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SWEDEN: CRACKED CONTROL RODS; GAPING HOLES IN THE 'CULTURE OF SAFETY'

A routine annual control of Unit 3, a boiling water reactor, at Sweden's Oskarshamn nuclear power plant in early October turned up a control rod that had broken off. On closer inspection other rods were found to be cracked. The Swedish Radiation Safety Authority (SSM) immediately ordered an inspection of all Swedish BWRs of the same construction, and especially a 'twin' reactor (Unit 3) at Forsmark.

(679.5902) WISE Sweden - Once the investigation ordered by the safety authority got under way (26 October), almost immediately cracks were found there, as well. The operator, a subsidiary of Vattenfall, was quick to assure the press that "even broken rods will work". Forsmark expected the reactor to be back on line after about 10 days. But on November 3, spokespersons for SSM confirmed the severity of the problem. All the control rods at Oskarshamn 3 and more than 60 rods at Forsmark will be inspected in coming weeks. All cracked rods will have to be replaced. Just how many is at present unknown. Both reactors are now expected to stay off line through November.

A reactor typically has 160-170 control rods. Used to regulate temperature in the reactor core, they are the first line of defence should it be necessary to interrupt criticality. (The second line of defence is to pump in boron.) In an interview with the Swedish technical weekly Ny Teknik Anders Bredfell, press officer for SSM, stressed the seriousness of the situation. The rods are an essential safety barrier; any risk of malfunction puts the safety of the reactor at risk, he said.

Many question-marks

The problems discovered at Forsmark and Oskarshamn are rarities. Lars Skånberg, also of SSM, said they were unique in his experience. Nor is it clear

why both units should begin failing at the same time. The design lifetime of the control rods is ten years, but cracks were found in rods ranging from 3 to 10 years of service and delivered in different batches over a span of years. All, however, were manufactured and supplied by Westinghouse, who are reported to have investigators on site at Oskarshamn.

The cracks and the total break are concentrated around the nexus of shaft and rod. Investigators are trying to determine whether the cause is a manufacturing or materials fault or so-called thermic fatigue, i.e. stress due to alternating extremes of hot and cold. Further study will determine if standard operating procedures will have to be revised.

"The safety of Swedish reactors is based on multiple lines of defense. Each line must be fully functional whenever a reactor is in operation," Mr. Skånberg stated. Seemingly commonplace, the comment has a cutting edge. Having reviewed past safety reports SSM has discovered that neither plant has checked the status of its reactors' control rods since last year. That is not acceptable: "It goes without saying that all systems and components that are of importance to a reactor's safety have to be checked on a regular basis," Mr. Skånberg said on Swedish Television October 28.

SSM has asked both operators

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to explain why the cracks have occurred. They have also been asked to explain why the problems went undetected. The reactors will not be allowed to come on line again until SSM is satisfied that the situation has been rectified.

Not the first time, hardly the last...

Both the Oskarshamn and Forsmark plants have repeatedly been faulted for poor safety routines. In Summer 2006 Forsmark was close to a serious calamity (potentially a meltdown) due to a fundamental design error in the auxiliary power system that had gone undetected. In 2007 plastic foil was found to have clogged vital pipes at Oskarshamn.

This past August an annual inspection at Forsmark (Unit 2) revealed that a broken valve in the reactor's

emergency cooling system had been known to be out of commission but left unattended-to since the previous year's inspection. No routine checks of vital components are carried out between annual "revisions" - in violation of the plant's own safety rules. SSM officials have demanded that Forsmark explain how the valve could have been ignored such a long period of time. And, once again they demand a report on the measures Forsmark's management is taking to revive an obviously ailing 'culture of safety'.

Most recently, Oskarshamn has come under fire for using untrained hired night watchmen to stand in for malfunctioning automatic alarm systems. In its evaluation SSM points out that the practice is "a serious breach of the company's safety policy. And it is especially serious inasmuch as

it has been going on for quite a while". The decision to do this was not documented in any company protocols. Worse, the relevant protocol was found to be "outright misleading". "All in all, [these are] indications that the 'culture of safety' needs to be improved with respect to physical security," SSM's press release concludes.

Sources: The Swedish Radiation Safety Authority: www.ssm.se (pressrum) / Sveriges Radio, News department (Ekot): www.sr.se / Sveriges Television, regional news: www.svt.se / Forsmark Kraftgrupp AB: www.vattenfall.se/forsmark / Gefle Dagblad (Gävle; 3 Nov): www.gd.se / Östran (Kalmar; 3 nov): www.ostran.se / Ny Teknik, 7 November 2008
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EPR: NUCLEAR SHOWCASE FOR DELAY AND COSTS OVERRUNS

The consistency of the work at the construction sites of the new EPR reactors in Finland and France is remarkable: bad work on the concrete basemat, insufficient quality control by Areva, subcontractors using the wrong procedures, no guarantees on metal quality... Consistently bad work is turning the industry's symbol of nuclear rebirth into an expensive showcase for headaches and delays.

(679.5903) Greenpeace International - The Finnish nuclear safety authority STUK continues to identify more problems at the construction of the new Finnish reactor, Olkiluoto-3 (OL-3). Last September, STUK and the Finnish utility TVO discovered that the Polish company EPG used an incorrect welding procedure in the fabrication of the steel liner, which is critical to the reactor containment leaktightness. An order to stop the welding has been ignored by EPG for weeks, where after all the welds had to be inspected using ultrasound testing.

OL-3 is EPG's first nuclear plant project. Already in 2005 STUK had identified problems with welding and control at the Polish company. EPG was subcontracted by Babcock Noell Nuclear GmbH, who in turn was subcontracted by Areva Siemens to supply the steel liner.

Another subcontractor, Creusot Forge, also has difficulties to deliver according to required specifications. Already in 2006 it was discovered that the grain size in the hot and cold leg forgings of the steam supply system was too big

and uneven for the nondestructive testing required by STUK. The legs had to be reforged, but a recent inspection revealed that the grain size in the new legs is still too large. According to STUK, the parts can now be inspected by the required method, however, possible implications of the larger and uneven grain size will have to be reviewed.

Flamanville

Also the construction of the French EPR, Flamanville-3, causes difficulties for Areva. The French safety authority ASN warned Areva to improve its oversight of the Italian subcontractor Societe della Fucine, who produces parts for the pressuriser of Flamanville-3. The Italians have used the wrong procedure for testing the quality test of forgings, and ASN no longer trusts the quality control system of the company. ASN says this also raises concerns about Areva's capacity to guarantee quality of other reactor parts.

ASN is following the OL-3 construction in Finland meticulously and exchanges a lot of information with STUK.

