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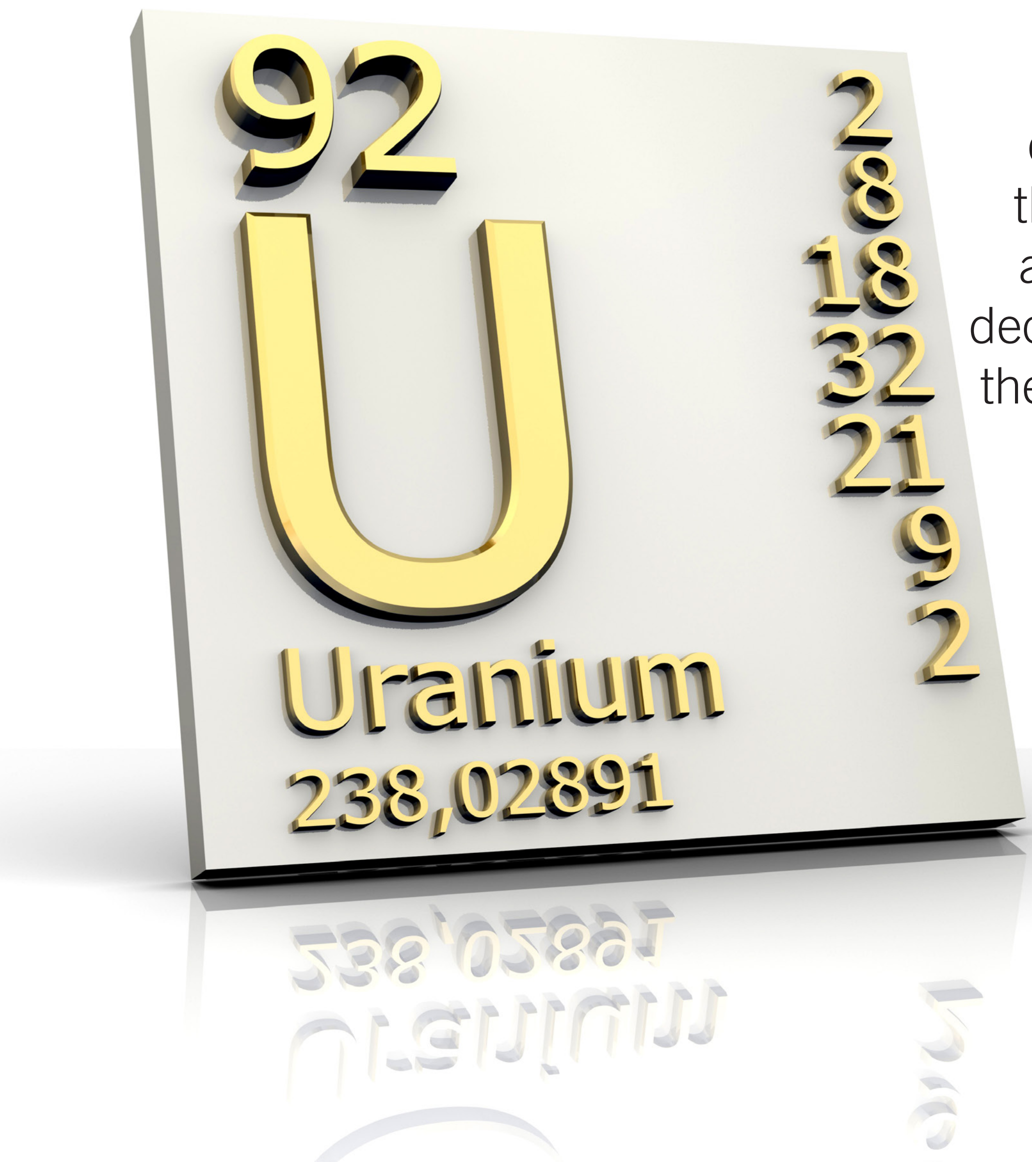
Nuclear Decommissioning



This Factfile briefly outlines the history of nuclear power in the UK, the strategy adopted for nuclear decommissioning and the practice for safely undertaking this.

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Introduction

The first generation of UK nuclear reactors was built in the 1950s and 1960s. Now an increasing number of reactors have reached the end of their useful life and their decommissioning is a topic of public concern. This Factfile briefly outlines the history of nuclear power in the UK, the strategy adopted for nuclear decommissioning and the practice for safely undertaking this.

