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Wylfa nuclear power station and the National Assembly for Wales

Summary

Wylfa is an old power station, already operating well past its sell-by date. It is currently closed following the discovery of unexpected safety-related problems in April 2000. Despite a history of safety problems, its owners, BNFL Magnox, not only want to continue operating it, but also to extend its life to 50 years.

BNFL Magnox is proposing to *manage* the current safety problems, rather than repair them. Their strategy is aimed at restarting the reactors as soon as possible, and it inevitably carries with it safety implications.

Electricity prices are currently falling, and are expected to decrease further following the introduction of new electricity trading arrangements early next year. This has an obvious impact on the potential economic performance of the station if it reopens, but it also impinges on safety issues as the operator strives to reduce costs in a hostile marketplace.

As yet, the National Assembly of Wales has no clearly defined role in relation to nuclear safety issues in Wales – the regulatory regime is overseen by the Nuclear Installation Inspectorate (NII), who report to the Secretary of State for Trade and Industry. However, given the seriousness of the safety issues being experienced at Wylfa, and the potential impacts of any nuclear accident on Wales overall, the Assembly should examine Wylfa and how the NII performs its role to ensure public safety.

Such an examination would provide the Assembly with the opportunity to consider the role of nuclear power in Wales, and how best to move towards sustainable, less dangerous means of generating electricity. The development of renewable energy industries in Wales will provide new jobs, as well as ensuring that the skills acquired by workers at Wylfa are used productively.

1. Background

Wylfa nuclear power station began operation in 1971. Its original design life was 20 – 25 years[1]: it is now nearly 30 years old. The station is owned by the Magnox Electric subsidiary of BNFL, who also own the notorious Sellafield nuclear plant in Cumbria.

Wylfa has two nuclear reactors, each originally intended to generate 590 MW of electricity net. Following the discovery of corrosion of internal reactor components in the late 1960s Wylfa's output was reduced. The current net capacity of each reactor is 490 MW of electricity[2]. Despite the downrating, Wylfa is the largest of the 7 Magnox stations which remain in operation.

250 MW of Wylfa's output is contracted to the Anglesey Aluminium Metal Ltd plant near Holyhead. This contract is due to expire in 2005[3]. As a result of the station's unplanned closure in April 2000, the factory – and the rest of Anglesey - gets its power through the interconnector to the mainland.

2. Nuclear safety and the Welsh Assembly

Safety in the nuclear industry is regulated by the Nuclear Installations Inspectorate (NII). The NII reports to the Secretary of State for Trade and Industry in England and Wales, who is also BNFL's major shareholder.

Although the NII is nominally independent of the nuclear industry, the obvious problem of finding nuclear specialists outside the industry to work for the regulators means that this independence is to some extent limited. This is exacerbated by the fact that the NII is dependent on BNFL Magnox for information about the state of the reactors. The NII does not produce its own initial data: it produces only an assessment of the data provided by BNFL Magnox[4].

Neither the operator's safety reports, nor the NII's detailed assessments of the reactors, are published. Instead, summary documents are produced by the NII which contain very little meaningful detail of the extent or relative importance of individual problems at the stations[5].

If a nuclear accident were to happen, the exact role of the Welsh Assembly is unclear. The NII advises the Secretary of State for Trade and Industry. The DTI will take the role of Lead Department for the organisation of responses and measures to protect the public, and the dissemination of information in England and Wales[6]. By contrast, the Secretary of State for Scotland would take the role of Lead Department in Scotland.