Flamanville-3 suffers similar construction problems as are observed in Finland, e.g. the French subcontractor Bouygues has admitted 'several months' delay in the construction of the concrete basemat. But also the drilling of the gallery for discharges causes headaches and is said to be at least one year behind schedule.

Three years and counting...

With an original starting date for Olkiluoto-3 commercial operation of 30 April 2009 approaching, the timetable for the construction is adjusted for the fourth time in two years. Start of operation is now estimated in 2012, three years behind the original schedule. TVO remains resolute in its position not to share the cost overruns with the Areva-Siemens consortium. Areva-Siemens in 2003 agreed on highly ambitious terms to win the OL-3 project, because they needed a showcase for the EPR. A fixed-price contract was agreed upon to reduce the risks for the Finnish investors. However, Areva claims partial TVO responsibility for the delays. TVO

committed to validating safety documents provided by Areva within two months after receiving them. According to Areva the document validation period has been closer to nine months, which would cause a domino effect on the time schedule. Areva-Siemens has started an arbitration procedure at the Stockholm Chamber of Commerce, but the subject of arbitration is unclear. Also subcontractors could be included in the dispute.

The continuing problems around the EPR construction illustrate the challenges facing companies and governments when choosing to pursue nuclear power. The OL-3 delays fuel the concern regarding financing of nuclear power plants, because investors are fearful of the unpredictability of nuclear construction. On top of that, the increasing prices of raw materials and scarcely available reactor-building expertise raise serious concerns. Also different approaches in regulation are worrying to investors. The OL-3 project exposes culture differences causing frustration: where the French complain about the huge amount of documents demanded by STUK, the Finns blame the French for being unprepared. In a report filed end October 2008, the US Nuclear Regulatory Commission warned the nuclear industry to be cautious regarding the construction of nuclear facilities. Apart from the problems in Finland and Flamanville, similar difficulties with bad concrete and faulty reinforcing steel were identified in the foundation of a new reactor MOX fuel plant at the Savannah River Site in the USA. Areva is one of the companies building and operating the plant.

Areva's other markets

Recently, the French company became involved in the waste repository Yucca Mountain in Nevada, USA. The US Department of Energy awarded a US\$2.5 billion (2 billion euro) contract for completion of the design and license application issues to USA Repository Services LLC, a subsidiary of URS Corp. that includes AREVA. The poor results with the EPR at Olkiluoto and Flamanville do not stop Areva from expanding its plant production capacity in the USA. In a joint venture with the American company Northrop Grumman, Areva announced the construction of a new large component factory in Virginia to be able to produce EPR's large parts. The new factory will be one of the few manufacturing sites able to finish the largest nuclear components such as reactor pressure vessels, steam generators and pressurisers. Like Areva's facility in Chalon, France, it will not forge the largest components, but rather produce finished components out of subcomponents produced elsewhere.

Areva expects to build at least seven EPRs in the USA. The Italian Energy Minister Scajola recently announced its interest in 'between eight and ten nuclear reactors of the EPR type'. The Italian government is expected to present its national energy policy in spring 2009, which will include nuclear energy for the first time since nuclear power was rejected in a referendum in 1987.

During a visit of Areva's CEO Anne Lauvergeon to the Jordan Prime Minister Dahabi in the beginning of November, plans to build a nuclear power plant in Jordan to be operational in 2015 were discussed. By 2030, Jordan envisages to produce 30 percent of its energy supply from

nuclear. The United Arab Emirates, another potential market for Areva, is setting up the legal framework needed to support a nuclear energy program before the end of 2008. In the beginning of 2009, it will narrow down technology options for its first nuclear power plant based on offers of at least two vendors. A final choice of technology and vendor is expected in the end of 2009 or beginning of 2010.

Not all new markets come easy. The decision on nuclear construction in South Africa has been once again delayed due to political turmoil and likely funding problems. The South-African utility Eskom is not expected to make a decision before the upcoming general elections, expected early 2009. Sources say the envisaged nuclear expansion in the country comes with an unexpectedly high price tag, causing doubts on whether there will be enough funding to realize it. Though Areva has maintained its original quotation for about half a year, the French company now seems reluctant to extend its current quote. If Eskom does not make a choice between Areva and Westinghouse soon, the price offered is likely to increase.

Sources: Financial Times, 3 November 2008 / World Nuclear News, 24 October 2008 / Nucleonics Week, 9 & 16 & 23 October 2008 / US Nuclear Regulatory Commission, 22 October 2008 / South African Mail&Guardian Online, 1 November 2008 / Power Engineering International, 31 October 2008

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IEA: EU WASTING MONEY ON FUSION RESEARCH; NEGLECTING EFFICIENCY

Recently, the International Energy Agency published its first review of the energy policy of the European Union. The review covered several nuclear energy issues. In the report, the agency kept itself far from proliferation concerns and branded nuclear waste as a mere "cooperation challenge". As the sister organisation of the OECD's Nuclear Energy Agency furthermore lauds nuclear power as a means to decrease energy dependence and to achieve climate goals, it won't come as a surprise that the IEA is generally supportive of nuclear power. However, the review did make some interesting observations concerning EU energy research policy which are worth reviewing here.

(679.5904) WISE Amsterdam - The EU's research funding is bundled in FP7, the 'Seventh Framework Programme for

research and technological development'. The budget for FP7 is spread out over several years and over a nuclear and a non-nuclear part.

The IEA noted that the EU's overall spending on energy research has gradually declined. "Most European energy firms now spend less than 1% of their net sales on clean technology innovation". It also noted that the FP7 program was drafted before energy emerged as a key concern for Europe. As a consequence, only 2.4 billion euros - spread out over seven years and 27 member countries - is reserved for non-nuclear energy research. In comparison; in the same period, 9.1 billion is invested on information technology research. The nuclear part of FP7 receives 2.8 billion euros divided over 5 years, 1.7 billion euro of which goes directly into nuclear fusion research.

The authors of the IEA question if Europe has its research priorities right. The EU has ambitious energy and climate targets for 2020, but the largest part of the energy research budget, which is already small, is being invested in a technology which, if ever,

will only pay off after 2050 - which the IEA, by the way, labelled as 'unlikely'. The OECD agency urgently recommend the EU to recast its FP7 before it expires to ensure more energy research can be done, in order to be able to achieve the Unions ambitious targets.

High ranking ITER researchers called the IEA's fusion position a "company accident". The IEA is quoted saying instead of cutting fusion research, it meant to press for increased funding of non-nuclear research. The IEA's policy review remained unchanged.

