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NUCLEAR BOMBS FROM LOW-ENRICHED URANIUM OR "SPENT" FUEL

Conventional wisdom says that low-enriched uranium is not suitable for making nuclear weapons. However, an article in *USA Today* claims that "rogue" states and terrorists have discovered that this is untrue. Not only that, but terrorists could separate plutonium from irradiated fuel (often called "spent fuel") more easily than previously thought.

(584.5495) WISE Amsterdam – Low-enriched uranium (LEU) is uranium containing up to 20% uranium-235. Uranium with higher enrichment levels is classified as high-enriched, and is subject to international safeguards because it can be used to make nuclear weapons.

However, a *USA Today* article claims that "rogue countries and terrorists" have discovered that it is possible to make nuclear weapons with uranium of lower enrichment, according to classified nuclear threat reports (1).

The information is not entirely new. Back in 1996, a standard book on nuclear weapons material stated, "a self-sustaining chain reaction in a nuclear weapon cannot occur in depleted or natural or low-enriched uranium and is only theoretically possible in LEU of roughly 10 percent or greater" (2).

Fuel for nuclear power reactors would not be suitable – this is typically enriched to 3-5% uranium-235. However, for a "rogue state" wanting to make high-enriched uranium, it would take less work to start with nuclear fuel than with natural uranium. It could be done in a "small and easy to hide" uranium enrichment plant – perhaps similar to the plant which has recently been discovered in Iran (3). Nevertheless, it would still require a substantial operation, since the fuel would need to be converted to uranium hexafluoride, enriched and then reconverted to uranium metal.

More significantly, many research reactors use uranium of just under 20% enrichment, which according to the *USA Today* article can be used to make nuclear weapons.

The U.S. has long promoted a program called Reduced Enrichment for Research and Test Reactors (RERTR), offering incentives for converting research reactors from high-enriched uranium to uranium of just under 20% enrichment, as an anti-proliferation measure.

The new revelations raise a question mark over the usefulness of the RERTR program, and imply that research reactors with uranium of just under 20% enrichment need to be well guarded too.

They also raise questions about the usefulness of dramatic military operations to secure high-enriched uranium at inadequately guarded research reactors, such as the operation in Serbia last year (4).

This operation apparently left behind a cache of irradiated fuel containing at least 10 pounds (4.55 kg) of plutonium.

Irradiated fuel

Irradiated fuel from nuclear reactors, often described as "spent fuel" even though it still contains lots of fissile material, could also be made into weapons more easily in some cases, according to the *USA Today* article.

IN THIS ISSUE:

Some stocks of irradiated fuel have been sitting around for many years, and are now far less radioactive. This would mean that only "modest facilities and equipment" would be needed to reprocess the fuel to extract plutonium.

IAEA response
Challenged over the proliferation dangers from "old" irradiated fuel and LEU of just under 20% enrichment, Davis Hurt from the International Atomic Energy Agency (IAEA) told *USA Today* that the IAEA could only expand its monitoring too include these materials if member states provided money to boost its budget. And, it seems that the nuclear industry is reluctant to pay for the extra security measures, and would rather either ignore the problem and hope it goes away, or else get the taxpayer to foot the bill.

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Contact: WISE Amsterdam

IRAN'S NUCLEAR PROGRAM

An International Atomic Energy Agency (IAEA) delegation has recently visited a uranium enrichment facility under construction in Iran. The visit has highlighted Iran's nuclear program: a program that began with U.S. support under the Shah and continued after the revolution under the Islamic fundamentalists.

(584.5496) WISE Amsterdam – Back in 1967, when a US-supplied 5-megawatt research reactor was started up at Tehran University (1), the U.S. was only too happy to provide Iran with nuclear technology. After all, at that time the Shah was in charge, and despite concerns over human rights abuses and lack of democracy, Iran was considered a "friendly" state.

Iran has always insisted its nuclear program is peaceful, ratifying the Nuclear Non-Proliferation Treaty (NPT) in 1970 and allowing IAEA inspections of its nuclear facilities. Back in the 1970s, this was enough to give the green light for the nuclear industry to seek business in Iran. The obvious question of why a country with vast reserves of oil and natural gas was so keen to use nuclear power to generate electricity was not asked. It was as if Iran's vast petroleum reserves caused dollar signs to appear in the eyes of the nuclear salesmen, blinding them to such concerns.

The first contracts came in 1974. West Germany's Kraftwerk Union (a subsidiary of Siemens) won a contract to build two 1200MW reactors at Bushehr on the Persian Gulf. Construction of the two reactors began in 1975 and 1976 (2).

France also agreed in 1974 to supply nuclear reactors to Iran, although the deal did not go so smoothly, and the formal contract for Framatome to build two 900 MW reactors at Karun was not agreed until 1977 (3).

Both the French and German contracts were notorious for corruption – it is estimated that the Shah's cronies received 20% of the total reactor contracts, "several hundred million dollars per reactor", in the form of kickbacks and "commissions" (4).

The Shah's plans went further, and included four more German reactors (to be paid for with oil) and eight U.S. reactors under a deal agreed with President Carter in 1978 (5). However, these extra reactors remained no more than plans.

