NIRS

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World Information Service on Energy
founded in 1978

NUCLEAR MONITOR

A Publication of World Information Service on Energy (WISE) and the Nuclear Information & Resource Service (NIRS), incorporating the former WISE News Communique

#581 **January 17, 2003**

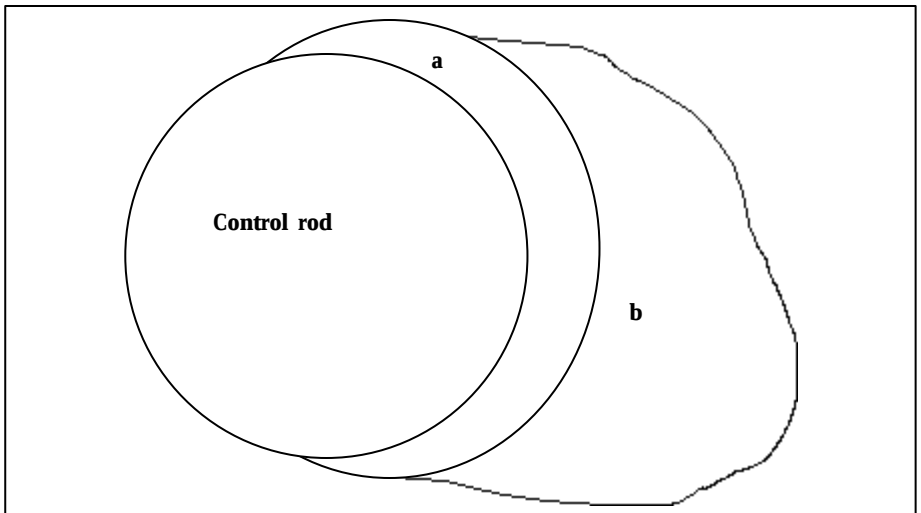
SWISS INCIDENT SHOWS DAVIS-BESSE HOLE IS NOT UNIQUE

In 1971, thirty years before a hole was found in the reactor vessel head at Davis-Besse in the US state of Ohio, a similar hole was found in Beznau-1 in Switzerland. This is revealed in a Westinghouse internal report on file at the U.S. Nuclear Regulatory Commission, whose chairman Richard Meserve continues to say that the Davis-Besse hole was "unexpected".

(581.5477) NIRS/WISE Amsterdam – The Westinghouse report (1) was one of the documents in a twelve-inch (30cm) stack of documents obtained by the Union of Concerned Scientists (UCS) in 1977 under the Freedom of Information Act (FOIA).

The stack of documents, detailing accidents and safety deficiencies in nuclear power plants, had been collected over more than 10 years by Dr. Stephen H. Hanauer, a senior official of the U.S. Nuclear Regulatory Commission (NRC). The existence of Dr. Hanauer's collection, which he nicknamed "The Nugget File", only came to light after the UCS noticed a handwritten comment on a slip of paper obtained under the FOIA.

Intrigued, the UCS telephoned Dr. Hanauer, who told them about his "Nugget File", a copy of which was eventually placed in the NRC Public Document Room as a result of another FOIA request. The UCS published excerpts from the collection in their classic 1979 book *The Nugget File* (2).



Comparison of Beznau-1 and Davis-Besse "holes". In Beznau-1, area a was corroded; in Davis Besse corrosion went deeper and further, reaching area b as well.

Page 28 of this book describes an "indentation" found in the reactor vessel head of Beznau-1, Switzerland in 1971 – just 2 years after the reactor was started. "As a result of a leak in the seal weld of a control rod drive mechanism, an appreciable accumulation of boric acid residue was found on the reactor vessel head. The volume of this boric acid 'snow' was estimated at 1 to 2 cubic meters [35 to 70 cubic feet]".

It continues: "After completion of the weld repair, inspection of the reactor vessel head uncovered a crescent-shaped defect having maximum approximate dimensions of 1¾ inches in depth, 2 inches in width and encompassing 180 degrees around the adapter joining the control rod mechanism to the reactor vessel".

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"Tests were begun in Pittsburgh and Europe to try and determine the exact attack mechanism that caused the indentation", according to the report. The outcome of these tests is not mentioned.

Nevertheless, as a result, "superintendents of all operating Westinghouse pressurized water reactor plants were immediately notified of the situation. They were cautioned to eliminate any accumulation of boric acid in contact with primary system components."

Since Davis-Besse was a Babcock & Wilcox reactor that did not begin operation until 1977, this 1971 notification was not sent to Davis-Besse.

Comparison with Davis-Besse

In the main "hole" at Davis-Besse, corrosion did not just affect the "crescent-shaped" area next to the control rod, but extended over a much larger area (3). It was also much deeper, extending right through the vessel wall as far as the stainless steel clad. (However, at Beznau-1 the reactor vessel is only 166mm thick with 5mm clad, whereas the Davis-Besse reactor vessel is 214mm thick with 4.8mm clad).