Historical Outline

The UK's nuclear power programme began in the 1950s. Driven by the need to build an effective nuclear deterrent, a large scale nuclear plant was constructed at Windscale in Cumbria. The plant consisted of two air-cooled natural uranium graphite reactors and their sole purpose was to produce weapon-grade plutonium for defence. The reactors became operational in 1950 and 1951.

Following the building of the Windscale plant, the Government decided in 1955 to develop a strategic nuclear power programme to meet Britain's growing energy needs. This led to the construction of four natural uranium/graphite moderated gas-cooled reactors at Calder Hall on a site adjacent to the Windscale reactors. Calder Hall was designed to produce plutonium with electricity as a by-product. It was followed by a sister station at Chapelcross in Dumfries and Galloway, Scotland. In subsequent years, these two stations effectively focussed on electricity production.

Nine Magnox stations, developed from the basic Calder Hall design, all with twin reactors, were commissioned in the years from 1962 to 1971. The name Magnox was derived from the cladding of the uranium fuel which used a nonoxidising material, a magnesium/aluminium alloy, as its fission product containment. These Magnox reactors, which were owned and operated by the Central Electricity Generating Board (CEGB) and the South of Scotland Electricity Board (SSEB), employed an on-load refuelling scheme which greatly improved the stations' efficiency and flexibility of operation.

Since the privatisation of parts of the nuclear industry in 1996, the Magnox stations have remained under state control operated by Magnox Electric plc which became wholly owned by British Nuclear Fuels plc (See **Fig 1** and **Table 1**).

In 2005, the Government set up the Nuclear Decommissioning Authority (NDA) to provide a UK-wide focus on the decommissioning and clean up of nuclear sites. Ownership of the Magnox sites is now with the NDA.

Key	
■	PFR being decommissioned
◆	AGR
✕	Magnox being decommissioned
▲	Magnox
+	Heavy Water Reactor being decommissioned
✳	PWR

Table 1: Nuclear Power Stations in the UK

Location	Site licence holder	Number of reactors	Commissioning date	Date ceased generation	Typical maximum power (MWe)	Site owner
Magnox						
Calder Hall	Magnox	4	1956-1959	2003	200	NDA
Chapelcross	Magnox	4	1959-1960	2004	200	NDA
Berkeley	Magnox	2	1962	1988-1989	276	NDA
Bradwell	Magnox	2	1962	2002	245	NDA
Hunterston A	Magnox	2	1964	1990	300	NDA
Trawsfynydd	Magnox	2	1965	1991	390	NDA
Hinkley Point A	Magnox	2	1965	2000	470	NDA
Dungerness A	Magnox	2	1965	2006	440	NDA
Sizewell A	Magnox	2	1966	2006	420	NDA
Oldbury-on-Severn	Magnox	2	1968	Ø	343	NDA
Wylfa	Magnox	2	1971	Ø	950	NDA
SGHWR						
Winfrith	UKAEA	1	1968	1990	92	NDA
AGR						
Windscale *	UKAEA	1	1963	1981	30	NDA
Hinkley Point B	NEL	2	1976-1978		1200	BE
Hunterston B	SNL	2	1976-1977		1200	BE
Hartlepool	NEL	2	1984		1200	BE
Heysham 1	NEL	2	1984		1200	BE
Dungerness B	NEL	2	1985-1986		1200	BE
Heysham 2	NEL	2	1988		1200	BE
Torness	SNL	2	1988-1989		1200	BE
PWR						
Sizewell B	NFL	1	1994-1995		1188	BE
Fast Reactor						
Dounreay PFR	UKAEA	1	1976	1994	250	NDA

Key:

NDA	Nuclear Decommissioning Authority
BE	British Electric
Magnox	Magnox Electric Ltd
UKAEA	United Kingdon Atomic Energy Authority
NEL	Nuclear Electric Ltd (A subsidiary company of British Energy)
SNL	Scottish Nuclear Ltd (A subsidiary company of British Energy)
*	Prototype for AGR programme
Ø	Current plan is for Oldbury to cease generation in 2008 and Wylfa in 2010

In 1963, a small prototype advanced station (30 MWe) began operating at Windscale. The Windscale Advanced Gas Reactor, (WAGR), used slightly enriched uranium oxide and this allowed higher gas and steam temperatures to be utilised. The project began in 1958 and following a successful period of operation closed in 1981. Decommissioning of this reactor has been progressing for a number of years with a return to a green field site as an aim.