The IEA commended the European Commissions' attempt to correct the lack (FP7) energy research funding by launching the Sustainable Energy Technology (SET) plan. However, here again, the EU erred while setting priorities. "It [raises] concern that demand-side technologies do not feature at all in the six priority areas of the SET Plan", the authors wrote. For that matter, it seems that the SET plan is a mere continuation of FP7 mistakes, where "out of nine non-nuclear thematic areas, only one is covering demand side". There is not yet a budget allocated to the SET-plan; this

is expected to happen in the course of the autumn.

The SET plan has its focus on renewables as solar, wind, and biomass, and on the smart grid, CCS and generation 4 reactors. Slowly awareness is rising that we have less than 100 months to prevent dangerous levels of climate change. And as both CCS and generation 4 reactors are due beyond 2030, they will be too late to be of any help to face the climate challenge. But one has to be very unfamiliar with EU decision making, or just plain naive, to expect that the EU will be willing and able to recast its FP7 work program midterm, and make energy efficiency and demand side management as soon as possible energy priority no. 1.

Sources: IEA Energy Policies Review: The European Union 2008 (http://www.iea.org/textbase/publications/free_new_Desc.asp?PUBS_ID=2045) / NRC Handelsblad, Eeuwige hoop op kernfusie, November 1st, 2008 [Dutch]
Contact: WISE Amsterdam

HEATED DISCUSSION ON GERMAN NUCLEAR WASTE: GORLEBEN... OR SOMEWHERE ELSE?

The German government demands that nuclear waste be stored safely underground in salt formations, clay layers or granite for a million of years from the year 2035 on. The casks with nuclear waste have to be intact for 500 years. Moreover the government demands that data on this waste are kept safe for at least 500 years. On these demands the Ministry of Environment held a conference in Berlin from 30 October to 1 November that was attended by 300 participants.

(679.5905) Herman Damveld - Minister of Environment Sigmar Gabriel opened the conference. He stated that the high radioactive waste is about 10% of the total amount of radioactive waste, but 99% of the total radioactivity, that will be accumulated at the year 2040. A total of about 24,000 m3 of high active waste has to be put in a storage place in 2035 at the latest, because then the licenses for temporary storage at the nuclear power stations expires. Since 1977 research takes place in and around the salt formation at Gorleben. The choice for Gorleben remains an enigma, relevant data are not made public, stated Anselm Tiggemann who has investigated this matter. In 1976 the

federal government named the salt formations of Wahn, Lutterloh and Lichtenhorst (all of them in Northern Germany). In 1977 the government of Lower Saxony (Niedersachsen) chose for Gorleben. Gabriel remarked on this saying that "the other three were judged safer",

Since 2000, in Gorleben around 1.4 billion euros has been spent for research and construction of part of the salt mine into a storage facility. In 2000 the government decided to install a moratorium on further research in Gorleben of a minimum of three years and a maximum of ten years. Meanwhile alternatives should be investigated. But almost nothing has

been done in search of an alternative. Proponents of nuclear energy want to go on with Gorleben. Gabriel on this: "Suppose that I want to continue with Gorleben as the sole disposal site. What in case the judge forbids the storage? Then there is no underground storage in 2035. The temporary storage sites are then final storage sites, though they are not designed for that." Therefore the minister wants to investigate more locations and then to chose the best one out of these. The choice for Gorleben has been made "without involving the community", Gabriel said. The experiences with the salt formation at Asse at which casks with low radioactive waste have been

leaking (see Nuclear Monitor 675: "Nuclear worries increase as German waste dump mine floods"), show "that there haven't been made adequate safety analyses," he said, "That has to be changed now and done better."

Walter Hohlefeldler from the German Atomic Forum wants to lift the moratorium on Gorleben immediately. He is convinced the salt formation meets the requirements that have been made in the past and that the nuclear waste has to be stored there. He admitted that he was amazed about the choice of Gorleben at the time:

"Gorleben is situated near the border with the former East Germany (GDR). In our circles there was a fear that the GDR should tap that nuclear waste and take it away. Now the GDR no longer exists we found we have to go on with Gorleben. Only if Gorleben appeared to be not safe, we have to choose another location. Alternative locations are known, but we don't want to charge these regions with a discussion on nuclear waste," Hohlefeldler said accompanied by a loud yelling boo from the public.

The available alternatives were made clear by Volkmar Bräuer of the Federal Office for Geology and Raw Material (Bundesanstalt für Geowissenschaften und Rohstoffe - BGR): in south Germany there are ten regions with granite; in north Germany there has been done 25,000 test-drilling in clay at which they found clay that is at least as good as they have found in the French place Bure that is on the list for storing nuclear waste. In north Germany there are at least five suitable salt formations. Besides the earlier named formations Wahn, Lutterloh and Lichtenhorst, he named Zwischenahn and Waddekath. Wolfram König of the Federal Bureau for Radiation Protection stressed that in the case of Gorleben the population was kept out of it. The decisions were taken on the basis of the Mine Law. According to this law only people that have interests in mining can go to the judge -and there are only a few people that have such interests.

Bräuer expects that the next government (after the general elections in 2009) should take a decision on the procedures to come to a final disposal facility. And that they want to make use

of experiences in other countries.

Hans Riotte of the Nuclear Energy Agency (NEA) in Paris stated that the NEA generally assumes an irreversible decision process: because participants learn from each other, they will also start to trust each other. The procedures have to be transparent and the criteria have to be clear. The different parties, among which the local groups, have to "get time and opportunity to build knowledge, therefore need also to have the financial possibility for this," Riotte said.

Country	Expected start of disposal
U.S.A.	After 2020
Finland	2020
Sweden	2020
France	2025
Belgium	2030
Russia	After 2025
Germany	2035
Japan	2035
Canada	After 2035
Switzerland	2040
U.K.	2040
	<i>Source: NEA</i>

Hans Wanner of the Head Department Safety Nuclear Facilities in Switzerland added his country did start a transparent and open process in 2006. First: in three stages a number of locations are chosen, which are then reduced to two locations and finally one location remains. At each stage the parliament decides and (if 50.000 Swiss demand it) there can be held a referendum.

Gordon MacKerron of the University of Sussex explained that in Great-Britain several disposal plans were met by resistance from the population and were halted. Therefore, in 1997, the authorities decided to involve the public. Scientific organizations didn't agree with that, because in their vision the science was not taken serious with that. In 2007 the government started with a new round of discussions. The decision at the beginning of 2008 to

build new nuclear power plants made the situation confusing. "Because it really is different to talk about present nuclear waste ('legacy waste') that you have to store anyway, or about new nuclear waste that possibly doesn't has to be produced," MacKerron stated.