Yet in the 30 years that passed since the Beznau-1 incident, it seems that boric acid corrosion was almost forgotten. In his 8 January 2003 response to the Inspector General's damning report on the NRC's handling of the Davis-Besse affair, NRC Chairman Richard Meserve still talks of "unexpected head corrosion" at Davis-Besse. That no-one at the NRC could have predicted that a crescent-shaped hole as found at Beznau might grow bigger (as at Davis-Besse) seems incredible.

Still, even if a NRC staff member had made such a prediction, they may well have kept quiet about it. Nearly half the NRC employees do not feel that it is "safe to speak up in the NRC" on concerns about safety and other issues, according to an internal survey (4).

All of this comes on top of last year's revelations in documents obtained by NIRS under the FOIA, showing how operator FirstEnergy had gambled safety for profits (5).

Cracking ignored

The boric acid corrosion at Beznau apparently came from a leak in the seal weld. At Davis-Besse, the leak came from cracking that the NRC had predicted might be present – indeed, they drafted a shutdown order for 31 December 2001, but never issued it, and allowed the reactor to operate until February 2002.

The cracking was also not new: in 2001, the UCS criticized the NRC for ignoring this widespread problem for 10 years (6). Yet the "Nugget File" shows that the NRC has also ignored the problem of holes due to boric acid corrosion for an amazing 30 years!

Yet the cracking problem is probably even more widespread than the NRC admit, as WISE Amsterdam revealed last year. There is evidence that hundreds of cracks in the world's PWRs go undetected because best available inspection technology is not used (7).

Back in Switzerland, the situation is not much better. For 23 years up to 1994, Beznau only had a provisional license because of "serious faults established at the end of its construction in 1971" – presumably the "hole" was one of them (8). It also has design defects such as a lack of protection against airplane crashes and earthquakes. Nevertheless, the reactor is still operational.

Immediately after last year's Davis-Besse incident, WISE Amsterdam faxed details to three nuclear power stations with histories of cracks similar to those at Davis-Besse (9). Beznau was one of these; another was Zorita in Spain, for which the authorities have now set a definitive closure date (10). The third was Sendai-1 in Japan – a country where a big scandal has since broken out over cover-ups of reactor defects (11). None of the utilities responded.

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WISE Amsterdam/NIRS
ISSN: 0889-3411

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The next issue (582) will be mailed out on 31 January 2003.

25 YEARS AGO

NIRS and WISE both celebrate their 25th anniversaries this year. This is the first article in a new 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 the resistance against the French breeder reactor Superphénix: "The local opponents of the Super-Phénix 1200 MW fast breeder at Creys-Malville (France) have begun work on an eco-house, self-sufficient in energy, on land given by a family just near the site. This is one of the signs of how the Malville opposition is pulling itself together after the impact of last summer's mass demo. On July 31 1977, 60,000 peaceful marchers from all over Europe converged on the site in heavy rain. They were met with police violence: one dead, 2 seriously mutilated (one French, one German), and a hundred wounded". (*WISE Bulletin* 1, May 1978).

Now

Resistance against the Superphénix continued at different levels and with success. In 1998 it was decided that Superphénix would be shutdown and dismantled. The net electricity production of Superphénix on completion of dismantling could well be negative – i.e. consuming more electricity than it ever produced. After its opening in 1986, it was plagued by many accidents and only operated for an equivalent of 278 days full power. (*WISE News Communique* 499-500, 16 October 1998)

On 2 August 1997, people commemorated the dead of teacher Vital Michalon in a "Flowers of life" camp at the site. Flowers were brought to the place where Vital died and others were injured in the July 1977 violence. (*WISE News Communique* 476, 25 July 1997)

Although Superphénix remains closed, the French government wants to re-start predecessor, the Phénix breeder, to carry out transmutation research (see article "French 'nuclear new year' begins with energy debate" in this *WISE/NIRS Nuclear Monitor*.)

FRENCH "NUCLEAR NEW YEAR" BEGINS WITH ENERGY DEBATE

The New Year in France saw a flurry of nuclear decrees, the go-ahead to re-start the Phénix fast breeder reactor and the opening of an inquiry on the Mélox MOX plant. All this is accompanied by the start of an "energy debate" for which the outcome has already been decided: a "recognized place" for nuclear power.

(581.5478) WISE Amsterdam – The new nuclear decrees mostly affect Cogema's reprocessing plant at La Hague. La Hague's reprocessing capacity will not be increased, but it will be allowed to reprocess different types of irradiated fuel. The plant's discharge limits will be modified, and limits will be set for some radionuclides and chemical products whose discharge was previously unregulated (1).

Another decree specifies that no more waste will be sent to the nearby La Manche waste dump, and sets limits for discharge of radioactive effluents from the dump. However, the official press release does not specify what will be done with the leaking drums of nuclear waste (2).

Phénix restart for transmutation

Another decision authorizes the re-start of the 250-megawatt fast breeder reactor Phénix, which started commercial operation in 1974 but was stopped in 1999 after numerous incidents. The permission to re-start was granted following an extensive safety re-evaluation.

The re-start is intended to enable "important research on the transmutation of radioactive waste, which was specified in the 30 December 1991 [nuclear waste] law as one of three avenues of nuclear waste research" (3).