Following a number of years of successful operation of WAGR, the CEGB and SSEB in the 1970s, embarked upon this advanced type of nuclear reactor station. The Advanced Gas Reactors (AGRs) used slightly enriched uranium oxide fuel enclosed within a stainless steel cladding which allowed operations at higher temperatures which improved thermal efficiency. Over the years from 1976 to the late 1980s, seven such stations were commissioned. Since 1996, the AGRs with the Sizewell 'B' Pressurised Water Reactor, (PWR), have been owned privately by British Energy plc. (see **Fig 1**)

Of the nine Magnox stations, all but two are permanently closed. Decommissioning has been progressing for a number of years at three of the closed Magnox stations: Berkeley closed in 1989, Hunterston 'A' in 1990 and Trawsfynydd in 1993. In addition, there are in Britain a number of other reactors closed and in various stages of dismantling including: WAGR; the Steam Generating Heavy Water Reactor (SGHWR) at Winfrith; the Prototype Fast Reactor (PFR) at Dounreay; and the Dounreay Fast Reactor (DFR). **Figure 1** shows the geographical location of the sites. **Table 1** is a list of all UK nuclear power stations and their current status.

What is Decommissioning?

Nuclear power plants represent a very large capital asset for their owners when operating and a liability when closed down. All Nuclear Power Plants (NPPs) require a licence to operate, which in the UK is provided by the Health and Safety Executive's Nuclear Installations Inspectorate. This is an independent regulatory body which sets down the conditions governing the issue of an operating licence for each nuclear site. The licence is unique to the particular site and is issued only when the Inspectorate is completely satisfied each and every safety issue has been addressed.

Berkeley Nuclear Power Station before decommissioning

The Site Operating Licence is enforced from a time before commissioning until many years after closure, although the rules at a given time after permanent closure may be less stringent and in a modified form. The safety of the public, the work-force and the environment are paramount from plant conception to the end of decommissioning.

Decommissioning of any nuclear installation is the period after permanent closure or cessation of generation, during which the plant and equipment is dismantled and removed over a long time scale until the location can be returned to a 'green-field' state or put to alternative use.

An essential part of decommissioning is to ensure that all the radioactive waste arising during the dismantling process is safely, securely, effectively and economically managed. This means that strategies must be adopted which encompass the following elements.

- Radiation doses to the public and to workers due to the radioactivity emanating from the waste must be kept 'As Low As Reasonably Achievable', the ALARA principle.
- The amounts of waste arising must be minimised as far as reasonably practicable.
- Disposal routes must be well defined and this may include interim storage of the waste. Waste should be put in a passively safe[1] form.
- Protection of the environment throughout the decommissioning process.

It should be noted that the decommissioning of a nuclear plant involves a considerable amount of waste which is not radioactive. This too must be suitably and safely disposed of so that it represents no threat to the public or the environment.

How Long Can A Nuclear Power Station Operate?

The early nuclear power plants at their conception did not have a specific operating life ascribed to them. Prior to 1989 however, the CEGB and SSEB did assign amortisation periods of 20-25 years to Magnox power stations. This figure has resulted in some public misunderstanding on the length of a station's working life. The early stations were designed to provide implicit margins of safety which would allow an operational life of 40 years or more and, since they were built, much refurbishment and upgrading work has been carried out both to improve plant performance and to meet higher safety standards.

The life of a power station can be limited by ageing mechanisms such as irradiation, embrittlement, thermal cycling, creep, fatigue, corrosion and erosion, cracking and wear combined with material fretting characteristics. To combat these the plant and its equipment must be constantly monitored and maintained to the highest standards. Updating of plant components is a further factor when refurbishment work is undertaken.

In the UK at all stages of construction, commissioning, operation and decommissioning, the independent regulator, the Nuclear Installations Inspectorate (NII), must be fully satisfied as to the continued safety of the plant. The decision by an operator to close a nuclear power station permanently will only be taken after all aspects affecting power station life have been studied, and the potential safety, technical and financial implications of further operation have been assessed. The Magnox reactors now undergoing decommissioning would have been subjected to rigorous examination of all the relevant factors before a final closure decision was made.

Principles of Decommissioning - The UK Strategy

Four broad objectives have been applied in the decommissioning strategies developed in the UK. These are:

- to ensure the continued safety of the public, the workforce and the environment;
- to minimise the environmental impact of the installation as far as reasonably practicable;
- to release land for other use as appropriate; and
- consistent with the above, to minimise the expenditure of national resources on decommissioning.