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[1] Wylfa Nuclear Power Station, The Findings of NII's Assessment of Nuclear Electric's Long Term Safety Review, HSE/ NII 1995

[2] Report by HM Nuclear Installations Inspectorate on the results of Magnox Long Term Safety Reviews (LTSRs) and Periodic Safety Reviews (PSRs), HSE October 2000

[3] Nucleonics Week, McGraw Hill, 24 August 2000

[4] The United Kingdom's National Report on Compliance with the Convention on Nuclear Safety Obligations, Health and Safety Executive, August 1998, http://www.hse.gov.uk/nsd/cns.pdf

[5] See in particular the Long Term Safety Reviews of the individual stations, which contain few if any details of the actual state of the reactors

[6] The United Kingdom's National Report on Compliance with the Convention on Nuclear Safety Obligations, Health and Safety Executive, August 1998, para 16.45, http://www.hse.gov.uk/nsd/cns.pdf

While the Welsh Office would deal with matters relating to the Secretary of State for Wales' responsibilities for the environment, water, health and agriculture, this would be subject to the specific responsibilities allocated to the DTI as Lead Department.

However, it has recently been recognised that the Welsh Assembly has a legitimate interest in issues of nuclear safety, because of the role it would have to play in the aftermath of a nuclear accident, and because of its duties on the protection of the environment[7]. The current situation at Wylfa presents an ideal opportunity for the National Assembly for Wales to begin to affirm this role and to establish communications with the NII on all issues of nuclear safety.

Some of the issues relating to safety at Wylfa are outlined in the following sections.

3. Wylfa's safety setbacks

Following a routine shutdown in April 2000, BNFL made a number of 'unexpected findings'[8] in Wylfa's reactor pressure vessels. This is just the latest in a long line of safety problems at the station.

The unforeseen problems in both reactors include: damage to the graphite in some channels in the reactor core, the failure of a number of welds in supports on the 'sniffing' system used to detect leaking fuel inside the reactor, and the discovery of faults in welds on superheater header penetrations passing through the walls of the reactor pressure vessel (see Figure 1).

The superheater header welds hold pipes to the reactor boilers in place where they enter the heart of the reactor. The Nuclear Installations Inspectorate is concerned that the pipes could abruptly move and fail, allowing cooling gas to leak from the reactor, or for steam and water from the boiler to be injected into the reactor itself. The failure of a single weld would create a 'beyond design basis' incident which has the potential for a significant and uncontrolled release of radioactivity into the environment.

BNFL Magnox are proposing to manage the problem of 14 of these faulty welds by fixing rings around the end of the ducts to prevent them from being blown out of the pressure vessel if a weld were to break[9]. It is important to recognise that this is not a repair to the welds, but merely an interim fix to allow the company to restart the reactor as soon as possible[10]. It is not designed to prevent the welds from failing, but merely to limit the consequences of such a failure:

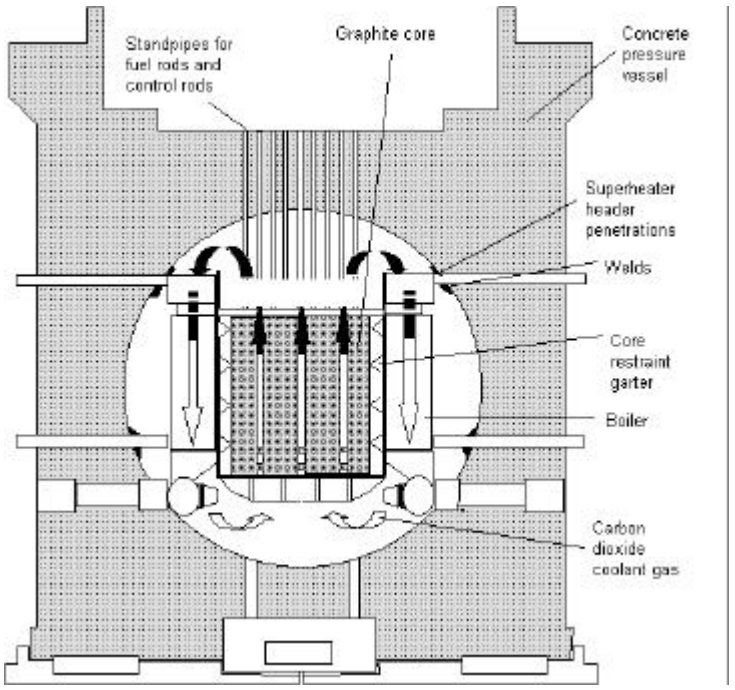
> *"BNFL Magnox is currently developing a strategy to address this problem. For the longer term it is examining the feasibility of carrying out repairs to the welds concerned, subject to ALARP considerations.* ***In the interim, in an attempt to return the reactors to service while the weld repair studies are underway, it is planning a programme of modifications to ensure that in the unlikely event of a failure of a superheater header penetration closure weld, the consequences will be acceptable." [emphasis added]***

