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U.K.: SHARP RISE IN DECOMMISSIONING COSTS

The Nuclear Decommissioning Authority has established the first comprehensive program to clean up the UK's first generation of public sector civil nuclear facilities. According to a report by the UK's National Audit Office estimated costs of decommissioning continue to rise rapidly, even for the most imminent work which might have been expected to have stabilized by now. Progress at some decommissioning sites has been hampered by changes at short notice to funds available, bringing uncertainty for sites and lessening value for money.

(667.5854) WISE Amsterdam - On January 30, the National Audit Office released its assessment of the Nuclear Decommissioning Authority's (NDA) ability to estimate the true financial cost of decommissioning and cleaning up the UK's fleet of ailing reactors and contaminated facilities. As costs for decommissioning appear to spiral out of control - rising sharply from £56 billion to £73billion (euro 97 bn , US$ 142 bn) over just a few years - the burden on the taxpayer grows ever more.

The NAO report found that the nature and scale of the decommissioning task inherited by the Authority in 2005 was highly uncertain. Many of the Authority's sites had not been designed with decommissioning in mind. And record-keeping, particularly in the early days of nuclear development, had not always been sufficiently detailed to inform decommissioning several decades later. Plans for decommissioning individual sites have gone through a number of iterations and cost estimates have increased significantly. In part, this reflects a more complete assessment of the range of work that needs to be taken forward. In 2007 the NDA estimated that the undiscounted cost of decommissioning its 19 sites over a 100 year period was £61 billion and that it would cost a further £12 billion to run operating sites to the end of their commercial life. This total lifetime cost of £73 billion was almost £12 billion (18 per cent) higher than the 2005 estimate. Point estimates of decommissioning costs must be interpreted with great caution, and in the knowledge that uncertainties will tend to be greater for more distant tasks, according to the NAO report.

The Nuclear Decommissioning Authority was established in 2005 "to ensure the safe and efficient" clean-up of the UK's first generation of civil nuclear facilities, and to commercially operate some of those facilities until the end of their working lives. It is funded by a mixture of grant-in-aid and commercial income from operating facilities. It is responsible for managing contracts with site licensees who perform or commission work at sites, and for running competitions to choose parent bodies which will own and provide strategic management to these site licensees. In 2006-07, the Authority spent around £2,200 million on work undertaken at its sites, including £905 million on decommissioning, of which £686 million was spent on project work. Forty per cent of the decommissioning project expenditure was undertaken at Sellafield. The Authority's largest site is the fuel processing facility at Sellafield, inherited from British Nuclear Fuels Limited. Its sites also include eleven Magnox power

MONITORED THIS ISSUE:

stations (two of which are still operating), formerly owned by BNFL, and four research reactor sites - including Dounreay - formerly owned by the United Kingdom Atomic Energy Authority. Its portfolio is completed by the operational fuel fabrication facility at Springfields, the fuel processing facility at Capenhurst (no longer operating), and the Low Level Waste Repository near Drigg.

Although NDA has only a short history, it has not been a happy one. Three weeks after it was created in April 2005, the spent fuel reprocessing plant at Thorp (at Sellafield) was shut down following the discovery of a leak of dissolved spent fuel. It had been leaking for nine months. Despite recent false promises of a restart, rather embarrassingly it still remains shut, with technical problems being cited (see elsewhere in this issue).

In a statement the NDA said that in less that three years since its creation the authority had gained a "detailed understanding" of the sites. It said it had managed to deliver £300m more work than budgeted, whilst also driving "fundamental change" within the industry. "Costs of the clean-up program were always expected to rise in the early years ... [and] we remain confident that ... we will stabilize and then ultimately reduce the UK's nuclear liability," it said.

According to Greenpeace, the NAO's examination of the NDA should be "a valuable lesson learnt and should serve as a warning to us all - that the government's irrational, ill-conceived and bloody-minded policy of supporting new nuclear reactors has been pushed forward while a solution to the radioactive waste issue still doesn't exist." Meanwhile the NDA is handing out millions of pounds of taxpayers' money to private companies because of badly designed contracts, and the cost of decommissioning nuclear facilities is rising. We've spent tens of billions on this already, and we're set to spend billions more dealing with the existing problem - to build a new generation of new reactors is pure folly.

The NAO report: "*The Nuclear Decommissioning Authority: Taking forward decommissioning*" is available at: http://www.nao.org.uk/publications/nao_reports/07-08/0708238.pdf

Sources: Greenpeace UK, Out of Commission, 31 January / BBC, 30 January, NAO press-release and report, 30 January 2008
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Decommissioning sites:
Wylfa , Hunterston A, Dounreay, Capenhurst (fuel facility), Calder Hall, Sellafield, Windscale, LLW Repository, Winfrith, Chapelcross, Bradwell, Berkeley, Oldbury, Trawsfynydd, Dungeness A, Springfields, Harwell, Culham JET, Hinkley Point A, Sizewell A

CANCELLATION OF IDAHO NUCLEAR REACTOR

On January 28, MidAmerican Nuclear Energy Company announced that it is cancelling its plans to build a new nuclear reactor in Payette County, Idaho. The company cited the poor economics of nuclear power for its decision, saying that its "due diligence process has led to the conclusion that it does not make economic sense to pursue the project at this time."

(667.5855) NIRS - MidAmerican was planning on Warren Buffett's Berkshire/Hathaway company to provide major financing for the project. Buffett is a major owner of MidAmerican. Which leads NIRS to the obvious conclusion: if Warren Buffett cannot figure out how to make money from a new nuclear reactor, who can? "This cancellation is the first of the new nuclear era," said Michael Mariotte, executive director of Nuclear Information and Resource Service, "but it won't be the last. Even before any new nuclear construction has begun in the U.S., cost estimates have skyrocketed and are now 300-400% higher than the industry was saying just two or three years ago."