Ortwin Renn of the University of Stuttgart has done much research on the acceptance of risks. "There will be resistance at each possible storage location, even if the authorities invent new procedures," he said.

"Environmental organizations will prevent storage as long as there are plans to build more nuclear power stations. And these plans continue to exist, so now we have the same arguments for already 30 years over and over again."

Renn asked himself how to proceed. He has 4 possible solutions but rejects the first three instantly. "First of all, there will be a government that has to take a decision on final disposal of nuclear waste, anyhow." But in any case, that will be too late to meet the 40-year license deadline, and therefore not fair to people living near temporary storage facilities who were promised that in 40 years time the waste will be removed. The government can - second possibility - decide to designate Gorleben as final disposal site, however that will decrease the believe in democracy a lot. A third possibility is to send the waste (for many billions of euros) to a foreign location: Eastern Europe for instance. However, this will make clear that the German government doesn't want to bear the consequences of nuclear energy. Fourth possibility: start all over again; with multiple locations, with input of the general public, and give the population the right to veto, even if the government would proceed with that specific location," Renn said. "First there has to be agreement on the criteria for disposal-site and the procedures for decision-making. And the responsibility has to be shared honestly."

Armin Grunwald of the Research Center Karlsruhe continued on the subject: "How do we give that responsibility shape and contents? In the current situation there is a hardening of conflicts on nuclear energy and nuclear

waste. We have to take a step back, to try to relax those positions. Only then an honest debate can be possible." After his introduction Grunwald chaired a working group on ethical questions. Wichert von Holten, priest in the Gorleben-region, posted the question how we can be responsible for storage during one million years. How can the situation in Gorleben improve? In his view, every nuclear waste transport to the above-ground interim storage in Gorleben means more pressure on the decision to go ahead with the underground final-disposal site in Gorleben too, no matter what. This view of Von Holten was sharpened by people from the Gorleben-region, who experience the transports as infringement of their own live. Due to the Castor-transports their freedom decreases (the atomic state): they are not allowed to move freely, they are deprived of many of their citizen's rights and often shocked by the harsh interventions of the police. This results in people not believing in democracy. A woman who is professionally involved in organizing the transports took the microphone and

said that she on her turn was shocked by the fierceness of the actions. Then, an exchange of experiences started: and in a moment of real dialogue the huge distrust in each other was less for a while.

waste has to be kept for 500 years, he said: "How to organize that is not yet drawn up, we have to investigate this further." This raised questions from the public: Isn't it strange that after 30 years of research in Gorleben, still no

Castor-protest

On November 8, more than 16 000 people demonstrated against the Castor transport in Gorleben, marching through the town and eventually settling just outside of it, near the gates of the "Zwischenlager" - the temporary nuclear waste disposal site. The protesters were accompanied by at least 400 tractors - a powerful testament to the sense of solidarity that exists around the issue of nuclear power and nuclear waste in this region. The days after the protesters succeeded in several blockades. Transport of the waste from La Hague (France) by train to Danneberg and then by lorry to Gorleben, was delayed 20 hours due to blockades. It was the largest anti-nuclear protest in Germany since 2001. The phase out of nuclear power will become one of the most important issues in the general elections next year. Meanwhile, in France, 10 people were arrested for sabotage of the high-speed train-tracks. Although not much is known so far, the actions are said to be a protest against the Castor-transports.

clear criteria to measure the suitability of the site have been established. Arens responded by stating that the discussion has to be about the criteria (1 million years, 500 years records of waste available, etc) published in a July 2008 report. The report "Safety demands for final disposal of heat-producing nuclear waste" is labeled as 'Entwurf' ('concept').

I left the conference with the words "Fortsetzung folgt" ('to be continued') in my mind and the sentence of one of the lecturers: "Although it is about storage for one million

This distrust became obvious again in the closing discussions on criteria for storage of nuclear waste. Georg Arens of the Ministry of Environment noted that it is not really about getting evidence that nuclear waste has to be stored safely for a million of years, it is more about an expectation. About the requirement that data on the nuclear

years, it would be nice if the criteria were available sooner."

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THE CREDIT CRUNCH AND NUCLEAR POWER

Since the decline following nuclear power's golden era of the mid-70s, there have been frequent predictions of a nuclear revival. The latest 'second coming', widely known as the 'Nuclear Renaissance' dating from 2002-03 is being pursued with greater determination than its predecessors.

(679.5906) Steve Thomas - After 5 years of the 'Nuclear Renaissance', the absence of any definitive new orders in key markets such as USA, UK and Italy has led to increasing doubts, even before the extent of the impact on the world economy of the 'Credit Crunch' is apparent, as to whether the renaissance will again be still-born. While the 'Credit Crunch' will not be good for most large scale projects, will it be particularly damaging for the prospects of a Nuclear Renaissance?

1. Finance

The most obvious place to start is at the heart of the Credit Crunch itself, the banking system, in particular the ability

of electric utilities to borrow the money needed to build nuclear plants. It is clear that one of the legacies of the 'Credit Crunch' will be that banks will be more risk averse and will also be more careful in their procedures for assessing risk.

A nuclear power station is the most capital-intensive way to generate electricity and, on its past record, the most economically risky. So it is clear that unless ways can be found to insulate the banks from this risk, the impact on the prospects for the 'Nuclear Renaissance' will be very severe. There are two main ways that banks can be insulated, at least in part, from this risk: by electricity consumers

or by government credit guarantees

1.1 Deregulation

In the past, while electricity was still a regulated monopoly, obtaining cheap financing to build nuclear power plants was made easier by the fact that consumers effectively guaranteed the loans. If costs escalated, performance was worse than expected, alternatives proved cheaper or electricity demand had been over-estimated, the plant owners simply increased electricity prices to recover the additional costs they had incurred. When this assurance broke down, either because competition had been introduced to electricity or, as in the USA in the late

1970s, because regulators were no longer prepared to make consumers pay for the errors of the company, finance became a thorny issue. In the USA, ordering ground to a halt and many existing orders were cancelled.