[7] Concordat Between the Health and Safety Executive and the National Assembly for Wales, 1 November 2000, http://www.hse.gov.uk/welsh/wcordat.htm
[8] Nuclear Safety Newsletter, NII, October 2000
[9] Nucleonics Week, McGraw Hill, 27 July 2000
[10] Nuclear Safety Newsletter, NII, October 2000

It is worth noting that soon after the discovery of the faulty welds, BNFL Magnox ruled out repairing them, effectively accepting that a failure of the welds would be acceptable[11]. This expedient approach is quite contrary to the 'defence in depth' concept which states that safety critical components should be failsafe and defect free.

Figure 1

Cross section of Wylfa reactor



The station has other documented safety problems which are exacerbated as the station ages. These include[12]:

- *deterioration of the graphite core:* this is caused by two factors: a reaction with the coolant gas which results in corrosion, loss of weight and reduced strength, and by neutron irradiation, which physically changes the lattice of the graphite atoms and increases the chemical reactivity of the graphite. The graphite core is the heart of the reactor; the ongoing structural deterioration and corrosion is therefore a central safety issue. As the reactor ages, the degradation of the core increases. The graphite core cannot be replaced.

- *corrosion of steel reactor components:* this is again caused by the carbon dioxide coolant gas, and in particular by the past introduction of methane into the gas to inhibit corrosion in the graphite core. Again, the degree of corrosion increases as the reactor ages. Of particular concern is the *core restraint garter*, which holds the core in place. The failure of the core garter could result in a shift in the graphite core, meaning that control rods may not be able to be inserted to control the nuclear reaction.

[11] BNFL Magnox spokesperson David Cartwright said: "*We would not redo the welds. Rather we'd strengthen them by mechanical means, some sort of bracing.*" Nucleonics Week, McGraw Hill, 22 June 2000

[12] Wylfa Nuclear Power Station, the Findings of NII's Assessment of Nuclear Electric's Long Term Safety Review, HSE/ NII, 1995

- *failure to meet modern safety standards:* even the NII admits that *"[I]t is not reasonable to expect older designs of reactor plant to be capable of full compliance with current safety standards even after completion of a wide ranging safety evaluation and subsequent improvements"*[13]. A clear example of this is Wylfa's resistance to earthquakes. Modern stations would be expected to withstand an earthquake reckoned to occur once in 10,000 years; Wylfa only has to withstand an earthquake with a 1 in 1,000 year frequency – in other words, Wylfa is 10 times less earthquake resistant than a modern nuclear power station.

Wylfa: a history of accidents

The station has had numerous accidents since it opened. Since 1990, the more serious of these include:

1993, July
Part of the reactor fuelling equipment fell off during refuelling operations, and landed in the reactor core. Although reactor fuel elements were not damaged, the graphite brick at the top of the fuel channel was cracked.
When the component was found to be missing, the reactor was tripped, leading to a release of radioactive Sulphur 35 more than twice the weekly discharge limit.
The operator initially classed this as a Level 0 event, although it was eventually reclassified as a level 2 event – an incident with significant failures in safety provisions.
Statement of nuclear incidents, 93/3/2

1993, August
During depressurisation of Reactor 1 following a shutdown, 138 GBq of Sulphur-35 gas were released into the atmosphere. This is more than twice the weekly discharge limit.
Statement of nuclear incidents, 93/3/3

1995, November
Incompletely vaporised carbon dioxide escaped from vaporisers and reached pipework beyond.
Statement of nuclear incidents, 95/4/3