Superphénix, the 1200-megawatt successor of Phénix, produced its first power in 1986 but shut down permanently in 1999. Continuing problems meant that it hardly ever worked, only operating for an equivalent of 278 days full power. (See also the feature "25 Years Ago" in this *WISE/NIRS Nuclear Monitor*).

Mélox inquiry

France has two plants producing MOX fuel. One, at Cadarache, must close because it lies in an earthquake zone, and the plan is to transfer its production to the other plant, Mélox (4). While Mélox is technically capable of increasing its production to take over the work of Cadarache, its production is limited by its current license.

A public inquiry on expanding the permitted production of Mélox so that it can take over from Cadarache opened on 8 January 2003. Gérard Le Bastard, the Mélox boss (official job title: director of the Business Unit "Recycling") claimed that the increase in the production will have "no impact". However, Greenpeace pointed out that it is "bizarre" that the risk of aircraft crash was not included in the study for expanding Mélox production (5).

Energy debate
The New Year has also seen the launch of an energy debate in France (6). Yet, even before the debate began, its outcome seems to have been decided. When French Prime Minister Jean-Pierre Raffarin set forth his energy policy on 3 July 2002, he said "a large-scale public debate would be opened and followed by legislation that would confirm … a recognized place for nuclear energy" (7).

The debate focuses on the next thirty years. This is significant for the nuclear industry, since French electricity is over 75% nuclear, but most French reactors will reach the end of their useful lives towards the end of this thirty-year period.

Anti-nuclear activists have denounced the debate as a sham designed to revive the nuclear industry. They believe the government's plan could be as follows: First, the "debate" will reach the conclusion desired by the government: that nuclear power is vital for France's future energy needs. Then they will stress the need to keep reactor builders in business, so reactors can be replaced when they reach the end of their useful lives. The government would then propose building a prototype in France of a new series of reactors – perhaps the European Pressurized Reactor (EPR).

A "tribune" (a kind of petition) has been launched against the possible launch of a nuclear new-build program, and has already been signed by several well-known people in France (8).

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2. For pictures of the leaking drums, see www.kare-uk.org/hague-waste-pics.htm
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5. *Midi Libre*, 9 January 2003
6. The debate can be followed on the Internet at www.debat-energie.gouv.fr
7. Quoted in Réseau "Sortir du nucléaire" press release, 5 January 2003
8. See perline.org or www.globenet.org/ape

Contact: WISE Amsterdam

GERMAN OPPOSITION PARTIES WANT 50-70 NEW REACTORS?

In Germany, an energy debate was organized by a parliamentary commission to investigate the development of sustainable electricity production in the period up to 2050. Its final report was released in July 2002 but consensus was not reached in the debate. A majority text was written by the Social-Democrat and Green Party government coalition partners. The opposition parties, Liberals and Christian-Democrats, released their own minority view report. If their wishes (strongly in favor of nuclear) are fulfilled, Germany could face the construction of 50-70 new reactors after the year 2010 according to a study by a consultancy firm. The parliamentary commission started in February 2000 to develop scenarios for electricity production up to 2050 that should meet climate protection criteria, i.e. reduction of greenhouse gas emissions. The commission examined three main scenarios: two suggested by the governing coalition, and one by the opposition.

-conversion efficiency: phaseout nuclear energy, more efficiency in production, continuation of fossil energy but separation and storage of greenhouse gases, increase in combined heat-power (CHP) production, no additional support for alternative energy (wind/solar).
-energy saving/alternative energy scenario: phaseout nuclear energy, strong support for efficiency in production, strong promotion for alternative energy sources (at least 50% in 2050).
-fossil/nuclear mixture: continuation nuclear energy and new reactors after 2010, no promotion for efficiency and alternative energy, abolishment of eco-taxes. This was the opposition's scenario.

The commission concluded that all three scenarios could meet climate protection criteria but that only the energy saving/alternative energy scenario would be feasible due to uncertainties in the other scenarios. For the efficiency scenario the separation and long-term storage of carbon dioxide is considered as unrealistic. The majority of the commission rejected the fossil/nuclear scenario due to its inconsistency with the present policy of a nuclear phaseout and the problem of nuclear waste.

As expected, the opposition parties, Christian-Democrats and liberals, did not share the commission's majority view on nuclear energy. After the release of the commission's report, the German Renewable Energies Working Group (Arbeitsgemeinschaft Erneuerbare Energien) ordered a study by EWO Energy Technologies in order to work out the fossil/nuclear scenario. EWO was asked to make a list of possible locations for new reactors. If the opposition's minority view comes true, about 50-70 new reactors will be constructed in Germany. After the study, the German Society for Information on Nuclear Energy contacted the municipalities affected to ask whether they would be in favor of new reactors in their community. This caused much unrest in the proposed sites as well as within the opposition parties themselves. They even suspected anti-nuclear groups of having initiated the study but had to admit their support for construction of new reactors, though downplaying it as pure theoretical reflections.
***Umweltnachrichten* 97, December 2002**

U.S. NRC EXCLUDES TERRORIST ISSUE FROM LICENSING HEARINGS

The U.S. Nuclear Regulatory Commission (NRC) has denied licensing contentions raised by NIRS and others on the risk of sabotage at U.S. nuclear facilities, arguing that it is "unnecessary and wasteful" to consider terrorist attacks because they do not fit into the model of probabilistic risk assessment.