"The extraordinary costs of nuclear power, coupled with its irresolvable safety and radioactive waste problems, killed the first generation of reactors, and are going to end this second generation as well. But it would be tragedy if the U.S. wasted any money on new reactors, when resources are so desperately needed to implement the safer, cheaper, faster, and sustainable energy sources needed to address the climate crisis," Mariotte added.

"Consumers expect reasonably priced energy, and the company's due diligence process has led to the conclusion that it does not make economic sense to pursue the project at this time," Bill Fehrman, President of MidAmerican Nuclear Energy Co, said in the letter to Payette County residents. MidAmerican Energy Holding owns and operates more than 20,000 MW of generating capacity, markets energy commodities and transmits and delivers electricity and natural gas to about 6.9 million customers worldwide.

Meanwhile, in another blow to the nuclear "resurgence," the Nuclear Regulatory Commission indefinitely suspended licensing hearings for NRG's two-unit South Texas Nuclear Project. Potential intervenors were supposed to file contentions by February 25, 2008, but a legal motion filed February 8 by NIRS, SEED Coalition, Sierra Club and Beyond Nuclear argued that the company's application was incomplete and changing. The NRC suspended the hearings on February 13 until the company has submitted a more complete application, which likely will take months. South Texas was scheduled to be the first reactor licensing hearing in the current wave of new reactor applications.

Sources: NIRS press-release, 28 January / Reuters, 29 January
Contact: NIRS

BRAZIL HELPLESS AGAINST LULA'S NUKE DREAMS?

Anti-nuclear movement; get your act together!

It is -unfortunately - a fact; the Brazilian Government is playing the nuclear game: up to eight more nuclear power stations like the determined Angra 3 in Rio de Janeiro; more uranium mining in Bahia, Ceará and maybe even in the Amazon; the planned export of enriched uranium and the construction of Brazilians first nuclear energy submarine.

(667.5856) Norbert Suchanek - Until 15 till 20 years ago many people spoke out against the nuclear industry in Brazil. But where are they today? Where is the Brazilian movement against the new nuclear dreams of the Government of President Lula da Silva? If you read the big "quality" newspapers like "*O Globo*", and look for critical articles on nuclear, the result is nearly zero. It seems that opinions against nuclear energy or reports about NGO-actions against Lula`s nuclear plans do not exist or are nearly invisible. It is the same situation, if you watch Brazilian television. Even in the ecology program of the more "intellectual" canal TV Brazil national anti-nuclear-speakers nearly have no voice. And of course information about problems of the nuclear industry in other countries also de facto has no place in Brazilian TV.

What you see every day are nice, nobody harming ecology documentary movies sponsored by the Petrol- and Bio diesel-Company Petrobras or sponsored by the big Brazilian mining giant Vale (former Companhia Vale do Rio Doce - CVRD). Altogether mixed with nice advertisements of the big global environmental organizations with as only message: "Global warming harms our planet, we must do something against it." But they do not say what we should do, nor do they inform the public that neither nuclear power nor the catastrophic agro fuel hype (bio-fuel) are the solution. Even worse: the tv-commercials of the big NGOs combine perfectly with the speeches and spots of the Brazilian Government and of the Brazilian corporations, which frequently claim: "we have the solution to save our planet: More agro fuel, more big hydroelectric dams and more nuclear power."

No place for Anti-Nuclear-Movement during hearing

With an article published by a local newspaper in São Paulo in November 2007 it is clearly demonstrated how sad the reality of the Brazilian ecology movement is today: During the official hearing (organized by the state environmental agency Ibama) about the construction of the new nuclear power plant Angra 3 in Rio de Janeiro, last November, there were 300 persons marching in favor of Angra 3. All wore T-shirts with a big "Yes" written on it. They all were brought from the city of Angra by busses, paid for by the state owned electric power company Eletrobras. Missing during the hearing was the regional anti-nuclear movement SAPE (Sociedade Angrense de Proteção Ecologica)

The simple explanation for that was made by a newspaper: the NGO, also based in Angra, could not get into the buses, because they came too late. The journal cited
the representative of President Lula's party (PT) in Angra with the words: "When they
came, the list was already completed." The spokesperson of SAPE answered: "To give a licence (to a nuclear power station) is not a race, it is a serious question. We should have a national discussion, so that we know whether the society really wants to take this kind of risk." In December the President of Eletronuclear, Othon Luiz Pinheiro da Silva, said that the construction of the nuclear power plant Angra 3 will re-start in September 2008 and will, according to da Silva, be completed in 2014. The original contractor, the German firm KraftwerkUnion (KWU), now part of Siemens, which was taken over by Framatome ANP and now Areva, is said to be taking the job.

Uranium-mining to boom

On January 29, 2008, the "*Northern Miner*" wrote: "With the approval late last year of the construction of a third nuclear reactor, Angra 3, slated for operation in 2014, Brazil's uranium outlook is changing, with big uranium production plans. The country's miners Vale and MMX Mineração e Metalicos are lobbying to be allowed to mine the country's reserves and to prospect for more deposits."

According to Reuters Brazil's state-run nuclear mining and fuel company INB hopes to get government clearance to start exporting uranium as part of a plan to quadruple production by 2011 and expand prospecting. INB said the Santa Quiteria phosphate and uranium mining project, which would involve a private partner to mine phosphates, hinged on the liberalization of exports. Santa Quiteria in the north-eastern Ceara state would produce 800 tons of uranium in 2011 and 1,200 tons later on, allowing Brazil to export over 1,000 tons of uranium not needed for the national market. At the moment Brazil's laws make uranium mining and trade a state monopoly and does not permit exports.