The poor record of nuclear plants being built to time and cost and the mixed record on reliability had always made nuclear a risky option, but now the risks are falling directly on to the utility building the plant, and if, as a result, the utility failed, financiers would not be repaid. This has been proved to be more than a theoretical risk more than once. In 2002, the privatized British nuclear generating company, British Energy, collapsed because its costs were higher than the wholesale electricity price it had to sell its power at. In this case, the British government chose to rescue the company using tax-payers' money and banks did not lose, but this will not always happen. The Olkiluoto project in Finland (see Box), the only Generation III+ design on which substantial construction work has been completed is acknowledged to be 50% over budget and 3 years late after only 3 years of construction. The owners, TVO, expect to be covered for the cost escalation by a 'turnkey' construction contract although whether this contract will stick is now far from

Dominion shuts down on uranium price slump. The Dominion uranium mine has been shut down, possibly permanently, because of start-up troubles and the sharp drop in the spot price of uranium. The mine was supposed to produce over 4 million pounds of uranium oxide per year. The owner of the South African mine, Uranium One, announced that the facility would be put in a state of 'care and maintenance'. The company explained that the decision was based on three main factors that ruined the project's economics. One was "inflation-related increases in project costs", another was "slower than expected ramp-up in development and uranium production," while the deciding factor appears to be the recent decline in uranium prices. Currently, it could be cheaper for Uranium One to meet its supply commitments by sourcing uranium on the spot market than extracting from its own mines. One reason the uranium price has dropped sharply in recent weeks is thought to be the abrupt exit of speculators from the market as troubled financial institutions seek to raise cash. The spot price of uranium oxide surged to an all-time high of \$137 per pound in July 2007, then slumped to \$75 by October that year. After that the price was variable but trended downwards until steadying for several weeks at \$65 per pound from August this year. The current spot price is \$44 per pound after a dramatic drop in the last six weeks, according to Ux Consulting.
World Nuclear News, 22 October 2008

clear.(1) But most of the costs of late completion - buying the replacement power from a potentially tight Nordic wholesale electricity market will fall on the owners.

Negligible quantities of new generation have been built since the Nordic market was created in the late 1990s and already, dry winters, which reduce the

availability of hydro-power, have led to large increases (up to 6-fold) in the wholesale electricity price. So for the period 2009-12, when Olkiluoto should have been producing 12TWh per year, the owners will have to buy that power from the wholesale market, assuming that amount of power is available.

TVO is owned by its customers, energy intensive industries such as paper and chemicals for which electricity purchase is likely to be one, if not the

Duke Energy raised estimated cost of constructing Lee III.

In a cover letter that Duke sent to the North Carolina Utilities Commission (NCUC) with its 2008 Integrated Resource Plan (IRP), the company said that it now expects the plant to cost some US\$11 billion (8.8 billion euro) -around twice its original estimate- to construct, excluding financing costs and inflation. In 2005, the company put the cost of constructing the Lee plant at between \$4 and \$6 billion. This is the first time the company has revised this figure. Duke told the NCUC that it "has not finalized an engineering, procurement and construction contract for the Lee Nuclear Station, and this estimate could be impacted by many factors currently affecting the global energy supply markets."

Duke submitted a combined construction and operation license (COL) application with the US Nuclear Regulatory Commission (NRC) for the proposed Lee plant at the end of 2007. The COL application is based on two Westinghouse AP1000 pressurized water reactors with a combined capacity of 2234 MWe. Duke expects to receive a COL for Lee in early 2012. The Lee plant would come on line about 2016-18 if the company proceeds.

World Nuclear News, 7 November 2008

For the nuclear industry, this would be the financial equivalent of a Chernobyl scale accident, probably making nuclear un-financeable on commercial markets for decades.

1.2 Government guarantees

Even before the 'Credit Crunch', the risk premium involved in nuclear projects discussed above was a severe barrier to new orders. At the top of the utilities' wish list for government support were credit guarantees, which shift this risk to tax-payers. One of the factors that made the Olkiluoto order financeable was export credit guarantees from the French and Swedish government that made loans at only 2.6% interest rate possible. At the time, the guarantees were shocking and looked extensive but in comparison with what US utilities are asking for, they now seem small.

In the USA, Congress has made \$18.5bn in Federal loan guarantees for new nuclear plants available for 2008/09.(2) This is part of the Bush Nuclear Power 2010 initiative, which was based on the premise that some Federal subsidies and guarantees to a handful of new plants would overcome barriers to new ordering and lead to a flow of new, unsubsidized orders. But while utilities have been keen to stand in line for these handouts, with 30-40 plants now at various stages of planning, it seems increasingly likely that without such subsidies, these

orders will not be placed. If the new US government really wants to get a significant proportion of the 30-40 reactors in the queue for US Federal handouts built, the \$18.5bn will not go very far. If we assume that a new plant will cost no more than US\$7-9bn and industry gets its wish that 80% of this cost is covered by Federal loan guarantees, guarantees worth about US\$250bn will be needed. By October 2008, 17 power companies had already applied for \$122bn in federal loan guarantees.(3)

There has also been speculation that the French and Japanese governments would offer loan guarantees for plants supplied by their national companies.(4) Areva NP is controlled by French interests, indeed, it is majority owned by the French state. Areva NP has also been reported to have the support of the French export credit guarantee organization for orders placed for its plants in South Africa. For the Japanese government, we are in uncharted waters. Despite the extensive nuclear program in Japan, this is the first time Japanese vendors have tried to win foreign orders. Mitsubishi has its own design while Hitachi uses GE designs. Westinghouse, although largely based in the USA is now owned by Toshiba, which also offers a GE design. Providing guarantees for one order, like Olkiluoto, which was seen as opening up the market for French exports might be acceptable to French and Japanese taxpayers. However, if such guarantees are a condition for all orders to be placed, taxpayers will see this as a blank check and, especially if the Olkiluoto order does lead to a default, a highly risky one.

For US orders, if public opinion remains that failures of the US banking were at the root of the 'Credit Crunch', the idea of foreign banks supporting US financial institutions to again make risky investments will be even more unpopular.

This is an issue that the new Obama administration will need to look at urgently. The US government seems to have three choices: abandon the program, which is more feasible for a new administration at the start of its term even though it would face huge

opposition from those who stood to gain from nuclear orders; build 3-4 'totemic' plants and hope there was no default; or cave in to the nuclear industry's demands for blank check support.

For other countries, especially the UK, the government has still not faced up to the prospect that loan guarantees will be necessary if orders are to be placed.

It is one thing for taxpayers to be forced to find this sort of sum to save the global banking system, it is a very different thing to volunteer this level of taxpayers' money simply to get nuclear power plants built when there are non-nuclear alternatives that would not need this level of support. The public opposition to the US government's \$700bn bail-out of the banking sector demonstrated that the public is not prepared to risk its money on what appear to be ill thought-out policies.