(581.5479) NIRS - The NRC, in a mid-December 2002 combined ruling, has denied the public the right to readdress known vulnerabilities in nuclear facility security through the agency's license intervention process.

In a unanimous decision, the five Commissioners swept aside challenges in four separate public licensing proceedings involving NIRS, the Blue Ridge Environmental Defense League, the Connecticut Coalition Against Millstone and the Long Island Coalition Against Millstone, the State of Utah and Georgians Against Nuclear Energy.

NIRS and the other security minded intervenors sought to assess the risk of sabotage from terrorism associated with re-licensing proceedings for Duke Power's Catawba and McGuire reactors, the proposed use of mixed-oxide fuel (MOX) in the reactors, the expansion of Millstone's irradiated fuel storage ponds, the establishment of an intermediate nuclear waste storage site on the Skull Valley Goshutes Indian Reservation in Utah and the construction of the MOX fuel fabrication plant at Savannah River, Georgia.

In light of the clear and present danger posed by the September 11 terrorist attacks, the NIRS challenge consisted of 14 security and terrorist-related concerns regarding the 20-year license extension of Duke Power's North and South Carolina reactors.

The NIRS contentions focused on unanalyzed structural vulnerabilities including the possible sabotage of dams on Lake Norman and Lake Wylie vital to the service of the reactors' cooling systems, the vulnerability of the reactor containment buildings and the irradiated fuel storage ponds to an attack by a hijacked commercial aircraft or a large truck bomb, the reliance of reactor safety systems on an electrical grid system vulnerable to recurrent sabotage and the impact of the use of MOX fuel on attracting a devastating radiation-enhanced attack.

An Atomic Licensing and Safety Board (ASLB) had referred the decision to include these security contentions in the Catawba/McGuire re-licensing hearing to the Commissioners in January 2002.

While refusing to address the actual structural vulnerabilities at the nuclear reactors and the protracted risks associated with license extension and such security deficiencies, the five Commissioners instead chose to reject all intervenor arguments on the "unquantifiable threat of terrorism." "It is decidedly not predictable," said the Commission Order, because there would be "no meaningful way" to postulate the probability of a specific facility being the target of a terrorist attack. "Therefore, consideration of those issues in a license renewal proceeding would be unnecessary and wasteful," the Commissioners added.

Similarly, the Commission ruled that threat of terrorism to be too speculative to consider in any licensing proceeding. "As there appears to be little practical benefit in conducting a license renewal terrorism review, the Commission has no duty under NEPA [National Environmental Protection Act] to do so," concluded the Order.

The Commission directed the ASLB to reject security contentions for all of the intervenors.

Despite the Commission's heavy-handed denial, nuclear power plants, nuclear waste storage and transport casks, plutonium-fuel fabrication facilities can be used as "dirty bombs" and targets of opportunity for enemies seeking to inflict mass civilian causalities and widespread, long-term economic damage.

The precedent to narrow the scope of licensing proceedings so as to "not unduly alarm the public" is more illustrative of NRC's determination to hide the industry's inability and unwillingness to afford the cost of turning nuclear power plants into fortresses.

It is only more alarming that the NRC is willing to turn a blind eye and simultaneously blindfold the public on these security issues rather than justifiably deny a facility license, an extension or shut down a vulnerable reactor through the adjudicatory process.

The NRC decision clearly serves to paint the enlarging picture that an inherently dangerous nuclear power technology is incompatible with democratic society.

Source and contact: Paul Gunter, NIRS Reactor Watchdog Project (pgunter@nirs.org)

KOZLODUY-1 AND -2 SHUT; COURT BLOCKS CLOSURE OF -3 AND -4

On 31 December 2002 the first two old units of the Bulgarian Kozloduy – one of the most dangerous nuclear plants in the world – were shut down after 10 years of demands for their closure from the G-7, the EU and local campaigners. However, a court has blocked plans to close units 3 and 4 in 2006.

(581.5480) CEIE – The first agreement between the European Bank for Reconstruction and Development and the Bulgarian Government envisaged that units 1 and 2 be closed in 1997 and units 3 and 4 in 1998.

Though the funding of the Nuclear Safety Account was fully disbursed and invested in different measures for temporary safety upgrades, the closure didn't happen due to resistance from Bulgarian officials, lack of investments in rehabilitation of other power stations or construction of new ones as well as ignorance of energy efficiency measures.

The will of the Bulgarian government to start accession negotiations with the EU led to the Memorandum of Understanding signed in November 1999. This required closure of units 1 and 2, but specified that agreement on the closure of units 3 and 4 must be reached in 2002. The EC maintains its position that units 3 and 4 must close in 2006, while the Bulgarian government argues for closure dates of 2008 and 2010 for units 3 and 4 respectively. At the end of the day the Government agreed to close units 3 and 4 in 2006 but asked the EU for a peer review in 2003 to say whether the upgrades made during last years brings the safety up to an acceptable level.