French enrichment, German waste
The Shah's nuclear exploits extended beyond reactors. He made a loan of US$1 billion to France in 1975 in return for a 10% share in the Eurodif uranium enrichment plant – a share still owned by the Iranian government, despite disputes and international court cases.

Yet perhaps the most appalling plans were to dump other countries' nuclear waste in the Iranian desert. First the Shah offered the desert as a dump for West Germany's nuclear waste (6). Later, Austria negotiated on dumping the waste from its soon-to-be-completed Zwentendorf nuclear power station (7) – this came to nothing after the Austrian people voted in a referendum against the opening of Zwentendorf.

Islamic revolution
The 1979 Islamic revolution put a stop to Iran's nuclear program, at least initially. At first, the Shah's

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The next issue (585) will be mailed out on 28 March 2003.

Oops! In the last issue, reference 3 for "Dismantling British Energy" should be "*Platts Nuclear News Flashes,* 14 February 2003. Also, the article number for "ECRR report challenges entrenched radiation assumptions" should be 583.5494.

In issue 582, our review of ASLEEP AT THE GEIGER COUNTER, Blue Dolphin Press, incorrectly stated the author's credentials. He is Sidney Goodman, M.S.M.E. (Master of Science in Mechanical Engineering.) The book can be ordered online (www.bluedolphinpublishing.com) or at 1-800-643-0765 in the US.

25 YEARS AGO

NIRS and WISE both celebrate their 25th anniversaries this year. This is the fourth article in a series, "25 years ago", comparing anti-nuclear news "then" and "now", to mark our first quarter-century of anti-nuclear campaigning.

Then

In issue 1 of WISE Bulletin we wrote about a big demonstration against the Lemoniz nuclear power plants in Basque Country (Spain): "Over 150,000 people – probably a record for a single anti-nuke demo – marched on March 12 [1978] against the construction of an atomic power plant at Lemoniz, in the Basque country (on the north coast of Spain). Five days later, the plant – which is nearing completion – was severely damaged by an explosion in the reactor core. ETA, the militant Basque independence movement, claimed responsibility. The dynamite has been smuggled into the plant in small quantities by site workers. Because the authorities ignored precise advance warnings about the explosion, two workers were killed and several wounded". (*WISE Bulletin* 1, May 1978)

Now

In its National Energy Plan of 1975, the Spanish government planned 35,000 MW of nuclear power by 1992 (between 35 and 70 reactors). These plans never became reality. In total 10 reactors have operated in Spain (of which one was shutdown in 1990) and in the 1984 National Energy Plan it was decided that no more than these 10 reactors would operate in Spain. A total of 7 planned reactors were cancelled (including the two reactors at Lemoniz).

The anti-nuclear movement was quite successful in the Basque Country and was supported by local city councils and all political parties. Its efforts concentrated on the Lemoniz reactors, some kilometers from the capital of Bilbao. ETA blew up hundreds of electric pylons connected to the site. In 1982, the construction at Lemoniz was halted although it had been stopped already due to sabotage work from ETA. (*WISE News Communique* 418, 16 September 1994 and 499/500, 16 October 1998)

nuclear program was rejected as "satanic", and was halted. Yet, after a few years, the ayatollahs changed their minds, and decided that nuclear power might be useful for supplying energy.

At the time of the revolution, one of the Bushehr reactors was 80% complete and the other 50%, and work focused on these two reactors. Yet, for the "Islamic Republic", re-starting the nuclear program was anything but straightforward.

Iran faced allegations that the real purpose of the program was the development of an "Islamic bomb". This is supposed to be prevented by IAEA inspections carried out under the NPT. However, Iran has never joined the Additional Protocol to the NPT, which would give the IAEA the right to take and analyze samples from around the plants.

Reactors bombed

Another alarming development was that the nuclear installations became targets in the Iran-Iraq war. Iran became the first country in history to attack a nuclear installation in another country when, on 30 September 1980, it bombed the Iraqi nuclear research facility near Baghdad. One of the reactors, Tammuz II, was in operation at the time (8).

The raid caused little damage, but the Iraqis shut the reactor down and removed the fuel, which was probably just as well, since on 7 June 1981, Israeli warplanes destroyed another of the reactors, Tammuz I (also known as Osiraq).

However, Iraq got its revenge for the Iranian attack when on 17 November 1987, ten Iranians and a West German were killed in an attack on the incomplete Bushehr reactors. Iran claimed that nuclear material was present at the time, though West German technicians said that this was not the case (9). Further Iraqi attacks followed.

New partners for Bushehr

The attacks wrecked the incomplete Bushehr reactors, but Iran soon tried to find partners to re-build them. Various companies were reportedly involved in talks: Argentina's INVAP (10) and Spain's ENSA and ENUSA (11), as well as the original builders Kraftwerk Union (until the West German government forbade further nuclear aid to Iran).

Finally the choice fell on the Russians, who were contracted in January 1995 to complete Unit 1 by installing one VVER-1000 reactor in pace of the wrecked Siemens reactor. This required modification of the containment building, since the Russian steam generators are too large to fit into the German-designed containment (12).

The arrangement with Russia includes supplying nuclear fuel for the reactor and taking back the nuclear waste. This means that Iran does not need fuel cycle facilities for Bushehr.