Brazil, which has the potential to be one of the world's largest uranium producers, so far only mines uranium from one source, the Caetite pit in the north-eastern state of Bahia. Caetite has an annual output of 400 tons that supplies Brazil's two nuclear reactors, Angra 1 and 2. Brazil's plans involve doubling annual uranium output at Caetite, and developing Santa Quiteria in north-eastern Ceara state into a major mine. While Brazil is not yet ready to hand over all uranium extraction to private miners, Santa Quiteria's phosphate reserves give the Brazilian government the possibility to grant a contract that would see another party mine the phosphates, separate them from the uranium, and hand over the yellowcake to INB.

Independent anti-nuclear information in Portuguese is needed

According to latest reports from the state environmental agency Ibama,

there will be now three new hearings about the nuclear power plant Angra 3 in March in Angra dos Reis, Paraty and Rio Claro because of irregularities denunciated by NGOs like SAPE. But nevertheless: according to long-term environmental journalist Norbert Suchanek from Rio de Janeiro it needs a strong international push from outside Brazil to wake up the Brazilian anti-nuclear-movement and stop the nuclear plans of the Brazilian Government. The big Brazilian corporations with governmental involvement depend on international contacts and contracts, like Petrobras or Vale, which actually are investing in uranium mining in Australia.
And of course independent financial resources are desperately needed to strengthen local anti-nuclear initiatives, to investigate and inform about the nuclear and uranium plans in Brazil and last but not least to educate the Brazilian indigenous and non-indigenous population about the hazards of the uranium industry. For example independent information in Portuguese is urgently needed to be distributed to the population. Information distributed on the internet is not very helpful as only very few people have effective internet access in Brazil and even less people know how to use it.

The international anti-nuclear and human rights movement must act soon!

Sources: O Estado de São Paulo, 27 November 2007 / Reuters, 10 December 2007 /
Email Norbert Suchanek, 18 February 2008 / Northern Miner, 29 January 2008
Contact: norbert.suchanek@online.de

WHO - IAEA CAMPAIGN GAINING MOMENTUM

The campaign to raise awareness about the WHO's 1959 Agreement with the International Atomic Energy Agency is strengthening. People are standing in front of World Health Organsation building in Geneva since April 26, 2007 {nearly 9 months now) and an important action is planned in Geneva for the Chernobyl commemoration day (26 of April). An appeal aimed at health workers to support the independence of the WHO has started.

(667.5857) WHO-campaign -
According to its Constitution, the World Health Organization is 'the directing and coordinating authority on international health issues.' This is unfortunately not true in the area of radiation and health. WHO is unable to fulfill its constitutional mandate in the critically important area of radiation and health because of the 1959 Agreement with the International Atomic Energy Agency, the official lobby of the nuclear industry.

The World Health Organization (WHO) works towards the resolution of public health problems and to this end, it is mandated 'to assist in developing an informed public opinion' (WHO Constitution, 7 April 1948). However, since the WHO/IAEA Agreement (WHA12-40) was signed on 28 May 1959, the WHO appears to be subordinate to the International Atomic Energy Agency (IAEA).
In the past, WHO was paralyzed in its struggle against passive smoking because it was infiltrated by the tobacco lobby. In the same way, WHO is paralyzed by the nuclear lobby, incomparably more powerful, represented by the IAEA, at the top of the UN hierarchy. This agency reports to the UN Security Council where it coordinates the promotion of commercial nuclear energy. The other UN agencies and the WHO report only to the UN Economic and Social Council.

The principal statutory objective of the IAEA is 'to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world'. The WHO/IAEA Agreement stipulates that 'Whenever either organization proposes to initiate a program or activity on a subject in which the other organization has or may have a substantial interest, the first party shall consult the other with a view to adjusting the matter by mutual agreement'. The Agreement also provides (Article III) for the application of 'certain limitations for the safeguarding of confidential information'. This confidentiality led to the non-publication of proceedings of the WHO Conference on Chernobyl, 23-27 November 1995. The 700 participants still await the Proceedings which were promised for March 1996. Dr Nakajima, who was Director General, WHO, at the time of the conference, confirmed in 2001, in an interview with Swiss Italian Television, that censorship of these proceedings was due to the legally defined relations between the WHO and the IAEA.

For research projects, 'adjusting the matter by mutual agreement' implies removing all freedom from WHO in the area of nuclear accidents. The annex to the program of the 1995 Conference in Geneva sets out the chronology of events of the Chernobyl accident, and confirms that WHO's involvement was too late. The last two points of the annex are noteworthy. 'Beginning of 1990: WHO was invited by the Minister of Health of the Soviet Union to set up an international aid project. May 1991: completion of the International Project by the IAEA.'
Thus, it was the IAEA which provided the plans for a project requested by the Minister of Health of the USSR. This explains why genetic damage, known to be a critical measure since the 1957 publication of a WHO 'Technical Report on the Genetic Effects of Radiation on Humans', was omitted, while dental caries were accorded high priority.

As a result, it is the promoters of atomic energy, the IAEA and its spokesman, the UNSCEAR, which depend for their recommendations on the self designated officials of the ICRP (International Commission on RadioProtection), which provide information to the United Nations on the health problems of Chernobyl. They cited 32 deaths from radiation in 1996. In 2005, they conceded 54 deaths and 4000 thyroid cancers in children - a fact which the IAEA could no longer contest, as it had done until 1995.

It is urgent for WHO to provide assistance to one million children, condemned to live in environments contaminated by radionuclides from Chernobyl. Up to 90% of the contamination is internal; and the rest external. Some internal organs accumulate huge concentrations of radionuclides. The resulting chronic contamination has very serious effects on health. In Belarus today, 85% of the children in contaminated areas are ill; before the explosion, this figure was 15%.(figures provided by the Minister of Health and the Academy of Sciences of Belarus during the parliamentary hearings in April 2000). The Chief Medical Officer of the Russian Federation noted in 2001 that 10% of 184,000 liquidators had died and one third was invalid. The Ukraine provided 260,000 liquidators. According to a press release from the Ukrainian Embassy in Paris, dated 25 April 2005, 94.2% of them were ill in 2004. At the Kiev conference in 2001, we learned that 10% of these workers, half of whom were young military recruits had died, one third was invalid and the situation was deteriorating rapidly. The Ukrainian Embassy stated that 87.85% of the inhabitants of the contaminated territory were ill and that proportion increases every year.