Meanwhile, in the beginning of 2003 the Supreme Administrative Court of Bulgaria (SAC) took a decision on the appeal of several Bulgarian lawyers and MPs from the Bulgarian Socialist Party (former communists).

Following their pro-Russian policy, the socialists made in 2001-2 several attempts to stop the closure of units 1-4, including collection of signatures, vote against the government, court appeal, etc. The SAC said that the decision of the Government for units 3 and 4 was taken in contradiction with the decision of the Parliament in July 2002.

The protests aimed at saving the dangerous old units at Kozloduy NPP started in early 2001 and were backed by a number of pro-Russian politicians who want a good reason to attack the government, desiring a crisis that could lead to a change of power. They were supported by several academicians and intellectuals, some of them well known for their communist background. Gradually, the media took the same position and claimed that this is "the nationally responsible one". No opposite opinion was published or broadcast during the last 2 years.

In the same time the government of Simeon Saxe-Coburg-Gotha (the former king who became Prime Minister in 2001) was unable to communicate properly with the public due to number of reasons some of them linked to the lack of knowledge about the case.

The campaign got strong support from abroad – claims by representatives of Russia and international nuclear organisations

BULGARIAN GOVERNMENT REVIVES BELENE PROJECT

On its last session on 19 December 2002, the Bulgarian government decided to unfreeze the construction of a second nuclear power plant situated around the small town of Belene. The construction of Belene NPP was started in mid-1980s but was stopped after mass protests from the citizens of nearby town of Svishtov. Svishtov was one of the worst affected towns in Bulgaria from the big earthquake in March 1977, centered in Vrancea (Romania).

The governmental decision follows a statement of the Prime Minister Simeon Saxe-Coburg-Gotha during the spring of 2001 in response to the closure of old units 1-4 at Kozloduy NPP. The most important decision – what type of reactor should be used (the initially proposed VVER-1000, a new Russian 600 MW, CANDU or another type) – has not been taken yet. It is not clear whether the construction will continue with one or two reactors at the same time. In addition, a number of analyses have to be done before the real construction work starts: an EIA, analysis of the seismic risks, analyses of the alternatives, etc. are still missing. The financing is also a big problem. Some estimations says that even the cheapest option, to continue with VVER-1000, will cost not less than 1.8 - 2 billion Euros (US$1.9 - 2.1 billion) for the first unit only.

Many Bulgarian NGOs are questioning the need for the construction of new nuclear units. The nuclear waste problem remains unsolved in Kozloduy and would increase with the new plant. There is no evidence that the investment would be financially and economically viable. According to an analysis of Atomenergoproject (Russia) from 1997 the cost of electricity production from Belene NPP would be 7 US cents per kWh while the electricity price in Bulgaria now is about 6 US cents for the population. The long-term contract for electricity export to Turkey is based on a price 3,55-4 US cents/kWh.

that Kozloduy units 1-4 were safe were very welcome in the Bulgarian media. But in the end, a few months before the Copenhagen summit, the government decided to close units 3 and 4 in 2006 in exchange of an "road-map" for Bulgaria's accession in 2007.

It is expected now that the government will lodge an appeal against the SAC judgement. There are several possibilities of how to proceed depending of the result of that appeal, but the less probable option is for the government to step back from its decision.

If this happens it would lead to a real crisis in the relations with EU and would touch some sensitive areas such as the negotiation process, pre-accession funding and the Euratom loan for Kozloduy units 5 and 6.

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NORTH KOREA'S NUCLEAR FACILITIES

With the North Korean nuclear crisis high on the agenda for the international media, this article looks at the country's nuclear installations in order to provide a background to the crisis.

(581.5481) WISE Amsterdam – Nuclear technology has a long history in North Korea. According to one source, it began back in 1947 when the USSR sent geologists to North Korea to conduct surveys for uranium deposits, and uranium was mined and sent to the USSR before the start of the Korean War in 1950 (1).

North Korea set up its own Atomic Energy Research Institute in December 1952, while the Korean War was still underway. Following the armistice of 27 July 1953 that ended the Korean War (which the South Korean president refused to sign), nuclear activities in North Korea continued, with help from the USSR.

IRT-2000 research reactor

Help from the Soviet Union included training North Korean nuclear scientists at Soviet institutes from 1956 onwards, and was formalized in a 1959 nuclear cooperation treaty between the two countries. This was followed by the supply of an IRT-2000 research reactor (also called IRT-2M), which was started in 1965.

The IRT-2M, located in North Korea's largest nuclear complex at Yongbyon, did not produce electricity, and initially used low-enriched uranium (10% enrichment). However, in 1974, North Korean specialists modified the reactor, increasing its power from 2 to 8 megawatts thermal, and switching to bomb-grade uranium of 80% enrichment (2).

1974 was a key year for the North Korean nuclear program. As well as the uprate of the research reactor, a new Atomic Energy Act was enacted. President Kim Il Sung also obtained help from China, in the form of training for North Korean nuclear scientists and engineers (3). This was followed by North Korea joining the International Atomic Energy Agency (IAEA) on 16 September 1974.