Uranium mining and fuel cycle facilities

Nevertheless, Iranian President Mohammad Khatami announced on 9 February that Iran has started mining uranium near the city of Yazd and is developing the facilities needed to operate a complete uranium fuel cycle (13). Khatami mentioned a yellow-cake production facility, a uranium conversion facility, a

uranium enrichment facility and a fuel fabrication plant.

The Saghand uranium deposit near Yazd is estimated to produce uranium at prices at 3 to 5 times current world prices (14).

Mining such an uneconomic uranium deposit gives rise to concerns that Iran wants to produce uranium for nuclear weapons, particularly since Russia has already agreed to supply nuclear fuel to Iran.

Most worrying of all are the uranium enrichment facilities, since they could be used for a uranium-based nuclear bomb program. So, when the IAEA's Director-General, Mohamed ElBaradei, made a scheduled visit to Iran on 21-22 February, the recently-revealed uranium enrichment plant at Natanz was included in the visit.

Enrichment plant

The Natanz plant hosts about 200 operational gas centrifuges, according to officials who accompanied ElBaradei on his visit (15). Iranian officials have since said that they intend to bring the plant onstream within the next few weeks (16).

While the plant's construction does not violate Iran's safeguards agreement, Iran is required to notify the IAEA before enrichment begins. This means that if Iran has already carried out any uranium enrichment, this would constitute violation of the safeguards agreement. Establishing this could however be difficult, since no environmental samples were apparently taken.

The new fuel cycle developments in Iran increase the pressure on Russia to drop its assistance with the construction of Bushehr for two reasons. Firstly, they provide additional evidence of nuclear proliferation; secondly, they may eventually threaten Russia's planned exports of nuclear fuel to Iran by providing an indigenous alternative.

Developments continue as this *WISE/NIRS Nuclear Monitor* goes to press.

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Contact: WISE Amsterdam

U.S. MOX: DANGEROUS, DIRTY, UNJUST AND UNPROVEN

The Draft Environmental Impact Statement has been released for a plant to convert excess U.S. weapons plutonium into mixed-oxide fuel (MOX). Meanwhile, Duke Energy has asked for a license amendment to use MOX.

(584.5497) NIRS Southeast – Even while admitting that more poor, and African American, and other minority people would be injured or die from an accident at the proposed US MOX fuel factory planned for the Department of Energy's Savannah River Site in South Carolina, the US Nuclear Regulatory Commission (NRC) gave a tentative green light to the project in its Draft Environmental Impact Statement in the last week of February 2003. Citing the need to meet Russia's desires under a bi-lateral agreement on surplus weapons grade plutonium from dismantled weapons and scraps from nuclear weapons production, the NRC also dismissed consideration of any alternative to the bomb fuel program, except continued storage under current conditions. The US and Russian scheme would commercialize nuclear weapons-usable plutonium by putting it into commerce as fuel for nuclear power reactors in both countries, and perhaps their trading partners as well.

Savannah River Site (SRS), located on the border between Georgia and South Carolina, is across the river from Augusta, Georgia. Downwind and down water of the site, the population is rural, primarily low income, and minority. Dr. Mildred McClain, Executive Director of Savannah's Citizens for Environmental Justice, said, "The report confirmed our biggest fear and suspicion about the impact of a potential accident in the MOX process at SRS - a disproportionate impact on minorities - we have always said that African Americans, because they live in the counties near the site, are a vulnerable population. This is a case of environmental injustice."

These communities are, today, at risk for sickness and death due to historical and ongoing activities at SRS, including plutonium and tritium production, processing and recovery, and associated ground water contamination, nuclear waste incineration, storage and dumping. Adding new ongoing radiation doses and new potential for disaster underscores NRC willingness to treat individuals and families as "expendable" when evaluating a US$4 billion project.

Alternatives for surplus plutonium

instead of MOX fuel production and use were offered to the NRC in public comments, including the immobilization of plutonium and another proposal promoted by scientists Allison McFarlane and Frank VonHippel to make "off-spec" MOX fuel that would not be used (1). Both plans would entail far less waste generation, eliminate potentially catastrophic problems of putting weapons grade plutonium into commercial reactors that were not designed to take it, reduce the transportation of weapons-usable material, and perhaps most important, keep plutonium out of commerce.

Offering no detailed analysis, NRC dismissed both of these options, invoking only the potential for Russian demands that the isotopic composition of the plutonium be changed. The NRC offers no citation for Russia requiring isotopic degradation, nor for the assumption that such "degradation" would prevent further use in a nuclear weapon. Hopefully someone will tell the NRC that it is possible to make nuclear weapons from reactor grade plutonium. The overall plan now under consideration is that identical plutonium fuel factories will be built by DCS in US and Russia.

The draft document, which covers only the construction of the factory by the contractors, Duke, Cogema, Stone and Webster (DCS), has been released for public comment. The final document is expected at the end of August this year, with the NRC's decision on a construction permit 30 days later. Georgians Against Nuclear Energy (GANE) and Blue Ridge Environmental Defense League have challenged the license for the plutonium fuel factory, as well as the license process.