Hundreds of epidemiological studies in Ukraine, Belarus and the Russian Federation, have established that there has been a significant rise in all types of cancer causing thousands of deaths, an increase in infant and perinatal mortality, a large number of spontaneous abortions, a growing number of deformities and genetic anomalies, disturbance and retardation of mental development, neuropsychological illness, blindness, and diseases of the respiratory, cardiovascular, gastrointestinal, urogenital and endocrine systems.

The petition demands revision of the Agreement (WHA 12-40) in order to restore independence to WHO in accordance with its constitution. It requests that revision of the agreement be put on the agenda of the next World Health Assembly so that WHO can 'act as the directing and coordinating authority on international health work', 'promote and conduct research', and 'provide information, counsel and assistance in the field of health' [Articles 2 a, n and q of the WHO Constitution] in the area of ionizing radiation and the health consequences of Chernobyl, and in particular the health effects of chronic, low dose radiation from prolonged ingestion of artificial radionuclides.

Source and contact: The Appeal by Health professionals is also available in French, German, Russian and Spanish language. Visit the website of the Independence for WHO Campaign for more information and to sign the petition at: www.independentwho.info Philippe de Rougemont, 71 rue Liotard, 1203 Geneva, Switzerland.

THORIUM-BASED NUCLEAR POWER: AN ALTERNATIVE?

It is said that the global reserves of thorium are considerably larger than natural uranium. Therefore the call for thorium-based nuclear energy is rising. In the past 50 years basic research and development on the use of thorium-based fuel cycles has been conducted in Germany, India, Japan, Russia, the UK and the USA. Test reactor irradiation of thorium fuel to high burn-ups has also been conducted and several test reactors have either been partially or completely loaded with thorium-based fuel.

(667.5858) Laka Foundation - In 2007, a lobby for nuclear power based on the thorium cycle, forced the Norwegian government to consider the option and establish a Thorium Report Committee. In February 2008 the report of the Committee, entitled *Thorium as an Energy Source - Opportunities for Norway*, was released. The Committee notes "[that] Norway has one of the major thorium resources in the world, a potential energy content which is about 100 times larger than all the oil extracted to date by Norway, including the remaining reserves." This sounds almost like the 1950s claim that 1 gram of 'concentrated' uranium, delivers the same amount of electricity as 100.000 kilos of coal. However, the authors also conclude that: "Due to a lack of data, it seems impractical to develop meaningful cost projections for any nuclear energy system using thorium. […] The main economical challenges to the development of a thorium based energy production will be the acquisition of funding necessary to carry out the required research and development." On receiving the report, Norway's minister of petroleum and energy, Åslaug Haga, said: "I register that the report neither provides grounds for a complete rejection of thorium as a fuel source for energy production, nor does it offer enough reason for embracing it as such. The government's viewpoint has not changed, meaning that there exist no plans to allow construction of nuclear power plants in Norway." Apparently financial and technical uncertainties in developing a thorium fuel cycle infrastructure have made the Norwegian government very careful to make a clear decision.

Just as uranium thorium is a naturally occurring radioactive trace element found in most rocks and soils. It was discovered in 1828 by the Swedish chemist Jons Jakob Berzelius, who named it after Thor, the Norse god of thunder. Australia and India each have around one quarter of the world's reserves, while both Norway and the United States have 15%. An international lobby is labeling thorium as a 'safe' alternative for uranium-based nuclear energy. The promoting experts point to a list of arguments that has to prove the advantages of thorium above uranium. However, can the supposed benefits of thorium pass the critical test?

Relying on the most frequently used claim of the lobby on the abundance of thorium there are reasons enough for a thorough analysis of their arguments.

The lobby always starts with an argument like this: "Thorium is about three times more abundant than uranium. Unlike natural uranium, containing 0.7% 'fissile' uranium-235, natural thorium does not contain any 'fissile' material and is made up of 'fertile' thorium-232 only." This presentation is quite misleading, because it omits a comparison with the possible uses of uranium fuels and particular uranium-238, just like thorium-232 'fertile', for Fast Breeder Reactors (FBRs). When the large scale development of FBRs was envisaged, the possibilities of using the 'fertile' uranium-238 were emphasized and were also believed to lead to infinite sources of energy. However, it is well-known that countless technical, political and economical problems have undermined the FBR development.

Just like the non-fissionable uranium-238 isotope, thorium-232 can't be split. Comparable to the uranium based fuel cycle in which uranium-238 is used to breed fissionable plutonium-239, the thorium based fuel cycle uses thorium-232 to breed fissionable uranium-233. Three stages can be distinguished (see: Thorium Cycle Scheme). In the first stage uranium-238 is converted into plutonium-239 in Indian CANDU reactors (PHWR), fed with natural uranium. In the second stage uranium-233 (and plutonium) is produced in a Fast Breeder Reactor (FBR) in which plutonium is the raw material and uranium and thorium are used as the blanket.

Though not yet achieved the first stage, forerunner India has almost reached the second stage of this three-staged fuel cycle. Last November the Indian minister of state Prithviraj Chavan declared that India has extracted 30,000 tons of thorium concentrate to prepare for the third stage of the nuclear power program. Nuclear scientists expect the thorium-based third stage (see box) to begin only around 2030. One of the reasons why the more than fifty year old Indian indigenous nuclear power program is making a slow progress is the lack of uranium technology and fuel, needed to speed up the utilization of thorium. The Indo-U.S. deal has to solve these problems.