Isotope Production Laboratory

The next key installation to be built at the Yongbyon site was the Isotope Production Laboratory in 1975. North Korea later admitted that it had carried out small-scale reprocessing in this laboratory, separating 300 milligrams of plutonium from fuel that had been irradiated in the IRT-2000. While this was clearly far to little to make an atomic bomb, it demonstrated that North Korea had the technology to do so.

In 1978, the IRT-2000 was placed under IAEA safeguards inspections, which were supposed to prevent the irradiated fuel from the reactor being sent to the Isotope Production Laboratory for separation of plutonium.

5-megawatt gas-graphite reactor

In 1979 or 1980 (4), North Korea began constructing its first electricity-producing reactor, Yongbyon-1 (sometimes confusingly called Yongbyon-2). This is a gas-graphite reactor based on the design of UK's Calder Hall 50-megawatt reactors, for which design information was declassified in the 1950s (5). However, while its thermal power is around 30 megawatts, it only generates 5 megawatts of electricity – which raises a big question mark over recent claims (6) that the country needs this reactor's electricity since oil aid was stopped (7).

The reactor is the only operational electricity-generating nuclear reactor in North Korea. It went critical on 14 August 1984 according to one source, 4 or 14 August 1985 according to others, and began regular operations in 1986 (8). It uses natural uranium, which has two advantages for North Korea. Firstly, North Korea has its own uranium mines but – back in the 1980's – had no uranium enrichment facilities. The use of natural uranium therefore reduced the country's dependence on the Soviet Union in line with Kim Il-Sung's policy of Juche (national self-reliance).

Secondly – and more worryingly – reactors using natural-uranium fuel are more suitable for producing plutonium for weapons use. In addition, the magnesium cladding of the Magnox fuel used in the reactor (just as in the UK's Calder Hall) makes it easier to reprocess (9).

This gave rise to a crisis in the early 1990s, following reports that the reactor was shut down in 1989 for about 70 days. The U.S. claimed that the shutdown enabled refueling and

reprocessing of the irradiated fuel to extract plutonium for nuclear weapons. North Korea only admitted removing damaged fuel rods and extracting about 90 grams of plutonium (10).

The crisis was resolved by the 1994 "Agreed Framework" (11), under which North Korea agreed to stop the reactor and halt construction of two other gas-graphite reactors. In return, an international organization, the Korean Peninsula Energy Development Organization (KEDO) was set up to build two light-water reactors in Kumho, and supply North Korea with fuel oil until the reactors are operational.

Recently, North Korea said it was withdrawing from the Non-Proliferation Treaty so that it can re-start the reactor to "protect its people from the winter" (12). However, the reactor's 5-megawatt output – less than a typical small wind farm – would only supply a tiny fraction of the country's electricity needs.

50-megawatt gas-graphite reactor
Given the tiny output of the 5-megawatt gas-graphite reactor, it is not surprising that North Korea began building larger reactors. First of these was another reactor at Yongbyon intended to generate 50 megawatts of electricity – the same as the UK's Calder Hall and Chapelcross reactors. Construction reportedly began in 1984 or 1985 though US intelligence did not detect it until 1989 (13).

It is not clear if the technology was copied from the UK's Calder Hall or France's G-2 gas-graphite reactor (14). Construction was frozen under the 1994 "agreed framework".

200-megawatt gas-graphite reactor
In 1989, North Korea also started to build a 200-megawatt reactor at Taechon, reportedly based on the French G-2 gas-graphite reactor (15). Again, construction of the reactor was halted under the 1994 "Agreed Framework".

Two 1000-megawatt reactors
In return for stopping the 5-megawatt reactor and halting construction of the 50 and 200-megawatt reactors, North Korea was to be supplied with two 1000-megawatt "light-water reactors" under the 1994 "Agreed Framework". The site chosen was Kumho, which according to one source was originally selected in 1990 for construction of four Russian VVER-440 reactors. When the Soviet Union collapsed in 1991, the North Korean regime first wanted to design and build its own reactors on the site, but in 1994 agreed that KEDO would build two Western-designed light-water reactors (i.e. PWR or BWR) on the site (16).

North Korea had another option for building nuclear weapons: mining its own indigenous uranium reserves and enriching the uranium to bomb-grade.

North Korea has repeatedly complained of delays in the construction – the reactors were to be completed in 2003, but the first concrete was not poured until 2002. The delays mean that even before the current crisis, delivery of key nuclear components was not expected until 2005. This probably explains why there seems to be no hurry to stop the Kumho project (17).

Reprocessing facilities
North Korea first began separating plutonium on an experimental scale in the Isotope Production Laboratory at Yongbyon, which was built around 1965. This laboratory has never been under IAEA safeguards, even though North Korea admitted in 1992 that around 300mg of plutonium had been separated in the laboratory in 1975 (18).

The real concern, however, is the "Radiochemistry Laboratory". North Korea said that this building, whose construction was never completed, was intended for "training specialists in the separation of plutonium, and for handling nuclear waste". However, this "six-story building, approximately 180m in length, 20m in width, and about the size of two football fields" is clearly too large to be just a training facility, and the IAEA concluded after a 1992 inspection that it was a reprocessing plant. Construction was halted under the 1994 "Agreed Framework" when it was placed under IAEA safeguards (19).