"The worst flaw is the process itself. The NRC has split the construction and operations licenses and the final environmental impact statement will be issued well in advance of NRC ever seeing the DCS license application to operate the MOX factory. The environmental impacts from factory operations will never be analyzed with details specific to this factory," said Glenn Carroll of GANE. "This counterfeit license process outweighs all our other real concerns and we have already challenged NRC on this." NRC has denied that there is a problem with their inventive new licensing approach, but Carroll asserts, "GANE intends to appeal the NRC's decision about the process in federal court if DCS attempts to begin construction before the NRC issues it an operating license for the MOX facility."

There are a number of gaffes in the document, which was delayed last summer by the decision by the Department of Energy (DOE) to kill the planned immobilization program that would have treated the most contaminated "junk plutonium" as waste. DOE's decision to, instead, make MOX fuel from all 34 tons of surplus plutonium has complicated the plan, including vastly increasing the amount of waste that would be generated by cleaning up the plutonium prior to making fuel. NRC originally said that the waste generated by repurifying the plutonium would increase sixty times by including the "junk" plutonium. These numbers have mysteriously shrunken to a fraction of that in the current analysis, with no explanation. Other issues include: inadequate seismic data; understated nuclear waste volume/inadequate waste management; allowable radiation dose to the public; and unresolved safety problems.

Duke Energy

In a separate action in the same week, Duke Energy, parent company of one of the partners in DCS, sent their first request for a license amendment to use bomb plutonium (MOX) fuel in four nuclear power reactors (McGuire 1 & 2 in North Carolina, and Catawba 1 & 2 in South Carolina). The petition seeks approval to use one of the reactors for experimental testing of 4 assemblies of bomb fuel in 2005. The new US factory will not make this test fuel since test is needed to complete the design for the factory.

Both Duke and the National Nuclear Security Administration reference the "Eurofab Option" for fabrication in Belgium or France when queried about where the test fuel would be made. Last summer, Belgian Greens acting with support from Greenpeace and For Mother Earth, forestalled any official Belgium decision to join the US MOX program. France also has made no decision. Tom Clements from Greenpeace International questions whether Duke's plan is viable: "I think it's totally unrealistic for them to act as if this can be pulled off by 2005. I think the political opposition in France and Belgium will remain."

Duke's application for use of the test fuel is, with the rest of the MOX program, somewhat behind schedule, but significant since The Charlotte Observer quoted Duke's MOX project Manager, Steve Nesbit as saying, "[this] means that we're 100 percent committed to making this program a success." Duke hopes to start using 40% bomb fuel in 2008. NIRS and the Blue Ridge Environmental Defense League have intervened on the license renewal for the four Duke reactors and both are reviewing options to intervene on Duke's application to make the fuel test.

The NRC DEIS is available on line at: www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1767/ Public comment deadline is 14 April. Comments may be submitted via e-mail (the@nrc.gov) or mailed to Michael T. Lesar, Rules and Directives Branch, Office of Administration, Mail Stop T-6D59, US NRC, Washington, DC 20555.

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Source and contact: Mary Olson, Director of the NIRS Southeast Office

DECISION LOOMING ON ANGRA-3 REACTOR IN BRAZIL

Brazil´s National Energy Council (CNPE) is expected to take a decision on the construction of the Angra-3 nuclear power plant in May this year.

(584.5498) Urgewald – The first statements of the new left-wing Brazilian government, which came into power in January 2003, suggest a slight tendency in favor of the construction of Angra-3. So far, there has been no official statement from the ministries involved. The decision will depend on the results of additional technical and financial feasibility studies that the CNPE commissioned in September last year and the availability of international financing.

The international partner of the Brazilian state-owned company Electronuclear in this project is Framatome ANP, the merger of the nuclear divisions of the French company Framatome and the German company Siemens. The former Siemens company has already filed, some years ago, an application for export credits of about US$540 million in equipment and services to be guaranteed by the German government. Due to the unstable economic situation of Brazil, the construction of Angra-3 depends totally on new export credits, because Framatome ANP will not be prepared to take such a high economic risk on its own.

Despite nuclear industry pressure, the German Minister of Foreign Affairs and the Minister of Environment and Nuclear Safety have confirmed several times that the German government agreed on not providing export credits for Angra-3. Following the 2000 decision to phase out nuclear energy in Germany, the governing Greens and Social Democrats agreed in 2001 on new environmental guidelines for the Export Credit Agency (Hermes). These guidelines exclude the export of "nuclear technology for new construction or for the conversion of nuclear sites" from export credit. There are still discussions within the government whether Angra-3 should be classified as an existing nuclear project because the German government has already approved export credits for Angra-3 in the past. In that case the new guidelines wouldn't apply. If the project is regarded as new (since it entails the complete construction of a nuclear power plant) it would be excluded from export credits.

> The existing evacuation measures are jeopardised by the unstable ground in the region: roads seem to be less durable and are often blocked by rockfall.

But German banks and Hermes are not the only option for Electronuclear to finance Angra-3. Since Framatome ANP is a French-German company, it is also possible that French banks and the French Export Credit Agency COFACE may instead provide the credits. Some Brazilian journals have already published some articles announcing this, but it still has to be clarified and confirmed officially if the French export credit agency COFACE is interested in the project if Hermes pulls out. It is worth noting that in October last year, the French and Brazilian governments signed an intergovernmental agreement on co-operation in the field of peaceful use of nuclear energy.