The first step in decommissioning is to reduce the risk from radiation hazards by discharging the irradiated fuel which is the main source of radioactivity on the site. This removes more than 99% of the radioactivity present. Fuel removed in the course of decommissioning is treated in the same way as spent fuel has been throughout the life of the station. Thereafter, the reduction of radioactivity solely due to natural decay will eventually allow the site to be restored for other use but only after about a hundred years. The plant and equipment remaining must be subjected to a controlled process of decontamination and dismantling, work which is closely monitored while it proceeds.

The planning of decommissioning work requires that the radiation exposure of workers and of the public at large is kept as low as reasonably achievable. This may mean delaying dismantling of some plant areas in order to take advantage of the natural decay of residual radioactivity. For example, a delay of 100-130 years would reduce dose rates by several orders of magnitude and remove as far as practicable the need to use robotic systems which are costly (**Fig 2**).

Following its final shutdown, the radiation levels inside a magnox reactor decrease quite rapidly - and naturally - the rate of reduction being dominated by the characteristics of the radioactive isotope cobalt60. Thereafter, two other isotopes (silver108m and niobium94) become the main contributors to the radiation level and their characteristics cause the reduction with time to be much less pronounced. By about a hundred years after final reactor shutdown, the radiation levels inside the reactor will have decreased by a factor of about a million. This was an important consideration in adopting the "SafeStore" strategy.

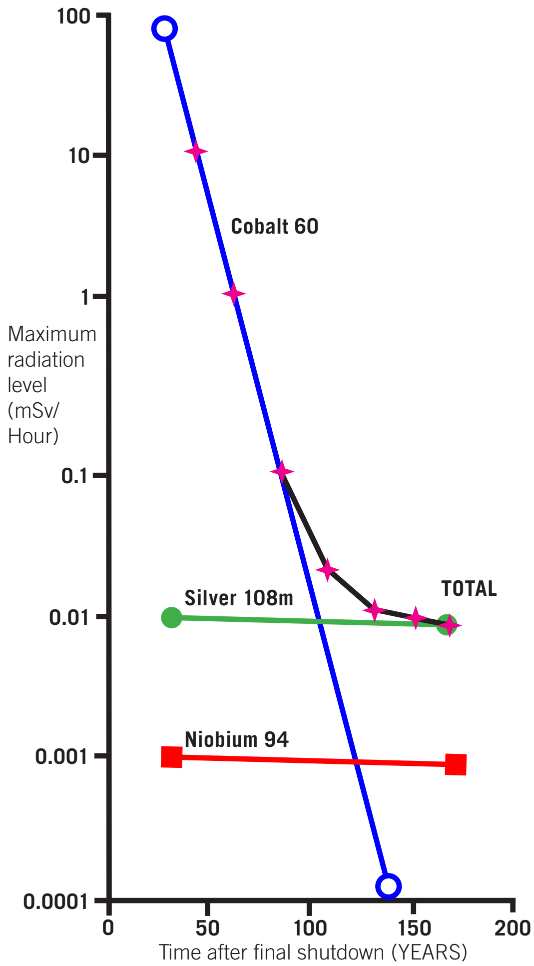

Figure 2. Reduction in dose rate with time inside a typical magnox reactor

In general, the strategy adopted in the UK falls into three stages.

Stage One

Defuelling and other Preparatory Work - is the complete removal of all fuel from the reactors and its dispatch to the reprocessing plant at Sellafield. This work will take around 2-5 years. In parallel with the defuelling, a start can be made removing some of the non-radioactive plant and buildings. Because of the need during this time to cover any inadvertent reactor power faults, the essential and emergency plant will remain in readiness until it is established, by calculation and agreed with the Regulator, that the possibility of accidentally going critical is vanishingly small.

Stage Two

SafeStore & Care/Maintenance Preparations - involves the removal of buildings in which there is no radioactivity (often this commences before the end of Stage One). Important activities at this stage include:

- retrieval of low level waste and either disposing of it to the Low Level Waste Repository or developing temporary storage solutions on site;
- retrieval of intermediate level waste (ILW) and construction of adequate passively safe storage arrangements on site pending the development of a national ILW repository in the longer term.