Uranium program
Still, even with the reprocessing facilities and reactors "frozen", North Korea had another option for building nuclear weapons: mining its own indigenous uranium reserves and enriching the uranium to bomb-grade. The recent crisis was prompted by allegations that North Korea had started a uranium-based weapons program (20).

Dr. Abdul Qadir Khan, who started Pakistan's nuclear weapons program based on centrifuge uranium enrichment technology from Urenco Netherlands where he once worked (21), was alleged to have supplied the same technology to North Korea (22). Khan denied these allegations (23).

However, it is worth remembering that a November 1999 report to the US Congress (24) had already warned of this possibility. Under "Uranium enrichment", the report stated: "Among the many mysteries surrounding North Korea's nuclear program are its extensive uranium mining and milling activities. North Korea's interest in uranium dates back several decades, and North Korea is known to have attempted to acquire uranium enrichment equipment" (25).

The report continued: "The capability to enrich uranium to weapons-grade would provide North Korea with a second path to nuclear weapons and, if realized, could add a dangerous new dimension to Pyongyang's nuclear weapons development activities".

Nuclear waste

Finally, it is perhaps worth remembering one of the sticking points that the 1994 "Agreed Framework" failed to resolve: the nuclear waste issue. In 1993, the IAEA demanded to inspect two suspected nuclear waste sites in the Yongbyon complex (an old nuclear waste site and the so-called "Building 500"). North Korea replied by deploying tanks around the sites and has consistently refused to allow IAEA inspectors to visit these sites. Under the terms of the "Agreed Framework," North Korea is required to accept IAEA inspections of these sites when a significant portion of the Kumho project is completed, but before delivery of key nuclear components (26).

The question remains as to whether the current crisis will deal with this outstanding waste issue. It underlines the nuclear industry's unsolved problem with nuclear waste: the technology to reprocess it to produce plutonium for bombs is tried and tested, but no known technology can stop it from remaining lethally radioactive for thousands of years.

The best solution for North Korea is not to finish the Kumho reactors, which would generate even larger quantities of waste; nor is it to re-start old reactors which are better at making plutonium than electricity.

As a *WISE News Communique* article concluded in 2001, the most effective strategy is an integrated coordinated effort to rebuild existing energy infrastructure, develop alternative energy resources, increase energy efficiency and meet humanitarian needs (27).

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Contact: WISE Amsterdam

NORTH KOREA: THEN AND NOW

As the North Korean nuclear crisis continues, it is remarkable how many similarities exist with an earlier crisis that led up to the signing of the "Agreed Framework" in 1994.

Then, as now, the crisis followed U.S. allegations that North Korea was developing nuclear weapons. It led to a war of words, as the U.S. threatened to attack North Korea, while North Korea responded by threatening to turn the city of Seoul in South Korea into a "storm of fire".

However, after the intervention of former U.S. President Jimmy Carter, the rhetoric became calmer and two sides entered into talks. These talks did not always go well, and they were interrupted by the death of North Korea's president Kim Il Sung, who was subsequently declared to be the country's "eternal president".

The talks eventually resumed, with the North Koreans saying they would keep the promise of a nuclear freeze which Kim Il Sung had made in his last days. They ended with the "Agreed Framework" which was signed in Geneva, Switzerland on 21 October 1994.

This "replace-nuclear-with nuclear" agreement basically laid down that North Korea would give up its existing nuclear program in return for the construction of two Western-designed reactors. These reactors would be "more proliferation-resistant", but would still produce plutonium – in much larger quantities than North Korea's existing reactors. As the November 1999 report of the North Korea Advisory Group to the U.S. Congress pointed out: "Such plutonium, while not weapons-grade, can be used to produce nuclear weapons and does not present an overwhelming barrier to those pursuing a dedicated nuclear weapons program."

SCOTTISH RADIOACTIVE PARTICLES STILL A MYSTERY

Nineteen years after the first radioactive "hotspot" particle was found outside the Dounreay nuclear complex on the north coast of Scotland, operators UK Atomic Energy Authority have launched a consultation process on how the problem should be tackled.

(581.5482) N-Base – Since 1984, 216 particles have been found on the foreshore below Dounreay; 700 have been recovered from the seabed off Dounreay; 22 have been found on the Sandside beach three kilometers west of the site; and nine from the seabed eight kilometers east of the site.

The source, or sources, of the problem are still not properly known; the movement of the contamination through the environment is not understood; the extend and location of the contamination is not fully known; and no-one knows for sure whether or not more particles are still being released into the environment.

The UKAEA says it believes particles are not still being released and admitted last year that at least several hundred thousand of the tiny particles, which are the chopped-up casings of spent fuel rods, were released over several decades and probably only stopped about five or six years ago.

No-one knows where the particles are now, but they are probably either on the seabed, dispersed over a very wide area, at least along the Caithness coast and towards Orkney, and who knows how much further afield. The particles may also have found their way onto beaches and foreshores and not uncovered by the limited monitoring required by regulators, or even been carried onshore by storms and gales. The best the UKAEA can offer are computer models that suggest the particles may have moved eastwards and into deeper water.