Rise and fall of the Brazilian nuclear sector

Brazil's ambitious nuclear plans were conceived in the early 1970s. A contract with the American company Westinghouse led to the construction of the first Brazilian nuclear power plant Angra-1 between 1972 and 1985. In spite of reports that the ruling military regime was planning to utilize nuclear technology for military purposes, the governments of Brazil and Germany signed a "Nuclear Accord" in 1975. This treaty envisaged construction of eight new nuclear power plants, a uranium enrichment plant and a conversion plant in Brazil, all to be delivered by German companies. However, Angra-2 is the first and only nuclear power plant to be completed under the terms of the 1975 Nuclear Accord. Angra-2 came on line only in October 2000 – 25 years after start of construction and 17 years later than scheduled. The overall costs of this project add up to a staggering US$10 billion, three times as much as was initially calculated (1).

The twin unit, Angra-3, which was originally supposed to be the second of the eight German supplied plants, has been in abeyance since the early days of the nuclear accord, set back by financial and organizational difficulties and different political priorities of the Brazilian civilian governments in the 80s and the 90s.

The Brazilian "energy crisis" of 2001 gave fresh impetus to the plans to build Angra-3. In the summer of 2001, Brazil faced an electricity shortage, because after a period of drought, the water level in the hydroelectric dams had fallen and capacity had decreased to 30% of full power. Hydroelectricity supplies about 90% of Brazil's electricity needs, and the Brazilian nuclear lobby used the crisis as an excuse to revive the plans to complete Angra-3.

Thus far about US$750 million has been invested in Angra-3, but it remains just an excavated pit. Some mothballed components for Angra-3 are stored on site. The annual maintenance expenses for both amount to about US$20 million.

Construction of Angra-3 would require a timeframe of about another 6 years and is estimated to cost an additional US$1.5 billion. The large investments already made are the main argument used by the defenders of nuclear power in order to convince the new Brazilian government to approve the completion of Angra-3.

The opponents stress that Angra-2 has already contributed significantly to the huge international debts of Brazil. The cost explosion for the construction of Angra-2 means that it will never turn a profit. And it is highly doubtful that another nuclear reactor would improve this situation.

Leaving financial arguments aside, there are other fundamental problems with the Angra site:

Location:
(i) Angra is situated in one of Brazil's few earthquakes zones.
(ii) Due to its proximity to the ocean, the presence of corrosive salt water has already caused severe problems in early construction phases.
(iii) Furthermore the bedrock is unstable. In the language of the indigenous people the region is called "Itaorna" which can be translated as "rotten stone."

Safety: The emergency planning zone is limited to a radius of 5 km around the plant site. Even for the near-by communities the emergency measures seem questionable, to say the least (2). Also, the existing evacuation measures are jeopardised by the unstable ground in the region: roads seem to be less durable and are often blocked by rockfall. Angra dos Reis is located 130 km east of Rio de Janeiro and 220 km west of São Paulo, Brazil's two biggest cities. The consequences of a major accident are incalculable.

Nuclear Waste: At the moment all used nuclear fuel is stored at Angra. But the storage facilities will be filled by 2004. Yet Brazil does not have any serious plans for mid or long term storage of nuclear waste.

Out-dated technology: Although some slight adjustments may have been made in technical planning, Angra-2 and 3 basically use 1980s technology. The time difference of two decades will certainly cause supply problems for acquisition of spare parts for Angra-2. This could have serious impacts for the plant's future maintenance. Another nuclear power plant of the same design will exacerbate this scenario.

Due to these enormous problems of the nuclear sector in Brazil, European and Brazilian NGOs are actively working on preventing the realization of the Angra-3 project.

In Porto Alegre at the World Social Forum in January 2003, Greenpeace and other NGOs organised a demonstration asking the new President Lula to invest in renewable energy instead of harmful, dangerous and outdated nuclear technology.

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DAVIS-BESSE ONE YEAR ON

One year after a big hole was discovered in the reactor vessel head at Davis-Besse nuclear power station in the US state of Ohio, allegations about incompetence, cover-up and lax regulation continue to fly around. Meanwhile, utility FirstEnergy has replaced the vessel head, loaded the reactor with nuclear fuel and is preparing to start it up.

(584.5499) WISE Amsterdam – The Union of Concerned Scientists (UCS) marked the first anniversary of the hole's discovery by publishing a 29-page report on the affair (1).

It shows how the U.S. Nuclear Regulatory Commission (NRC) identified that Davis-Besse could not safely operate, and drafted a reactor shutdown order for the first time since Peach Bottom in 1987.

Yet, under pressure from FirstEnergy and its lawyers, this order was never implemented, as revealed last year in documents obtained by NIRS under the Freedom of Information Act (2). The UCS report points out that boric acid corrosion had been found on the lid of a U.S. reactor vessel, Turkey Point-4 in Florida, back in 1987. This is in addition to the revelations in the *WISE/NIRS Nuclear Monitor* of the 1971 hole in the lid of a Swiss reactor, of which details were also on file at the NRC (3).