Stage Two also sees the commencement of work to secure reactor buildings in which there is radioactivity. Such work may entail replacing external cladding with high integrity materials and the in-filling of unnecessary openings. The construction of the secure building termed “SafeStore” must provide a robust shell capable of resisting accidental or intentional damage or unauthorised access. This preparatory period will last around 20 years, after which the SafeStore will be subject to remote surveillance (with only limited visits required to check on plant security) for a period of around 100 years.

Table 2 presents a decommissioning time line demonstrating how decommissioning is planned to proceed over a one hundred year time frame.

Operators remove a redundant uranium storage flask from the storage pond withdrawal bay at Sellafield

Table 2. Decommissioning time line

Typical time frame[i] (Years)	
0	Cease electricity generation
~2-5	Reactor defuelling: spent fuel dispatch to Sellafield. Post-operational site clean-out
~5-20	Decommissioning ■ Progressive dismantling of radioactive and non-radioactive plant and buildings (e.g. cooling towers, turbine halls, cooling ponds and ancillary plant). ■ Clean-up of radioactive materials - disposal of site low level waste to the national LLW repository. ■ Construction of new intermediate level waste packaging and interim storage facilities. ■ Hazardous and non-hazardous wastes (e.g. asbestos, oil, chemicals) dispatched off-site for disposal or recycling. ■ Preparation of SafeStore reactor building.
~20-100	Care and maintenance ■ Only significant building remaining: SafeStore reactor and ILW store.
~40-50[ii]	Dispatch ILW packages off-site to national repository.
~100-200	Dismantle reactor buildings and ILW store. Ground remediation and landscaping.
~120	Delicensing/final site clearance for potential re-use or to original state.

i. Some flexibility possible on individual sites. May be feasible to accelerate approach to Care and Management.

ii. Dependent on availability of national ILW repository.

Decommissioning of cubicle 3 gloveboxes in the redundant PFR Plant at Sellafield

Stage Three

Final Clearance - this follows typically about a hundred years from shut down and will lead to full site clearance and restoration to a green field site. The timings generally are not rigidly defined and the strategies adopted allow a flexible approach to be made depending on a particular station's requirements.

Compared to a more rapid approach, this UK strategy has three main advantages. It reduces the radiation exposure of workers, minimises the volumes of Intermediate Level Waste (ILW) and Low Level Waste (LLW) and it is cost-effective. The strategy outlined applies to the Magnox stations and to the AGRs. For the PWR, which is a modular design reactor, a generally similar approach may be adopted although timescales may differ.

As has been stressed, the major source of radioactivity of a nuclear power station is the fuel. Following defuelling, internal dose rates will still preclude human access for dismantling. Although many such operations could be safely carried out by remote techniques, these are costly and it is preferable to defer much dismantling until a significant amount of natural radiation decay has occurred. Such a delay reduces the exposure of workers, reduces the quantities of radioactive wastes that need to be safely disposed of, and further lowers the overall discounted costs of decommissioning.

Organisation of Decommissioning in the UK

On 1 April 2005, the Nuclear Decommissioning Authority took ownership of, and strategic responsibility for, the decommissioning and clean up of all twenty of the UK public sector civil nuclear sites.

Established by the Government under the 2004 Energy Act, the NDA will not carry out the decommissioning work and remediation itself but will have the responsibility to contract out the work. On the sites previously under BNFL ownership, such as the Magnox reactor sites, work will initially be contracted out to businesses within the BNFL group.

In the future, these contracts will be subject to fair and open tender from suitably qualified organisations. The decommissioning work will be carried out by the contractors also known as site licensees in accordance with the annual work plans and five year strategies developed with the NDA.

NDA Funding

The NDA is a non departmental public body. It is funded by a combination of Government grant-in-aid and income from commercial operations which include electricity generation from operating Magnox power stations, fuel manufacturing and reprocessing of spent nuclear fuel. In 2007/8 NDA expect to spend about £2.8 billion, with income contributing about half of this; about 15% of this spend relates to the Magnox decommissioning stations.

NDA Strategy

Key principles of the NDA strategy include:

- prioritising health, safety, security and protection of the environment;
- placing a key focus on the reduction of significant hazards;
- aspiration to deliver an accelerated decommissioning schedule wherever feasible;
- establishing competition for the management and operation of sites so as to improve contractor performance and deliver value to the taxpayer.