2. Nuclear construction costs

2.1 Cost estimates

One of the most bewildering aspects of the nuclear debate in the past few years has been the escalation in forecast nuclear costs, even before any new plants have been built. The figure of US\$1000/kW (so that a 1000MW plant would cost \$1bn) was touted by the nuclear industry in the late 1990s as an achievable cost for the new

vendors would have to pay for any cost overruns, there was an expectation that it was at least of the right order of magnitude.

It is now clear that construction at the site is going very badly and the project is 50% over budget and 3 years late. Further cost increases are expected. Even companies as big as Areva NP's owners (Areva and Siemens) cannot easily take losses on this scale without expecting serious repercussions from their shareholders.

How far the cost overrun is the result of the problems at the site and how far it is because the price was an underestimate will probably never be known. Areva, in its attempt to pass these costs on to TVO, will have a strong incentive to argue it is due to specific site problems.

However, prices continued to escalate rapidly even after the Olkiluoto price was announced. By 2008, the estimated construction cost from a range of sources for a Generation III+ unit seemed to be settling at around US\$4000-6000/kW, double the Olkiluoto price and often double the estimates made by the same utilities a year or two previously. These cost estimates are not extrapolations by anti-nuclear activists, they are from credible organizations with no apparent motive for over-estimating costs such as experienced nuclear utilities and

Organization	Plant	Estimate (\$/kW)	Date
Duke Power(5)	Lee (AP-1000)	4700	November 2008
Progress Energy/Harris(6)	Harris (AP-1000)	4000	October 2008
Standard & Poors(7)	n/a	3000-5000	October 2008
E.ON(8)	n/a	6000	May 2008
Florida Power & Light(9)	Turkey Point	5400-7900	February 2008

Generation III+ nuclear plants then being designed. This figure was seen by many outside the industry as a target rather than a realistic forecast. So when the first order for a Generation III+ plant was placed for Olkiluoto in 2004, the size of the contracted cost, \$3bn or US\$3000/kW - three times the figure the nuclear industry had forecast - was not a surprise to experienced industry watchers. It was seen as a 'loss-leader', although given that the

financial institutions like Standards & Poors.

A variety of explanations can be suggested for this escalation.(10) These include:

- Rapidly rising commodity prices driven by China's demands for them which makes all power plants more expensive, but affects nuclear plants particularly severely because of their physical size;
- Lack of production facilities, which

means that utilities hoping to build nuclear plants are taking options on components like pressure vessels;

- Shortages of the necessary nuclear skills as the nuclear work-force ages and is not replaced by younger specialists; and
- A greater awareness amongst utilities, especially given the experience with Olkiluoto, that if the estimates they make are not accurate, there will be serious financial consequences for them.

If the recession triggered by the 'Credit Crunch' does bite hard, commodity prices (including fossil fuels) could fall steeply and this might at least help check the growth in estimates for nuclear construction costs - it will also tend to reduce the price of other types

of power plant, albeit to a lesser extent. However, the 'Credit Crunch' will have no impact on moderating the impact of the other factors. Given that the current costs estimates are based on minimal actual construction experience and such estimates have, in the past, seriously actual costs, the figure of \$6000/kW may yet turn out to be an under-estimate.

2.2 Turnkey contracts

The financial assurance a turnkey contract seemed to give was an important element in Areva NP winning the Olkiluoto contract and also the French and Swedish governments offering loan guarantees. However, it was surprising that Areva NP was so desperate for the order that it was prepared to take the massive financial

risk a turnkey contract involves. There have been few (if any) genuine 'whole plant' (as opposed to individual component) turnkey contracts since the notorious 12 turnkey orders that launched commercial ordering in the USA in 1964-66.⁽¹¹⁾ These lost the vendors massive amounts of money although they did achieve one of their aims, which was to convince utilities that nuclear was little more challenging than, say, a coal-fired plant and could be ordered with confidence as a proven technology.

Turnkey orders for nuclear plants are much more risky compared to other power plants because so much of the work in nuclear construction is on-site engineering and construction, a process that is notoriously difficult to control. It is also not easy for the

Finland's Olkiluoto plant

The Olkiluoto construction project in Finland has become an example of all that can go wrong in economic terms with nuclear new build. It demonstrates the problems of construction delays, cost overruns and hidden subsidies. A construction license for Olkiluoto was issued in February 2005 and construction started that summer. As it was the first reactor ordered in a liberalized electricity market, it was seen as proof that nuclear power orders were feasible in liberalized electricity markets and as a demonstration of the improvements offered by the new designs. To reduce the risk to the buyer, Areva NP offered the plant under 'turnkey' terms, which means that the price paid by the utility (TVO) is fixed before construction starts, regardless of what actually happens to costs. The contract allows for fines on the contractors if the plant is late. The schedule allowed 48 months from pouring of first concrete to first criticality.

Finance

The European Renewable Energies Federation (EREF) and Greenpeace France made complaints to the European Commission in December 2004 that the financial arrangements contravened European State aid regulations. The Bayerische Landesbank (owned by the German state of Bavaria) led the syndicate that provided a loan of €1.95bn, about 60% of the total cost, at an interest rate of 2.6%. France's Coface provided a €610m export credit guarantee covering Areva NP's supplies, and the Swedish Export Agency SEK provided €110m. In October 2006, the European Commission finally announced it would investigate the role of Coface. Subsequently, in what was seen as an eccentric judgment, it found that the guarantees did not represent unfair state aid. Regardless of this, it is clear that the arrangements for Olkiluoto are based on substantial state aid that will not be available to many plants. The interest rate on the loan is far below the levels that would be expected to apply for such an economically risky investment.

Construction problems

In August 2005, the first concrete was poured. In September 2005 problems with the strength and porosity of the concrete delayed work. In February 2006, work was reported to be at least 6 months behind schedule, partly due to the concrete problems and partly to problems with qualifying pressure vessel welds and delays in detailed engineering design. In July 2006, TVO admitted the project was delayed by about a year and the Finnish regulator, STUK, published a report which uncovered quality control problems. In September 2006, the impact of the problems on Areva started to

emerge. In its results for the first six months of 2006, Areva attributed a €300m fall in first-half 2006 operating income of its nuclear operations to a provision to cover past and anticipated costs at Olkiluoto. The scale of penalties for late completion was also made public. The contractual penalty for Areva is 0.2% of the total contract value per week of delay (past May 1, 2009) for the first 26 weeks, and 0.1% per week beyond that. The contract limits the penalty to 10%, about €300m. In December 2006, after only 16 months of construction, Areva announced the reactor was already 18 months behind schedule, which seems to assure that the full penalty will be due. In late 2007, the cost overrun was reported to have increased to €1.5bn and in October 2008, the estimated delay was increased to three years.

