because such options were not available.

For instance, on February 27, 1978, within a year after the Carter policy statement (banning commercial reprocessing), U.S. and U.K. scientists announced the development of Civex, "a method of reprocessing spent fuel from atomic power plants that would not produce pure plutonium, which could be used to make atomic bombs."
The statement went on to say that "in the Civex process, spent fuel would be treated so that it could be reused as fuel … but the plutonium in it would not at any stage be purified to the extent that it could be used for a bomb … the fuel, at every stage of the process, would be so highly radioactive that it could not be handled directly by human beings, a fact that would presumably deter terrorists from attempting to steal the material."

Sound familiar? This is exactly the same wording used today by promoters of UREX+ and pyroprocessing. But the Carter Administration was fully aware of the proposal and expressed interest. The U.S. General Accounting Office reviewed the proliferation-resistance characteristics of Civex and similar approaches at the time and found that they would have little impact on diversion by states, although they would provide enhanced protection against terrorist theft.

Plutonium in spent fuel is relatively inaccessible to terrorists because it is mixed with fission products, some of which—notably 30-year half-life cesium-137—emit penetrating gamma rays when they decay. The radiation dose rate one meter from a 50-year-old spent fuel assembly would be high enough to deliver a fatal dose within half an hour. As a result, a spent fuel assembly, which contains about 4 kilograms of plutonium, will be "self-protecting" by the standards of the IAEA for more than 100 years. In contrast, the penetrating-radiation dose rate from separated plutonium is so low that it can be safely carried in a light airtight container

But the products of the various UREX+ processes would be far less self-protecting than the Civex product, which would retain some cesium-137. Neither the UREX+1a or pyroprocessing flowsheets result in a plutonium product that is "so highly radioactive that it could not be handled directly by human beings." In March 2006, DOE has conceded this point by saying that "The plutonium mix from UREX+ would not meet the self-protection standard of spent fuel and, therefore, the physical protection measures and safeguards associated with the process will need to be stringent."

But DOE de-emphasizes the importance of this admission, stating that "the GNEP model works because only the supplier states will be engaged in the recycling of spent fuel. These are states with strong non-proliferation records … and in most cases are nuclear weapons states." This response recalls the question asked earlier: why then do we need to develop more proliferation-resistant reprocessing technologies at all?
When DOE officials are questioned on this point in private conversations, they say that these technologies will provide enhanced protection against subnational threats. Yet they have provided no evidence that these approaches would be effective. It has already been well-established that the UREX+1a product, a mixture of plutonium and minor actinides (neptunium-237, americium and curium), does not have a significantly greater resistance to theft than does the plutonium itself. The bulk barely increases and the radiation barrier at 1 meter remains below 1 rem per hour; a dose-rate far below the IAEA's threshold for "self-protection" (i.e. a level of radioactivity making even short exposures to the material very hazardous to human health). That IAEA criterion is 1 Sievert (100 rem) p/h at 1 meter. But even this dose is not nearly high enough to interfere with completion of the mission by incapacitating the participants. For that objective, the fuel would have to be able to maintain a dose rate on the order of 10,000 rem/hr, a rate unlikely to be achieved by any nuclear power reactor spent fuel.

A response to the fact that UREX+1a does not meet even the 100 rem/hour standard is to suggest that instead of using UREX+1a, UREX+1 should be used instead. UREX+1 separates a mixture of plutonium, minor actinides and lanthanides. Of all the lanthanide fission products, only

cerium-144 (actually its short-lived daughter, Pr-144) and europium-154 are relatively long-lived and generate significant external dose rates from hard gamma emission. With lanthanides included, the dose rate of the UREX+ mixture would be between 15 rem/hour and 100 rem/hour at 1 meter; again, below the IAEA self-protection standard and the NRC and DOE definitions of highly irradiated material. But adding lanthanides into the mixture would add even more complications to the proposed GNEP fuel cycle: it would require additional refining capability at each "advanced fast-burner" reactor site, costing many billions more.

Moreover, if the goal is to reduce the attractiveness of the reprocessing product (to Level D), there is a far easier way and less hazardous way: simply blend the plutonium with uranium to a plutonium concentration below 10%. In fact, this is consistent with the French claim that light-water reactor MOX fuel is not "separated plutonium". However, both approaches would be completely ineffective in reducing the vulnerability of the closed fuel cycle to terrorist theft.