Also, no one really knows their source. Two possibilities are the official favorites: the dispersion chamber on an old discharge pipeline; and the plant's drainage system. The UKAEA admits discharging the particles through the old pipeline and believes more were released when high-pressure hoses were used until a few years ago to flush parts of the plant's drainage system, so dislodging contamination lodged in the drains.

The UKAEA would be prosecuted today for these actions. They only got away with it in the past because of lax regulatory supervision.

Another possible source is the controversial waste shaft, which is unlined, flooded and subject to tidal movement, showing there is a connection between the groundwater and the sea. The UKAEA, however, insists the shaft is not "leaking" particles into the environment.

The criticisms of the monitoring required by the Scottish Environment Protection Agency at Sandside have been well documented, not least in *N-Base Briefings* over recent years, and these argument continue today. Sandside estate owner Mr. Geoffrey Minter and his scientific consultants believe inadequate equipment and techniques are uncovering only one per cent of possible particles on the beach.

After the first seabed survey in 1997 when 35 particles were found, a 2km fishing exclusion zone was introduced. Although particles have now been found outside this zone, the authorities have refused to extend its limits.

While the UKAEA has boasted of the 1 million pound (US$1.57 million) annual diving surveys it has commissioned in recent summers, the work has in fact covered a tiny area of the seabed - but still found over 700 particles. This summer the divers surveyed five areas outside the exclusion zone between Strathy Point and Brims Ness, 8km east of the plant, and each only the size of a football pitch. Nine particles were found off Crosskirk and east of Brims Ness.

The five areas represent a tiny fraction of the seabed in the Pentland Firth - let alone further afield. The present diving contract is limited and divers are prevented from going deeper than 25 meters for technical and safety reasons.

The UKAEA's options for action

The UKAEA has started a public exhibition in Caithness and published a newsletter with details of the options it sees for future action. After public discussion of these, a "stakeholder panel" will consider the options and responses and recommend what action should be taken. These proposals will then be subject to a formal public consultation. The present exercise is the first example of the UKAEA's new "openness".

The options range from continuing as at present, with some monitoring and removing any particles which are found, at an annual cost of about 250,000 pounds, through to spending possibly tens of millions of pounds dredging and cleaning the seabed over a wide area.

Source: *N-Base Briefing* 355, 11 January 2003

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IN BRIEF

Russian reprocessing plant shut. Russia's only reprocessing plant, Mayak, has been forced to shut after losing its license to dump radioactive waste in nearby Lake Karachay. The plant can only operate by continuous dumping of radioactive waste, so was forced to shut. Nuclear safety agency Gozatomnadzor said the plant had to shut "because it did not respect safety rules". Vladimir Slivyak of WISE Russia, while welcoming the plant's closure, warned that stopping reprocessing might be part of a plan to persuade the US to allow nuclear waste originating from US-origin fuel to be dumped in Russia.
Ecodefense! press release, 13 January 2003; *The Moscow Times*, 14 January 2003

Sweden: Oskarshamn to burn MOX fuel. The Swedish environmental ministry on 20 December 2002 has allowed the Oskarshamn NPP to burn MOX fuel from Sellafield. Before Sweden stopped reprocessing of irradiated fuel, 140 tons of fuel from Oskarshamn-1 and –2 were sent between 1979 and 1982 to Sellafield to be reprocessed. In the past, Sweden considered canceling the reprocessing contract and taking back the fuel, which had not yet been reprocessed. But the Swedish government concluded in 1996 that this would be impossible, partly because the fuel containers had leaked. So it gave permission to reprocess the fuel resulting in 832 kilograms of plutonium. Oskarshamn owner OKG then applied to the government in 1998 for a license to burn MOX fuel. Anti-nuclear groups urged the then environment minister Kjell Larsson not to allow the use of MOX and proposed the immobilization of the plutonium as a better option. Two months ago, after the elections in Sweden, a new environment minister was appointed, Lena Sommestad. Unlike Kjell Larsson (who died on 22 December 2002), who opposed the use of MOX, Sommestad gave permission for the use of MOX.
WISE Sweden, 15 January 2003

Mike Sadnicki dies. Mike Sadnicki died on 27 December 2002 after a long illness. Mike was an expert in unraveling the tortuous accounting practices of the nuclear industry, producing classic reports such as "Managing Nuclear Liabilities" and last year's "An Examination of BNFL Reports and Accounts". He also produced studies illustrating clearly the uneconomic nature of MOX fuel and reprocessing. He spent many years of his life in a wheelchair, but this did not stop him traveling. We will always remember his visit to the WISE Amsterdam office and his helpfulness in answering our questions.
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WISE/NIRS NUCLEAR MONITOR

The Nuclear Information & Resource Service was founded in 1978 and is based in Washington, US. The World Information Service on Energy was set up in the same year and houses in Amsterdam, Netherlands. NIRS and WISE Amsterdam joined forces in 2000, creating a worldwide network of information and resource centers for citizens and environmental organizations concerned about nuclear power, radioactive waste, radiation, and sustainable energy issues.

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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