Experts from the thorium lobby now say that all aspects of the thorium-based nuclear energy program can be technically achieved. The most important advantages according to the lobby are on the level of efficiency, proliferation, harmfulness and half-lifes of radioactive waste, and reactor safety. A Norwegian expert claims that thorium produces 250 times more energy per unit of weight than uranium in the present reactors. In addition the thorium lobby stresses that thorium fuel in contrast with uranium fuel doesn't produce any plutonium and that the spent thorium fuel would be much less radioactive than 'conventional' nuclear waste. Also they claim that the half-lifes of the radioactive waste products are in the range of hundreds of years instead of thousands of years in the case of 'conventional' spent nuclear fuel. Another often-used argument is that thorium reactors will not be based on moderated chain reactions like in 'conventional' nuclear reactors, but on accelerator-driven systems (ADS). ADS could be the third stage of the three-staged thorium based fuel cycle. However, India considers the Advanced Heavy Water Reactor (AHWR) as the first option.
ADS consist of three main units: the accelerator, the target/blanket unit and the separation unit. The accelerator generates high energy charged particles which strike a heavy material target. This bombardment leads to the production of a neutron source, a process called 'spallation'. The produced neutrons enter a subcritical core - often called a blanket - where they can be multiplied.

Indeed, all of these claims sound attractive, but in fact these 'advantages' don't pass the critical test. Criticasters states: in reality not 250 but some 40 times the amount of energy per unit mass - compared with uranium - might *theoretically* be available from thorium. Though less than claimed by the thorium-lobby, this still seems to be a high efficiency. However, the problem remains if this would be technically feasible. And, in theory the energy per unit mass is maybe even comparable in the case FBRs are used to breed fuel in the uranium based fuel cycle.
On proliferation: though it is important to note that a thorium reactor doesn't produce any weapons-grade plutonium, one needs to mention at the same time that the reactor does produce weapons-grade uranium-233. In fact uranium-233 is even a more effective fissile material than uranium-235. It has the same significant quantity (SQ) as plutonium-239: an amount of 8 kg is sufficient to make a nuclear bomb. Therefore the waste from thorium reactors is still a security risk. There is only one remark: compared to plutonium-239 uranium-233 is somewhat more difficult to separate from the spent fuel.

The main reason for that however, brings another disadvantage in the thorium-uranium fuel cycle to the surface: the high gamma radioactivity due to contaminants in recovered uranium-233, namely uranium-232 and thorium-228, both of which are neutron-emitters, reducing its effectiveness as a fuel and which is partly responsible for the high costs of fuel fabrication. Brian Johnson, a researcher from the Oregon State University, states more specifically on uranium-232 in a 2006 study sponsored by the American Nuclear Society: "Unfortunately if one assumes a closed fuel cycle, thorium has a disadvantage in that there are some highly penetrating radioactive materials, thallium-208 and bismuth-212, that are

India: Thorium Cycle Scheme

	reactor(s)	fuel / blanket	product(s)
Stage 1	PHWR (CANDU)	natural uranium	plutonium
Stage 2	Fast Breeder Reactor (FBR)	plutonium / thorium and uranium	uranium-233 and plutonium-239
Stage 3	Advanced Heavy Water Reactors (AHWR)	thorium-232 uranium-233 plutonium	uranium-233 thorium-232 plutonium

Thorium fuel cycle in India

In the early 1950s India started research and development efforts on the thorium / uranium fuel cycle and thorium-fuelled reactor programs. India can be considered as the main pioneer in developing the thorium fuel cycle and has several advanced facilities to this. The Indian authorities consider a closed nuclear fuel cycle of crucial importance for its three-stage nuclear power program with its long-term objective of tapping India's vast thorium resources. In the front end of the cycle, the program is providing inputs to the indigenous Pressurized Heavy Water Reactor (PHWR) phase. This type of reactor is elsewhere known as CANDU, the Canadian heavy-water reactors fuelled by natural uranium. Though the long-term goal of India's nuclear program is to develop a heavy-water thorium cycle, their PHWRs and light-water reactors are currently used to produce plutonium. Hence, 'fertile' thorium and thorium-based fuel has to be utilized in combination with 'fissile' material (for now plutonium-239 or uranium-235) in order to breed 'fissile' uranium-233. Besides a breeding product this uranium-233 has to become also the feeding 'fissile' material in the future for the just described first stage of the aimed thorium-based nuclear fuel cycle in order to close this fuel cycle. The second stage in the fuel cycle uses fast breeder reactors (FBRs) burning the plutonium to breed uranium-233 from thorium. The blanket around the core will have uranium as well as thorium, so that further plutonium is produced as well as the uranium-233. Finally, in the third stage or the back end of the fuel cycle Advanced Heavy Water Reactors (AHWRs) are supposed to burn the uranium-233 and the plutonium with thorium, getting about two thirds of their power from the thorium, according to the lobby. Up to a few years ago the lobby mentioned a figure of 75 per cent.

Despite the glorifying stories from Indian officials even the first stage of their indigenous nuclear energy program is not yet fully achieved. The two PHWR-units in Kakrapar were the first reactors in the world that have tested thorium. In 1995, Kakrapar-1 achieved only about 300 days of full power operation and Kakrapar-2 about 100 days utilizing thorium fuel. More details are not available. In fact the first stage has not passed the laboratory scale. Irradiation of thorium fuel bundles takes place in a research reactor at Trombay. The use of thorium-based fuel on a 'commercial' scale is planned in Kaiga-1 and -2 and Rajasthan-3 and -4 reactors, which are currently under construction. Finally these thorium-based PHWRs can only become 'commercial' when India has sufficient resources of natural uranium to feed these PHWRs in order to get plutonium as the fissile material to start the thorium based nuclear fuel cycle.