The NRC gathered and analyzed an impressive store of information on the problem of vessel head degradation, enabling it to identify the dangers at Davis-Besse, but backed down at the crucial moment.

To be sure, FirstEnergy put the NRC under extraordinary pressure, bringing their lawyer along to meetings (which no other utility did, According to the report) and lobbying on Capitol Hill to prevent a shutdown.

Yet as a watchdog it is the NRC's job to resist such pressure when regulating the nuclear industry. In this, the NRC singularly failed. Indeed, local Member of Congress Marcy Kaptur "can't think of a mad enough word" to describe the NRC's failure (4).

Cover-up
More evidence of cover-up at Davis-Besse has followed the notorious "red photo" (5) of corrosion products on the vessel head. Local news channel WTVG Toledo reported on 20 February 2003 of a video showing workers using crowbars to chip away boric acid from the reactor vessel head in April 2000. The work was overseen by Andrew Siemaszko, who was fired by FirstEnergy for falsely signing a report saying that all the boric acid had been cleaned off the vessel head.

Siemaszko has since filed for wrongful termination, claiming that he wanted to finish cleaning the vessel head but bosses would not allow him to do so. He thinks that if he had been given a few more hours to complete the cleaning, the hole may have been found back in 2000. He says that the company is using him as a scapegoat (6).

Restart preparations
FirstEnergy reported on 26 February that refueling of Davis-Besse was complete, although several maintenance tasks are still to be completed before re-start (7). Also, startup approval from the NRC is needed.

Meanwhile, Member of Congress Dennis Kucinich has petitioned the NRC to revoke FirstEnergy's operating license for Davis-Besse. This led to an angry response from FirstEnergy, accusing Kucinich of making "patently false" claims (8).

"Red" finding and "get-out"clause
On 25 February, the NRC issued a preliminary "red" finding – the highest of four levels of safety significance – for the hole in the vessel head at Davis-Besse. Despite this, the NRC is apparently not intending to force operators of other PWRs identified as "high-risk" for vessel head degradation to replace vessel heads. And, while the NRC issued an order in February for inspections of the "high-risk" reactor vessel heads, operators can apparently avoid the inspection if they announce plans to replace the vessel heads soon (9).

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Contact: Paul Gunter, NIRS Reactor Watchdog Project (pgunter@nirs.org)

U.S. AND CHINA JOIN FUSION PROJECT

The ITER nuclear fusion research project, which at one time was close to collapse, seems to be back in business, at least for the time being, with the U.S. and China joining the project negotiations. The two countries have joined just as a choice needs to be made between the four candidate sites for ITER.

(584.5500) WISE Amsterdam – The ITER project (International Thermonuclear Experimental Reactor) is expected to take 10 years to build and cost US$5 billion (1). This huge international research and development project, second only to the International Space Station in terms of cost, is designed to produce nuclear fusion in a mixture of two isotopes of hydrogen (deuterium and tritium), which would combine to form helium nuclei (alpha particles) and neutrons.

In order to achieve fusion, the deuterium and tritium would be heated up to enormous temperatures – tens of millions of degrees – so that the nuclei can collide and undergo nuclear fusion. At this temperature, the mixture would take the form of a plasma, in which electrons are no longer bound to the atoms. Intense magnetic fields, produced by huge superconducting magnets, would be used to confine this plasma in a donut-shaped reactor vessel known as a "tokamak" (from the Russian acronym for "toroidal magnetic chamber").

Lots of electricity in – but nothing out, yet
The projected energy from nuclear fusion is 410 megawatts –

BUSH AND EISENHOWER: 50 YEARS OF NUCLEAR OPTIMISM

"Fusion is the same kind of nuc-lear reaction that produces — that powers the sun. The energy pro-duced will be safe and clean and abundant…Imagine a world in which our cars are driven by hy-drogen and our homes are heated by electricity from a fusion power plant. It'll be a totally different world than what we're used to. The quality of life will be ad-vanced."

- from U.S. President George W. Bush's "Hydrogen Fuel Initiative" speech, 6 February 2003

"The United States knows that peaceful power from atomic energy is no dream of the future. The capability, already proved, is here today. Who can doubt that, if the entire body of the world's scientists and engineers had adequate amounts of fissionable material with which to test and develop their ideas, this capability would rapidly be transformed into universal, efficient and economic usage?"

- from U.S. President Dwight D. Eisenhower's "Atoms for Peace" speech, 8 December 1953

comparable to that of a small power station. However, there are important differences.

Firstly, it is not actually designed to generate electricity – a successor to ITER (tentatively called DEMO) is planned in order to demonstrate electricity production. The 410-megawatt figure is thermal power. It includes 82 megawatts in the form of alpha particles, and 48 megawatts in radiated power (2), with most of the energy carried by the neutrons emitted by the reactor.

Secondly, it requires a power input of 110 megawatts. So, even if a steam turbine and generator were connected to ITER, this 110 megawatts would need to be subtracted from the turbine's power of maybe 150 megawatts, leaving a net power production of only around 40 megawatts.