1996, January
BNFL Magnox discovered that they had mislaid a drum of nuclear waste intended for incineration. The company presumes that the missing drum had already been incinerated, resulting in a breach of the authorised radioactive discharge limits.
Statement of nuclear incidents, 96/1/1

2000, November
BNFL Magnox was fined £15,000 after it admitted illegally discharging sodium hypochlorite into the Irish Sea in breach of its discharge authorisations. The Environment Agency found that a sump close to the discharge point had concentrations of sodium hypochlorite more than 20,000 times the maximum permitted level. The discharge had a bleaching and sterilising effect, turning rocks and seaweed white.
Environment Agency

Sources:
NII Statements of Nuclear Incidents. The more recent are available at: http://www.hse.gov.uk
Environment Agency: http://www.environment-agency.wales.gov.uk

[13] Wylfa Nuclear Power Station, the Findings of NII's Assessment of Nuclear Electric's Long Term Safety Review, HSE/ NII, 1995

The design lifetime of Wylfa has caused some confusion. For the first 13 years of its operation, it was expected to last for only 20 years because its higher gas coolant pressure would cause more damage to internal steel and graphite components than in other Magnox stations[14]. The NII has subsequently stated that the design life was 20 – 25 years. However, BNFL recently announced an extension in the station's life up to 50 years[15] – well beyond the operating timescales envisaged by the station designers.

What is clear, though, is that many of the safety problems experienced at Wylfa are both progressive and irreparable, meaning that they will inevitably become more severe as the station ages.

4. Wylfa's economics and the new electricity market

In 1999 – 2000, BNFL's Magnox Division made an operating loss of £37 million, even before the company took into account increased estimates of the costs of dealing with nuclear waste, and the impact of the early closure of Hinkley Point A power station[16].

Early next year, new electricity trading arrangements (NETA) will be introduced, transforming the way that electricity is bought and sold in England and Wales[17]. NETA is expected to lead to a fall of more than 10% in electricity prices[18], meaning that BNFL Magnox's already dismal economic performance will worsen as selling prices for their electricity falls.

In addition, NETA also means that electricity generators and suppliers will be penalised if they do not fulfil their generation or supply contracts. So if BNFL Magnox fails to generate the electricity they have contracted to generate, they will face punitive financial penalties. The Magnox nuclear stations in general are far from reliable and subject to sudden closures as new safety problems emerge. Again, this means that BNFL Magnox's financial performance will suffer.

BNFL Magnox claims that it is losing £400,000 pounds each day that Wylfa does not operate[19]. This figure relates to their total potential income from selling their electricity, and does not take into account their day-to-day operating and maintenance costs, nor 'exceptional' costs such as the required safety inspections and management at Wylfa. Even making allowance for this, £400,000 a day is likely to be an overestimate, given the fall in electricity prices since the beginning of 2000.

The implications of Wylfa's closure and the introduction of NETA are not just related to economics. Wylfa is the largest Magnox station, and hence the least uneconomic in terms of

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[14] The then-operator, the CEGB, stated in a 1979 internal document that "*Operations Department advise that it is prudent to assume that all Magnox plant will have a 25-year life except for Wylfa where* ***a 20-year life should be assumed*** *because of higher gas coolant pressure causing increased steel and graphite damage.*" 1979/80 Development Review, CEGB Planning Department, page 8.4, para 815 [***emphasis added***]

[15] BNFL confirms Magnox station lifetimes, BNFL Press release, 23 May 2000

[16] BNFL Annual Report and Accounts 2000, BNFL, September 2000

[17] For more information, see NETA documentation at the website of the gas and electricity regulator, Ofgem: www.ofgem.gov.uk

[18] Margaret Beckett Consults on Proposal Following the Energy Review, DTI press release, 25 June 1998, P/98/515

[19] Nucleonics Week, McGraw Hill, 24 August 2000

its overall costs and potential income. BNFL Magnox would be extremely reluctant to close the station for good, given that it in effect props up the economic performance of the rest of their Magnox fleet. Put simply, the company cannot afford for the station to remain closed and will do all it can to restart operation. Given the pressures of the new electricity market, this could well result in a situation where BNFL Magnox will have to cut costs at Wylfa or other Magnox stations: this of course includes the approach the company takes towards nuclear safety and whether or not stations should be closed following the emergency of safety problems.