Relations between Areva NP and TVO are near breaking point with Areva NP now appearing to want to renege on the turnkey contract, claiming that TVO had not fulfilled its part of the deal. It now seems likely the issue will have to be decided in the courts

Implications

The scale and immediacy of the problems at Olkiluoto has taken even sceptics by surprise. It remains to be seen how far these problems can be recovered, what the delays will be and how far these problems will be reflected in higher costs (whether borne by Areva or TVO). However, a number of lessons do emerge:

- The contract value of €2000/kW, which was never - due to the turnkey nature of the contract - a cost estimate, now appears likely to be a significant underestimate.
- Turnkey contracts may well be required by competitive tenders in liberalized electricity markets. Or regulators may impose caps on recoverable nuclear construction costs, which would have the same effect. The willingness of vendors to bear the risk of cost over-runs in the light of the Olkiluoto experience is open to serious question.
- The skills needed to successfully build a nuclear plant are considerable. Lack of recent experience of nuclear construction projects may mean this requirement is even more difficult to meet.

There are serious challenges to both safety and economic regulatory bodies. The Finnish safety regulator had not assessed a new reactor order for more than 30 years and had no experience of dealing with a 'first-of-a-kind' design.

vendor to control the quality of work for the large number of contractors involved.

Standard & Poors were clear in a recent report that turnkey contracts would not be on offer.(12)

3. Competitiveness and demand

Nuclear power is just one of many possible ways of meeting electricity demand and if it is not competitive or demand does not justify it, in the long-term plants will not be built. Going back thirty years, large numbers of US orders were cancelled when it became clear either that demand did not warrant them or that the cost of meeting demand with nuclear plants would have been prohibitive.

3.1 Competitiveness

Even though estimated costs have escalated rapidly in the past 3 years, this seems to have had little impact on the enthusiasm of governments for nuclear power. One explanation for this was the rapid fossil fuel prices and insecurity in their markets. As in 1975, after the first oil crisis, the notion that fossil fuels could ever be cheap again seemed unimaginable. But now, as then, while fossil fuel markets are far from perfect, they do respond and by autumn 2008, this response was already apparent. High oil prices lead in the short-term to recession and the 'Credit Crunch' is likely to deepen this recession. This will reduce energy demand in the short-term because of the reduction in economic activity. In the longer term, there will be a more

significant demand and supply side response. This is clearly illustrated by the marketing of new cars, which for the first time in 30 years are being sold on their fuel consumption. On the supply side, higher oil and gas recovery rates will be justified, exploration efforts redoubled and previously uncommercial reserves, especially gas will become economic.

The competitiveness of renewables will be improved, but it might be energy efficiency that is the real winner. 'Fuel poverty', in the UK government's definition, a household spending more than 10 per cent of disposable income on energy, has become a major issue with the forecast that by the end of 2008, a quarter or more of British households will be fuel poor. Building nuclear plants might help keep the lights on in the long-term, but even its most committed advocates cannot claim it will reduce the price of power. Spending money on energy efficiency to reduce demand will not only keep the lights on and replace fossil fuels, it will also permanently lift households out of fuel poverty with huge health and welfare benefits as well as reducing strain on the social security system.

Few policies pay off so handsomely in so many ways.

3.2 Capacity need

When all other arguments fail, the nuclear industry falls back on capacity need. Without a nuclear power program, they argue, the lights will go off, a prediction usually based on a projection of high electricity demand growth. High energy prices and the 'Credit Crunch' are

Paladin warns of impact of credit crunch. Australia's Paladin Energy has warned that the uranium mining industry is not immune to the global financial crisis. In its latest quarterly report the company notes, "The impact of the credit tightness on the supply side of the uranium business will probably cause the deferral or cancellation of some planned uranium projects, especially those at the high end of the cost curve, and reduce the money available for exploration companies, which will only exacerbate the supply-demand imbalance in the future." However, Paladin said, "Reactor construction and forward planning for new plants continues strongly in China and other major Asian countries as well as in Russia. Demand for uranium in the medium to long term remains extremely strong." Paladin announced that output at its Langer Heinrich mine in Namibia during the quarter ending 30 September had reached full capacity of 2.6 million pounds U3O8 (1000 tU) per year.
World Nuclear News, 15 October 2008

likely to cause a recession and a strong demand side response on energy efficiency so electricity demands will be much lower than earlier forecasts.

4. Other markets

While most eyes are on the US and UK nuclear programs, other countries' programs are also being affected. South Africa has, for the past decade, been trying to commercialize Pebble Bed Modular Reactor technology, but progress has been slow and the publicly-owned South African utility, Eskom is now prioritizing orders for 'conventional' nuclear plants, either the Areva NP EPR or the Westinghouse AP-1000. It has a budget of R343bn (US\$34bn) to build 16GW of new coal and nuclear plant by 2017. In the longer term, it plans to build 20GW of nuclear plant by 2025. But at \$6000/kW, its budget would provide less than 6GW of new nuclear capacity. Eskom's credit rating is falling: in August 2008, Moody's reduced their rating to Baa2. It is also deeply unpopular because of numerous black-outs in the past two years so its priority must be to deal with power shortages and strengthen the grid so these black-outs are a thing of the past. New nuclear plants which, realistically, will not be on line before 2020 will do nothing to achieve this. So South Africa's ability to proceed with any nuclear program now looks questionable.(13)

Berlusconi has been vocal in his support for nuclear power and is trying to overturn the 1987 referendum verdict

Credit crunch may delay Entergy spin-off. Entergy has said that its planned separation of its non-utility nuclear business from its regulated utility business through a tax-free spin-off may be postponed due to the current global financial crisis. In November 2007, the company announced plans to create Enexus Energy Corp to be a standalone owner of six of its current 11-reactor fleet. In addition, it plans to create another company, Equagen, to take operating responsibility for the Enexus' and Entergy's reactors. In a filing to the US Securities and Exchange Commission, Entergy said, "State regulatory decisions and financing are now the critical path. Entergy continues to target receiving regulatory decisions in the fourth quarter. However, due to unprecedented turmoil in the financial markets, it is uncertain whether or not financing fundamental to the spin-off transaction can be effected in the near-term." It added, "Entergy and Enexus stand ready to launch the financing when market conditions are favorable for such an issuance."
World Nuclear News, 30 October 2008

that required the phase-out of nuclear plants in Italy.(14) However, the practical difficulties of re-launching the program, such as re-building skills and capabilities, were always underestimated and the 'Credit Crunch' may make finance, even for a utility of the size of ENEL, difficult, especially given the financial strain on ENEL of its purchase last year, for over €40bn, of the Spanish utility, Endesa.