Another paradoxical aspect of the GNEP proposal is that although it carries an implicit criticism of conventional reprocessing programs that separate pure plutonium, it refuses to address the threat posed by these programs. As a result, the quantity of separated plutonium in the world is likely to increase, rather than decrease, over the next several decades.

There is no sign that DOE is willing to actually do anything to address the current proliferation risk associated with existing plutonium stockpiles. Soon after GNEP was rolled out in February 2006, the Rokkasho Reprocessing Plant (Japan) began active testing with spent fuel, which will ultimately result in the separation of about four metric tons of plutonium. When the plant reaches full-scale operation, it will produce about eight metric tons per year. But Japan has already accumulated a plutonium stockpile in excess of forty tons, in contradiction to its 1997 pledge that its nuclear fuel cycle was based on the principle of "no surplus plutonium". There is every indication that countries that now utilize PUREX, including France, Japan, the U.K., Russia and India, regard GNEP as an endorsement, not a rejection, of their current practices.

Sources: "*The Global Nuclear Energy partnership: Will it advance nonproliferation or undermine it?"* (July 2006), Edwin S. Lyman, Union of Concerned Scientists / "*Is U.S. Reprocessing Worth The Risk?"* (Sept,.2005), Steve Fetter & Frank von Hippel, Arms Control Todav / "*Terror risks of nuclear fuel*". CS Monitor. 16 March 2006

world on a non-discriminatory, non-political basis. This would reduce the need for countries to develop their own uranium enrichment technologies at a time when concerns about nuclear proliferation are growing. Both the US and Russia have announced their willingness to make nuclear material available for a fuel bank, under such a scheme. An IAEA administered fuel bank was a key proposal made by an Expert Group in 2005, tasked with finding options to improve controls over fuel enrichment, reprocessing, spent fuel repositories and spent fuel storage.

If the idea moves forward, the IAEA will decide how the fuel bank will operate and, presumably, who would have access to the fuel and which consortiums are producing the fuel, and de-facto are controlling the enrichment market.

Monopoly

The fact that most such initiatives are simply backup proposals -- combined with the questionable benefits of "multilateralization", the general indifference of countries that purchase nuclear fuel toward such proposals, and the historically rare interruptions of nuclear fuel supply -- means it is unlikely they will deter countries truly interested in pursuing their own enrichment capabilities. Upon close examination, GNEP and GNPI are not even truly multilateral initiatives -- Russia will maintain control of the nuclear technologies used under GNPI, while the United States and existing nuclear suppliers will do the same under GNEP.

The status of have's and havenot's was formalized in the Non Proliferation Treaty but these initiative are a further step and actually undermine the NPT's, Article IV ('free access to nuclear energy technology for peaceful purposes') and with that the entire NPT, because Article IV is the 'carrot' in the NPT-'stick' .

These proposals to create national or international monopolies on the nuclear fuel cycle are very unlikely to be acceptable. The implication of these proposals is, in effect, that certain countries can be trusted with the fuel cycle while no one else can.
And the use of punitive sanctions or (the threat of) military intervention in order to enforce restrictions on access to fuel cycle technologies, would add greatly to the unacceptability of such proposals. These kinds of actions would further increase the discriminatory nature of these strategies. Specifically, the five acknowledged nuclear weapons states, which are also the five permanent members of the Security Council, along with their allies would be shielded from any negative consequences. The embracing of "preemptive" military strikes by powerful states like the U.S. and Israel (which have both demonstrated their willingness to carry out such a policy in defiance of international opinion), further erodes the acceptability of such proposals.

Apart from all other arguments, nuclear power is a very unattractive option if the direct result of that option, the proliferation of nuclear weapons, is restrained by increased regional tension, sanctions that most directly hurt ordinary people, and a heightened risk of conventional war.

Sources: Eric Hundman: *"Nuclear Fuel Supply Proposals Aimed at Weakness in Nonproliferation Regime"* published on www.cdi.org 21 December 2006 / *"US plan for nuclear cartel faces reality check*", MSNBC, 24 January 2007 / Brice Smith, "*Insurmountable Risks*", Brice Smith, IEER, 2006 / *IAEA Bulletin*, September 2006 / Nuclear Threat Initiative, at http://www.nti.org / Press Release by Green Action (Kyoto), Citizens' Nuclear Informaton Center (Tokyo) and Ecodefense (Moscow), 28 February 2007

Laka Foundation
March 2007