As a result, unless new performance-improving techniques are discovered, a fusion reactor designed to generate electricity would need to be much bigger (perhaps 4000 megawatts fusion power to generate 1000 megawatts electrical power).

This, of course, would make it much more expensive as well, raising the question of whether it would ever receive funding – especially given the problems of funding ITER.

Funding nightmare

A design for the ITER project has been available since 1990. However, it soon ran into funding difficulties. The U.S. cut funding in 1995, and other countries also expressed their doubts (3). The project almost collapsed in 1998, when Congress called an end to U.S. funding (4). This left Canada, the EU and Japan funding the project, with Russia contributing expertise.

The project team then scaled down the proposal, producing what some have described as "ITER-lite", and reducing the expected construction cost from US$10 billion to US$5 billion. Researchers also used climate change as an argument for funding the project (5).

The "ITER-lite" proposals mean that one key goal has been abandoned for now. The original proposal was designed to achieve "ignition": a self-sustained fusion reaction requiring no external heat input.

The new proposal does not achieve this – it still requires external heat input, but produces ten times as much heat as is supplied. As noted above, most of the energy produced is in the form of neutrons, and is dissipated as heat when these neutrons bombard the reactor components and the thick biological shielding around the reactor.

The news that the U.S. will re-join the project, and that China will join too, clearly makes fusion researchers happy after many years of despair. However, it does nothing to diminish the negative sides of the project, such as the nuclear waste it will produce.

200,000 years of nuclear waste

Proponents of nuclear fusion point out that while one of the two fuel components (tritium) is radioactive, the principal waste product (helium) is non-radioactive. This is true, but some then draw the false conclusion that nuclear fusion does not produce nuclear waste.

In fact, the neutrons produced by the nuclear fusion reaction would irradiate the reactor vessel and surrounding components just as in the more familiar fission-based nuclear reactors. Activation products would make these components radioactive, and they would need to be dealt with as nuclear waste when ITER is decommissioned. ITER's own web site admits that it would take "about 200,000 years for the worst isotopes to decay to levels at which the material can be re-used with direct human contact"(6).

Choice of site

Four sites are under consideration for hosting the project: Clarington in Canada, Rokkasho in Japan, Cadarache in France and Vandellos in Spain. A group from the ITER project visited all four of the sites in the last quarter of 2002. They concluded that all the sites would be suitable for the ITER project (7).

The site in Canada has some notable

MILITARY USES

Fuel for the ITER is a mixture of deuterium and tritium, just as for H-bombs. While deuterium is used extensively elsewhere (e.g. in CANDU nuclear reactors), the largest current user of tritium is the nuclear weapons program. Tritium is radioactive, with a half-life of 12.3 years, so the tritium component of H-bombs must be replaced from time to time or they will not work.

One of the uses of ITER will be to demonstrate "lithium blanket" technology, in which neutrons from the fusion reaction would react with lithium to generate tritium. This interests the military, and a 1987 U.S. government report suggested that the nuclear weapons program might therefore shoulder some of the costs of fusion research. However, the report warned, "associating fusion power with the nuclear weapons program could also become a severe liability in terms of public acceptance".

Another future possibility would be a "fission/fusion hybrid reactor", which would "breed" fissile materials such as uranium-233 (from thorium) or plutonium-239 (from uranium). These could either undergo immediate fission, generating extra power, or extracted for use in other nuclear reactors or nuclear weapons. However, the report warned: "In combining the fusion process with fission, a hybrid reactor could also combine their liabilities".

Appendix A of *Starpower: The U.S. and International Quest for Fusion Energy,* October 1987

advantages: it is free from seismic activity, it is near a major metropolis (Toronto), and the tritium needed by ITER can be obtained "next door" from the Darlington Nuclear Generating Station. However, the Canadian federal government has not yet made a financial commitment to cover the costs of any additional infrastructure needed for the project, in contrast to the other three sites.

The Rokkasho site in Japan would need extra seismic protection, and is rather far from big cities or international airports. However, the Japanese authorities are prepared to provide many facilities to attract ITER, and Japan has a strong research program in nuclear fusion. Japan is also constructing a reprocessing plant in Rokkasho.

The Cadarache site would also need extra seismic protection – the Cadarache MOX plant is due to close this year because of seismic risks. It is also the only site not on a major waterway, which means that some large components would have to be constructed on-site. However, it has the advantage that Cadarache is already a nuclear fusion research center.

This leaves the Vandellos site, which is adjacent to two nuclear power plants, but is split into two by a railway line. However, it has good transport links, and also the possibility that a once-though sea cooling system could be used in place of cooling towers.

Always 50 years away?
Whichever site is chosen, even if ITER and subsequent plans go ahead, it will still be 50 years before nuclear fusion reactors could become a viable source of energy. This is in line with the well-known joke about nuclear fusion technology: that scientists have kept saying for the last 50 years that it will be commercially available in 50 years' time.

Meanwhile, a simpler, more effective method of producing electricity from nuclear fusion already exists: photovoltaic solar cells, which convert light from the sun – which is powered by nuclear fusion – directly into electricity.