5. Decommissioning funds

While the 'Credit Crunch' could have an immediate impact on the prospects for new nuclear orders because of its impact on finance, construction, demand and competitiveness, it could also have a long-term impact on funding for decommissioning. Under the polluter pays principle, the responsibilities for decommissioning should be clear. Those that consume the electricity should be responsible for paying for the clean-up of the site. This is best ensured by setting up 'segregated funds' that are invested in low risk investments. In practice, funds have not always been segregated and decommissioning cost estimates have proved a huge under-estimate so funds have been lost or are inadequate. While for long-term investments, the return will fluctuate over time, the 'Credit Crunch' may well lead to large

shortfalls in these funds which will not be repaired simply by the next economic upswing. Only a few examples have surfaced so far but if these prove to be the tip of an ice-berg, more extensive ways of ensuring adequate funds are available when needed. The Vermont Yankee plant's decommissioning fund was reported to have lost 10% of its value in a matter of weeks.(15) This plant is licensed until 2012 but the license may be extended for another 20 years in which case, there will be time to make up the shortfall. Decommissioning of the Zion plant (already closed) has had to be delayed because of inadequacy of funding.(16) If plants are reaching the end of their life with inadequate funds for decommissioning there may well be a need for further assurance mechanisms. For example, it could be required that utilities take out financial instruments (insurance policies) so that if there is a shortfall, it will be covered by the insurers.

6. Conclusions

There are likely to be many unexpected developments before 'business as usual' for the world economy resumes but two changes are clear:

- Bank's scrutiny of projects they lend money to will be far more rigorous in the future so that the mistakes that

led to the 'Credit Crunch' can never be repeated;

- Public appreciation of risk will be sharpened and where risk is being passed to taxpayers, government will need a strong case for such support to be agreed.

The implications for nuclear power of these changes are severe and it is clear that governments and utilities will no longer be able so easily to pass the risk of nuclear programs on to taxpayers and electricity

consumers. Nuclear power has demonstrated extraordinary resilience in the past 2 decades, still remaining on the policy agenda despite its failings. So it would be unrealistic to assume that in a decade, powerful interests would not still be lobbying for more nuclear orders. But the current conditions may be the best and perhaps the last chance for the nuclear industry. The external factors, such as fossil fuel prices, the need to act on climate change and the geopolitical situation are as favorable as they are likely to get. So if nuclear cannot take advantage of these will it get another chance? But the nuclear workforce is ageing and not being replaced and if a whole generation of new designs, which in a decade will be looking a little dated, has remained largely on paper, will there really be the appetite amongst private companies to spend the money necessary to bring another generation of designs to the market? Olkiluoto will continue to be the marker for the industry. At best, if there are no more delays and cost overruns, it will be a warning to potential investors, but if things keep going wrong and TVO fails financially, that will be the financial equivalent of Chernobyl to the nuclear industry.

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Zambian mine feasibility study put on hold. The partners in the Chirundu Uranium Project joint venture in Zambia have decided that the project's feasibility study will be suspended due to current financial conditions. Albardon Ltd of Australia and African Energy Resources Ltd - which hold 30% and 70% stakes in the project respectively - began a bankable feasibility study (BFS) for the Chirundu Uranium Project in May 2008. The project comprises two deposits: Njame and Gwabe. These deposits have indicated resources of over 9.5 million pounds U3O8 (over 3650 tU) contained within 14 million tonnes of ore. In a statement, the partners announced that "a decision has been made to defer further progress on all aspects of the BFS." However, they said that they would continue updating the resource estimation at both deposits in order to obtain a Measured and Indicated Resource for the project. This, they said, is expected to be completed by the end of 2008. In addition, a modified metallurgical test program at the Mintek Laboratories will continue to evaluate processing options and process optimization, which will allow the completion of the process flow-sheet design. Albardon and African Energy said that they "will continue to monitor the situation on an on-going basis to resume the outstanding components of the BFS once market conditions improve."

World Nuclear News, 31 October 2008

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IN BRIEF

Second Yucca Mountain needed in US. US. Energy Department (DOE) will tell Congress in the coming weeks it should begin looking for a second permanent site to bury nuclear waste, or approve a large expansion of the proposed waste repository at Yucca Mountain in Nevada. Edward Sproat, head of the department's civilian nuclear waste program, said November 6, the 77,000-ton limit Congress put on the capacity of the proposed Yucca waste dump will fall far short of what will be needed and has to be expanded, or another dump built elsewhere in the country. Sproat, addressing a conference on nuclear waste, said the Energy Department will send a report to Congress in the coming weeks maintaining that the Yucca site will need to be expanded. He said within two years the amount of waste produced by the country's 104 nuclear power plants plus defense waste will exceed 77,000 tons. Yucca Mountain is not projected to be opened before 2020 at the earliest.

USA-Today, 7 November 2008

BE pays police-training to remove protestors. Police officers who are called to protests at the Sizewell nuclear power plant will receive specialized training and equipment courtesy of British Energy, the owner of the reactor.

British Energy has given £10,000 (US\$15,000) to the county's police force to help them remove campaigners from the site. The money will be used to provide training for officers on how to use specialist cutting equipment - designed to release those who attach themselves to fences or buildings.

"Over the years protestors have increased the diversity of their 'lock on' capabilities, attaching themselves to a building or large object, and the police have responded with their training and specialist equipment to allow the safe removal of protestors. The funding from British Energy will allow the constabulary to purchase the appropriate equipment and training", according BE.

The last protest at Sizewell happened earlier this year when campaigners linked their arms together with tubes outside the reactor-site

EADT24, Essex en Suffolk online (UK), 4 November 2008

The Nuclear Monitor

The Nuclear Information & Resource Service was founded in 1978 and is based in Takoma Park, Maryland. The World Information Service on Energy was set up the same year and is housed 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.

The 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, a Ukrainian version is published by WISE Ukraine (available at www.nirs.org). Back issues are available through the WISE Amsterdam homepage: www.antenna.nl/wise and at www.nirs.org.

Receiving the Nuclear Monitor

US and Canadian readers should contact NIRS to obtain the Nuclear Monitor (address see page 11). Subscriptions are \$35/yr for individuals and \$250/year for institutions.

New on NIRS Website: www.nirs.org

Tell Warren Buffett to close UniStar Nuclear and cancel new reactors. Warren Buffett's MidAmerican Energy is purchasing Constellation Energy, 1/2 owner of UniStar Nuclear, which wants to build 4 new EPR reactors in the U.S. Tell Buffett no thanks, let's invest in sustainable energy instead. New petition on the front page of NIRS' website.

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