After operating a fast breeder test reactor (FBTR) for two decades India is now on the brink of launching a commercial fast breeder program to take India's ambitious thorium program to the second stage. India has vast reserves of thorium but modest amounts of uranium. Scientists at the Indira Gandhi Centre for Atomic Research, Kalpakkam, have said the conversion of thorium into uranium-233 fuel would depend on the rate of growth of the second-stage, fast-breeder reactors. Currently a 500 MW prototype FBR at Kalpakkam is under construction and is expected to become operational in about four years. It will have a blanket with thorium and uranium to breed fissile uranium-233 and plutonium respectively. Three more of such FBRs have been announced for construction by 2020.

Other steps the Indian government has taken to develop appropriate technologies for the utilization of thorium are the setting up of the research reactor Kamini at Kalpakkam, operating since 1997, using uranium-233 fuel obtained from irradiated thorium, and the development of technologies to reprocess irradiated thorium fuel and in fabricating uranium-233 based fuel.

According to Indian scientists the planned FBRs can use about 30 tons of thorium for conversion. The actual amount of thorium available for conversion from the 30,000 tons of thorium concentrate would depend on the level of concentration. A one per cent concentration would mean 300 tons while a 10 per cent concentration would mean 3,000 tons of thorium available for conversion. Thorium in India is mainly recovered from monazite, a naturally occurring mineral. Monazite is produced as a co-product along with substances such as ilmenite, zircon and rutile.

In a recent interview the Indian minister of state Chavan said India needed to have international cooperation to acquire uranium technology and fuel, which was insufficient in the country. In a veiled reference to the Indo-U.S. deal he said: "The government is trying for international cooperation in this sector and also trying to convince the House to allow it to obtain uranium to speed up the process of atomic nuclear fuel." [..] "If the government is allowed to go for international cooperation, there will be enough uranium available that will speed up our nuclear program much faster."

unavoidably created in the spent fuel. They occur as part of the decay of uranium-232 which cannot be separated chemically from the uranium-233 in the spent fuel." These disadvantages make clear the difficulties in handling thorium based spent fuel and the purification of uranium-233 for re-use in the three-staged cycle. Except the handling of the material, these problems don't play any role in the military use of uranium-233. The fissile power of uranium-233 is not influenced by the contaminants. Finally, it is worth to note that because of these disadvantages the spent fuel of a thorium reactor is much more dangerous when used in dirty bombs.

As noted above thorium reactors must breed their own nuclear fuel from

uranium-233. The point is, however, that there is almost no separated uranium-233 anywhere in the world. In order to get it one has to start with for example plutonium-239 to get one reactor in operation. After 40 years this will have bred enough uranium-233 from thorium-232. Thus, if the Indians succeed in their ambitions somewhere in 2048 the first thorium reactor of the closed thorium fuel cycle could be in operation. But only if India succeeds to develop a proper method to reprocess the thorium-based spent fuel and to isolate the uranium-233 for re-use. As described above this is not an easy job and much more difficult than isolating plutonium-239 from uranium-based fuel. The technology is still in a experimental stage and hasn't even reach the developmental stage.

Though thorium - compared with uranium - has the advantage that smaller quantities of long-lived minor actinides and transuranic elements are formed when this fuel is used, the fact remains that these long-lived and highly radioactive elements are still present in the spent nuclear fuel. The chemical separation appears to be much more complicated than in the reprocessing of spent fuel in the uranium-based fuel cycle. This means that the half-lifes of the high-level radioactive elements can't be reduced from thousands to hundreds of years in the partitioning and transmutation process. That has to be rejected as wishful thinking. Thorium produces its own set of actinides which also pose problems for their management. The encountered problems can't be solved with the current reprocessing technology. Therefore new technologies and plants have to be developed.

Lately, thorium-based fuel is named as a promising alternative for MOX-fuel to burn weapons grade plutonium. Through a joint operation between the Kurchatov Institute and Thorium Power Inc. funded by the US, a plutonium incinerating thorium-based fuel design for current reactors is "about two or three years from implementation in a reactor", according to Thorium Power Inc. in 2006 in Brian Johnson's 2006 study.. The author continues: "Thorium-based fuels could reach the disposition goal more than twice as fast as MOX in the same reactor." This would mean that fewer reactors would be needed to burn the plutonium. At the same time he notes: "While MOX and thorium-based fuels have a great deal of data, it is difficult to get any hard data on how much plutonium can be disposed of per year using fast reactors." Therefore it isn't easy to make any conclusive statements on the value of thorium-based fuels for this purpose, when we restrict ourselves strictly to the available methods of burning plutonium. In fact there is not so much difference with the use of MOX and all the disadvantages connected to this as described in the past decades (reactor-safety, Pu-transports, Pu-fuelfabrication, proliferation-risks, etc)

Further there are some disadvantages of thorium - when compared with uranium - that were recognized from the beginning, but now appeared to be almost forgotten: thorium is more radioactive than uranium, making its handling in fabrication stage more beset with dangers. In addition there are potential difficulties in the back-end of the fuel cycle. The plutonium-238 content would be three to four times higher than with conventional uranium fuels. This highly radioactive isotope causes a much higher residual heat and therefore the time for spent fuel storage in water is much longer. To put it mildly, the technical problems regarding the reprocessing of spent fuel is not solved for this reason.