The relationship between economic performance and safety provides a further reason for the National Assembly for Wales to examine Wylfa and safety issues before NETA is introduced.

5. Closing Wylfa

Greenpeace argues that Wylfa should not be allowed to restart: the safety problems posed by the station, together with the intractable problem of its nuclear waste, mean that allowing the station to operate again would be hugely irresponsible. However, this will inevitably have an impact on future employment and the local economy. It is important to emphasise that action should be taken now to ensure that this is a positive impact which allows the area to diversify and develop new areas of expertise.

5.1 Decommissioning

Once Wylfa is closed, its buildings and components are classified as nuclear waste and have to be decommissioned. BNFL Magnox's current decommissioning strategy envisages the process taking 135 years from the closure of the station, although the company is currently considering reducing this to around 110 years. The strategy is in three parts, basically encompassing the defuelling of the reactors, dismantling some buildings and reactor components, and the construction of a 'safe store' around the remaining buildings and the reactor core about 30 years after the end of defuelling. Safe stores would remain in place for around 100 years after their construction.

This is the longest deferral of decommissioning in the world[20].

Although the company tends to portray this drawn-out process as driven by concerns over worker radiation doses, it is in fact dictated by economic considerations. It is cheaper if future costs are deferred to allow funds set aside now to accumulate in value into the future, although this 'discounting' approach has been much criticised on ethical grounds[21].

There are several major areas of concern about BNFL Magnox decommissioning plans, including:

- the buildings will be left in place for a period which could exceed 170 years (ie from construction to the end of the safe store period). However, it is inevitable that materials and structures will deteriorate over that timescale, potentially inhibiting their future dismantling. In addition, future generations will not have the practical knowledge available today about the intricacies of individual reactors. The NII is particularly concerned about BNFL Magnox's timetable, and is instead arguing for a

[20] Nucleonics Week, McGraw Hill, 8 July 1999

[21] See for example *UK Nuclear Decommissioning Policy: Time for Decision*, Gordon Mackerron, John Surrey, Steve Thomas, SPRU, University of Sussex, January 1994

decommissioning strategy that will take around 50 years – bringing it into line with strategies in other countries[22].

- simply closing the reactors and removing the used fuel will not remove the risk of a nuclear accident. The graphite core will remain reactive and at risk of fire, and the steel components surrounding the core will continue to corrode
- the third area of concern relates to concepts of sustainability: to what extent is it justifiable for current generations to defer taking action now for economic reasons, and instead leave the management of Wylfa's nuclear wastes for our descendants?

5.2 Future jobs

Magnox stations employ around 350 people each. After closure, BNFL Magnox expect these levels to be maintained for around a year. After that, around 250 staff would be retrained for the defuelling stage of decommissioning, which takes around 3 – 4 years. After defuelling, levels would fall gradually, eventually levelling off at around 50 people several years after closure[23].

This staged decline in job numbers gives local economies, which have often become largely dependent on the Magnox stations, the opportunity to diversify before there are widespread job losses. In fact, BNFL Magnox appears to be encouraging certain efforts in this direction at the Bradwell Magnox station, which is due to close in 2002, by retraining a proportion of their staff there.

The role of the Welsh Assembly in BNFL Magnox's decommissioning strategies is not yet fully clear. What is clear, however, is that the Assembly can make a positive contribution to encouraging the diversification of local economies. If the Assembly were to decide to push ahead with the development of renewable generating technologies, areas around closed nuclear stations would the invaluable resource of skilled technical personnel for plant operation and maintenance.

[22] Nucleonics Week, McGraw Hill, 8 July 1999

[23] BNFL confirms Magnox station lifetimes, BNFL Press release, 23 May 2000. Trawsfynydd nuclear power station was closed in 1993. In 1999, there were around 200 people working at the station. It is intended to reduce this to around 150 soon.