References:

1. BBC, 25 February 2003
2. www.iter.org/ITERPublic/ITER/paramstab.html
3. *WISE News Communique* 446.4425, "Uncertain future of ITER"
4. *WISE News Communique* 497.4916, "Fusion nightmare: End to the ITER?"
5. *WISE News Communique* 516, "In brief"
6. www.iter.org/ITERPublic/ITER/FAQ.html
7. JASS Final Report on ITER candidate Sites, 26 January 2003

Contact: WISE Amsterdam

IN BRIEF

UK Energy White Paper published. A long-awaited and much leaked Energy White Paper was published on 24 February 2003. In this UK government policy document, a major increase in renewable energy is proposed. This largely depends on financial and regulatory support by the government. The White Paper assumes a goal of 60% reduction in carbon dioxide emissions by 2050.

On the one hand the White Paper is critical about nuclear energy, stating that "its current economics make it an unattractive option for new, carbon-free generating capacity and there are also important issues of nuclear waste to be resolved", and it does not propose building any new nuclear reactors.

On the other hand, it states that "we do not rule out the possibility that at some point in the future new nuclear build might be necessary if we are to meet our carbon reduction targets". A further consultation and White Paper would in that case be needed.
Energy White Paper (www.dti.gov.uk/energy/whitepaper/), 24 February 2003; *N-Base Briefing* #362, 1 March 2003

Russian Nuclear Security Chief murdered. The director of the Ministry of Atomic Energy's International Center for Nuclear Security (ICNS), Sergey Bugaenko, was found dead in the stairway of his Moscow apartment building on 27 February. The police assume that he surprised burglars breaking into his apartment and was killed by a blow to his head from a blunt object. Two crowbars were found nearby the site. However, the police are also inves-tigating the possibility that the killing could be related to his work. The ICNS was created on the basis of a U.S.-Russian bilateral agreement in 1996.
Radio Free Europe Newsline, 28 February 2003

JCO executives sentenced for criticality accident. Six former executives of the JCO fuel plant in Tokai Mura, Japan, were given suspended prison sentences of two to five years on 3 March for their part in the 1999 criticality accident at the Tokai facility (see *WISE News Communique* 519.5091: "Criticality accident at Tokai nuclear fuel plant"). The company itself, JCO, which has already been stripped of its license to operate the plant, was fined 1 million Yen (US$8,490) – an incredibly low amount given that two workers were killed and more than 400 people were exposed to radiation. In 2000, JCO agreed to pay US$121 million in compensation to settle 6,875 cases from local residents, farmers, fishers and industries that suffered losses (see *WISE News Communique* 534: "In brief").
***The Guardian*, 4 March 2003**

Japanese utility tells users to switch off. In a series of advertisements in the press and television, the Japanese TEPCO utility is asking its customers to turn down room thermostats, adjust refrigerator settings and switch off power supply to televisions and video recorders when not in use. The remarkable conservation campaign is needed

because TEPCO is afraid it cannot supply the needs of 27 million customers following the closure of its 17 nuclear power plants. Due to falsified safety inspection reports, TEPCO had to, or is about to, close the 17 reactors for additional inspections (see *WISE/NIRS Nuclear Monitor* 582.5487: "Update on TEPCO scandal"). It has also reopened conventional power plants, purchased power from other companies and asked big consumers such as industries to introduce conservation policies, but TEPCO is still afraid that this won't be sufficient. TEPCO "apologizes for the inconvenience".

***The Guardian*, 28 February 2003**

100+ NGOs say "Abolish Euratom!". Over one hundred NGOs across Europe have called on the Convention on the Future of Europe to support the abolition of the 45-year-old Euratom Treaty. The Euratom Treaty of 1957 is considered out of date, undemocratic and biased towards nuclear energy over other energy options. The Convention members are involved in the process of drawing up a new constitution for an enlarged EU. The groups demand a new constitution that reflects "the prevailing views of European citizens today" under which all energy options have equal treatment. Not to do so would risk a new constitution being blighted by a nuclear legacy no one wants.

Friends of the Earth Europe press release, 3 March 2003

Belgian blockade. Between 100 and 200 militant trade unionists blockaded the entrance to the three-reactor Tihange nuclear power station in Belgium for fifteen days in protest against job losses. Around 60 executive staff remained in the plant during the blockade – although the strikers said they could leave, top management feared that they would not be allowed back in and so ordered them to stay on site and kept the reactors operating. They were supplied with food and clothing by helicopter, although strikers tried to disrupt the flights by releasing hundreds of helium balloons with attached pieces of metal as the helicopters attempted to land next to the nuclear power plant. The blockade was lifted on 28 February after utility Electrabel offered early retirement or alternative jobs within the utility.

ANP, 3 March 2003; *The Guardian*, 24 February 2003; Expatica News, 24 February 2003

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WISE/NIRS NUCLEAR MONITOR

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The *WISE/NIRS Nuclear Monitor* publishes international information in English 20 times a year. A Spanish translation of this newsletter is available on the WISE Amsterdam website (www.antenna.nl/wise/esp). A Russian version is published by WISE Russia and a Ukrainian version is published by WISE Ukraine. The *WISE/NIRS Nuclear Monitor* can be obtained both on paper and in an email version (pdf format). Old issues are available through the WISE Amsterdam homepage: www.antenna.nl/wise.

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