It would be a revolutionary step forward in nuclear safety if all nuclear reactors could be replaced by accelerator-driven systems (ADS) in the foreseeable future; there is no need to use a moderated chain reaction: a chain reaction that can get out of control, which could cause melt-downs. In addition the lobby claims that introducing ADS can reduce by at least 3 orders of magnitude the time needed for the geological disposal of nuclear wastes.
The recent Norwegian study summarizes the advantages of an ADS fuelled by thorium, relative to a conventional nuclear power reactor, as follows, and states that such a system is not likely to operate in the next 30 years: There is a much smaller production of long-lived actinides, there is a minimal probability of runaway reaction, an efficient burning of minor actinides and a low pressure system. The disadvantages are summarized as follows: more complex; less reliable power production due to accelerator downtime; the large production of volatile radioactive isotopes in the spallation target; and the beam tube may break containment barriers. This overview still gives a too optimistic view. One has to keep in mind that the ADS is in an early testing stage. Even when ADS will succeed there are still problems such as the production of radioactive waste, as noted above. Though the system was named as a promising instrument to transmuted long-lived highly radioactive transuranic elements, the results are poor.

Above this, there are other serious problems that could occur with thorium fuelled reactors. A well-known example is the thorium high-temperature reactor (THTR 300) in the German municipal Hamm/Uentrop. The reactor has been out of operation since 1986. Besides the reactor building, the nuclear power plant has been demolished. Hamm/Uentrop was closed, because the company in charge of the plant was unable to control it properly and covered up numerous technical problems, such as serious problems with replacing the thorium fuel spheres.

For those reasons one has to conclude that thorium is not a serious alternative for uranium. Even when India is able to solve the many hooks and eyes it would take many decades, if ever, before the full thorium cycle is large and reliable enough to be 'commercial', while the current problems with nuclear fission remain to exist. Just like 'conventional' nuclear power the technology can't play any significant role in tackling the urgent problems connected with climate change.

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IN BRIEF

South African nuclear industry backs down. The powerful South African nuclear industry has backed down and withdrawn the complaint it laid with the Broadcasting Complaints Commission (BCC) over the screening by Carte Blanche of *Uranium Road*, a documentary about the country's nuclear industry. The hearing, planned for February 20, 2008, was cancelled because a settlement was reached. It is understood that the settlement involves Carte Blanche screening a follow-up programme on the nuclear industry. Earthlife Africa believes that the nuclear industry has in this way managed to make claims about the veracity of the film and yet has avoided having to
substantiate their criticism of the documentary in a public forum. Earthlife Africa believes that the nuclear industry representatives agreed to a settlement because of the publicity surrounding the hearing, and that they were keen to avoid public scrutiny.
Uranium Road is a documentary about the history of the nuclear industry in South Africa as well as the present status of nuclear power in the country. It was screened on Carte Blanche in November 2007. It raised questions about the nuclear industry and was intended to generate public debate. Dr Rob Adam, who was interviewed in the film, laid a complaint on behalf of NIASA (Nuclear Industry Association of South Africa).
Earthlife welcomes any debate that encourages awareness about the impact of nuclear power on our environment, because many South Africans only hear about nuclear power from the nuclear industry.
Press-release Earthlife Africa, Maya Aberman, coordinator@earthlife-ct.org.za

ITER: China pays more, US less. The United States will suspend for this year its financial participation in the international ITER nuclear fusion project for budgetary reasons. The move came after the US scientific community discovered late December that its research budget had been cut by 400 million dollars, rather than increasing as expected. Roughly 160 million of that amount was earmarked for 2008 for the France-based ITER project, expected to be up and running by 2016. "It's not a cash contribution that has been withdrawn from the project, but equipment that the Americans were to have constructed that will be delayed," an ITER-spokesperson said. The United States is expected to contribute 9 per cent of the 10-billion dollar project shared among Europe, China, Russia, Japan, South Korea and India. The European Union is to contribute the lion's share, or 46 per cent of the total
Oak Ridge National Lab Director Mason said he doesn't believe the Congress intended to kill the participation in ITER when it almost zeroed out funding. "That's why I'm still hopeful we will get back on track." At this point, however, there are serious questions about the consequences e to the U.S. project effort by the 2008 budget (in which only US$10.7 was appropriated for ITER-related research instead of the requested US$160 million) and exactly will happen if Congress is less than accommodating to the Bush administration's request for US$214 million in fiscal 2009. If the United States gets back on track for funding the effort in 2009 and progresses with the procurement of materials and equipment for the project, there's still time to recover the overall schedule and make the deliveries on time around 2014-15, Mason said. If there's no ITER commitment by Congress in the 2009 budget, the U.S. will basically default on its partnership and, according to Mason "also be subject to financial penalty -- somewhere in the range of US$750 million in U.S. dollars." Meanwhile, China, which joined ITER in 2003, announced to pay US$1,4 billion to the Thermonuclear Experimental Recator-project. This represents around 10% of the estimated costs.
Times of India online, 18 January 2008 / Knoxnews.com, 11 February 2008 / WNN, 8 January 2008

No to transferring KWh to extend Biblis A's life
Germany's regulators on February 6 rejected RWE's petition to extend Biblis A's lifetime by transferring allotted kilowatt-hours to it from the newer Emsland plant, German regulatory sources said. RWE is expected to sue the federal government and the case will probably come to court toward the end of 2008. This is the first of several pending cases where Gabriel must decide whether to allow older reactors to operate for longer lifetimes based on safety comparisons between older and newer units from which KWh are to be transferred. It is expected that other utilities' requests, which Gabriel has not yet decided, will also be rejected during the coming 18 months.
Biblis-A returned to service February 9 after a forced 17-month repair outage, according to owner-operator RWE. Both Biblis-A and Biblis-B were shut in fall 2006 to repair and replace defective support anchors. Biblis-B returned to service in January. The unplanned (?) outages will assure that both units will not exhaust their remaining lifetimes under full-power operation until after the 2009 Federal election, according to RWE officials.
Platts, 7 & 11 February 2008

Further trouble for comatose THORP. Still not fully open since the leakage accident in April 2005, hopes to restart the Sellafield THORP plant soon have been dented by the mechanical failure late January of the elevator system which feeds fuel from the plant's feed pond into the main plant for reprocessing. Despite THORP re-start approval having previously been given by HSE's Nuclear Installations Inspectorate (NII) late last year after the plant's almost three-year accident closure, normal reprocessing has so far been impossible because of the unavailability of a downstream evaporator to deal with THORP's liquid high level wastes. Whilst the lack of evaporative capacity remains an ongoing problem, the breakdown of the feed pond elevator on 28 January is likely to add further to the delay in getting back to full operation.
With some 800 tonnes of foreign fuel still to be reprocessed in THORP, overseas customers already highly critical of the plant's past performance will be dismayed by this latest breakdown and the further inevitable delay it will cause to the reprocessing of their fuel. The plan to complete all overseas contracts by 2010/11 - already 2 years behind at the time of the THORP's accident closure in 2005 - has now slipped to an overall delay of at least 5 to 6 years.
CORE Briefing 1, 30 January 2008

Japan: fault under nuke plant not checked and new faults discovered….. Japan Atomic Power Co. did not check the fault line under the Tsuruga nuclear plant in Fukui Prefecture when, in 2004, asking permission and starting the procedures to add two reactors. There are already two reactors online (Tsuruga 1 and 2) with a total capacity of 1520 Mw and the utility wants to add two APWR (1538 Mw each) to the site. JAPCO did not research the fault lines on the grounds that it has been inactive for the past 55,000 years even though it is believed to have shifted within the past 20,000 years, according to Takashi Nakata, a professor at Hiroshima Institute of Technology. He urged the company to immediately check the facility's quake resistance. Under quake resistance guidelines that came into force in 2004, faults that have been active during the past 50,000 years should be checked, and a 2006 revision changed the duration to the past 120,000 to 130,000 years.
On February 15, Tokyo Electric Power Company announced that a part of a fault near the site of its planned Higashi-doori nuclear plant might be an active fault. The fault is named the Yokohama Fault and was assessed to be inactive when the license application was submitted on 29 September 2006. TEPCO is carrying out further surveys. Tokyo Electric, Asia's largest power producer, will delay the Higashi-doori No. 1 reactor in Aomori prefecture, northern tip of Japan's Honshu island, by at least 12 months from the plan to start construction in November 2008. The Higashi-doori plant would be the first built by the company since completion of Kashiwazaki Kariwa No. 7 in 1997.
Email from Philip White (CNIC), February 19, 2008

…. Kashiwazaki Kariwa still closed after last year's earthquake. TEPCO's facility in Niigata prefecture's Kashiwazaki Kariwa, the world's largest nuclear power plant, has been shut since July 16, 2007 when a 6.8 magnitude earthquake caused a fire and radiation leaks. The seven reactors at Kashiwazaki remain shut as the company conducts a detailed check of the damage. Tokyo Electric predicted a net loss of 95 billion yen (US$839 million) for the year ending March 31 -- the first loss in 28 years -- because of costs to repair Kashiwazaki Kariwa and buy oil and gas for non-nuclear plants to make up for the shortfall in electricity production.
Email from Philip White (CNIC), February 19, 2008

Turkey decides on nuclear power site. In a surprising move, the Turkish government has decided to build its first nuclear power plant at Akkuyu, on the eastern Mediterranean coast, despite warnings from environmentalists that the site was in an earthquake prone location,.This puts aside a decision two years ago to locate the initial plant at Sinop, on the Black Sea. Akkuyu was under consideration from the 1970s to 2000 for a nuclear plant, and has the advantage of already being licensed. The Turkish Electricity Trade & Contract Corporation (TETAS) is calling for bids for the first plant, which will probably be built by the private sector with all its electricity sold to the state utility for 15 years. A government decision on plant type and construction arrangements is expected by the end of 2008, and first power is expected in 2014.
AUA Weekly Digest, 15 February 2008

WNN: Monju to return in 2008 with new plutonium core. Japan's Monju fast breeder reactor should return to service this year, with fresh plutonium fuel replacing its initial core load. A safety review is currently underway concerning replacing the

reactor's current fuel load. During the 12 years that Monju has been offline, enough plutonium-241 in the inner core has transmuted to americium-241 to cause a deterioration in the level of reactor response.
The 280 MWe fast breeder prototype reactor was built and operated by the Japan Atomic Energy Agency. It started up in April 1994, but a sodium leak during performance tests has seen it out of action ever since. The restart of Monju is a key aim in Japan's national nuclear program, which foresees the FBRs expected to follow Monju becoming the main nuclear power systems of the 21st century. Design changes necessary to improve Monju's safety were made between September 2005 and May 2007, with verification tests starting in August 2007 and set to finish in August this year. About one quarter of the required verification tests have been carried out to date.
WNN, 17 January 2008

A present to our children's children's children's…. The families of Australian and British soldiers used as guinea pigs in nuclear tests in Australia 50 years ago will carry a higher risk of major health problems for up to 20 generations. A British parliamentary inquiry has been launched into the medical effects of the nuclear testing program on more than 20,000 servicemen, as 800 survivors and their families mount a High Court challenge for compensation. Early medical studies show veterans' children either died hideous deaths, with multiple medical complaints, or were 10 times more likely to have a deformity. Their children's children were eight times more likely to have genetic defects, and their children twice as likely to get cancer.
The nuclear tests were conducted at Maralinga in the South Australian desert, at Christmas Island, on the Monte Bello islands off the Western Australian coast, and on other Pacific Islands.
December last year, a House of Commons cross-party inquiry acknowledged health problems from the radioactive tests and recommended interim payments of Aus$10,000 each. It said families could suffer an increased risk of health problems for up to 20 generations.
Australia Herald Sun, 18 January 2008

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Oops!
The January 28 special edition ('Confronting the nuclear resurgence') was numbered 665. That should have been number 666 of course.

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