Safety Responsibilities

At nuclear licensed sites, legal responsibility for nuclear safety, industrial health and safety, security and environmental protection is placed on the Site License Companies (SLCs). The SLCs hold nuclear site licenses from the Health and Safety Executive and discharge authorisations from the Environment Agency for sites in England and Wales, and from the Scottish Environment Protection Agency for sites in Scotland. The SLCs have therefore to be the 'controlling mind' for all activities that affect health, safety, security and the environment (HSSE) at all times.

As part of the new competitive approach to contracts for management and operation of the nuclear sites, new SLCs may need to be created, with relicensing of nuclear sites, and new radioactive discharge authorisations being obtained.

Whilst the NDA has HSSE responsibilities for their contractors' performance, these do not impinge on the legal responsibilities of the SLCs.

Environmental Impact Assessment

The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (EIAD99) require that any licensee wishing to begin to decommission a nuclear power station must:

- apply to the Health and Safety Executive for consent to carry out a decommissioning project;
- carry out an environmental impact assessment, and
- prepare an environmental statement that summarises the environmental effect of the project.

British Energy Nuclear Power Stations

Responsibility for decommissioning work at British Energy sites remains with BE. This covers the AGR stations at Dungeness B, Hinkley Point B, Hunterston B, Hartlepool, Heysham 1 and 2 and Torness and the PWR station Sizewell B.

However, following the restructuring of British Energy, under the Energy Act 2004, the NDA was given responsibility to oversee BE's planning for the decommissioning of its nuclear power plants. These supervisory functions include reviewing and approving BE's strategies and budgets for decommissioning its power plants.

Financial Aspects

Decommissioning and waste management costs should normally be taken into account by all utilities during a power plant's lifetime whether they are in the public or private sector. These financial provisions should systematically be made to cover current operations and to ensure that no future liabilities are left unaccounted for.

The costs throughout the whole fuel cycle can be divided into fixed and variable. The variable costs apply to the management of wastes from irradiated fuel, which depends on the plant life generation. Other decommissioning costs can be regarded as fixed. Whether a Utility is in the public or private domain, decommissioning costs should be viewed as a charge to be set against the total cost of each kWh of electricity produced.

Recognition of the need to make prudent provisions for meeting present and future liabilities is best expressed by detailing the approach adopted. This is given below.

The Government's policy over decommissioning is that it should be carried out as soon as reasonably practicable after closure, taking all relevant factors into account. There has been considerable concern about the likely costs of decommissioning all of the Nation's nuclear installations. A significant difficulty arises in estimating the decommissioning costs arising up to around 100 years into the future.

The Government accepts responsibility for certain nuclear liabilities. For example, after 1986 when the UKAEA was established as a Trading Fund, the costs of treating and disposing of the Authority's wastes prior to April 1986 was accepted.

As far as BNFL is concerned, the Government took the responsibility for meeting certain liabilities on the company's formation. Most of the liabilities other than the above fall upon the commercial nuclear generators.

The large sums involved in decommissioning are financed by using the principle of discounting, a method which expresses a future financial commitment in present values i.e. it is the reverse of compounding. Discounted payments are set against present earnings on a year by year basis.

These payments are calculated to generate, over the operational lifetime of a station, an investment sufficient to fund the initial decommissioning of the station. They also take into account the subsequent SafeStore period, to generate sufficient funds to complete the dismantling and safe disposal of the waste and restoration to a green-field site. The application of discounting significantly reduces the provisions which need to be made in a Utility's annual accounts in order to provide the large sums required for decommissioning. The rate of discounting is usually set two or three percentage points above inflation.

Up to the time of the privatisation of British Energy plc, any surplus monies made by the State owned Utilities were required to be deposited in the public sector. The money was retained in the form of investments in the generating business or deposits in the National Loans Fund. This meant that nationalised industries always had to use or deposit surplus cash so that it would enable the public sector to reduce the Public Sector Borrowing Requirements, (PSBR). Such sums were never allocated by the Treasury to any specific purpose.

Following the privatisation of the AGRs and the PWR stations, with the new company (British Energy) taking ownership of these assets, the Government imposed the adoption of segregated funding. To implement this, the structure established the setting up of an independent Fund Company which would receive funds and invest them to meet the decommissioning costs in the long term. With its flotation in 1996, British Energy received an initial endowment of £228 million in aggregate covering Nuclear Electric and Scottish Nuclear. Further contributions by British Energy were to follow on a quarterly basis of the order of £16 million annually (subject to RPI indexing).

The financial restructuring of British Energy was completed in January 2005. This changed the way in which the company's nuclear liabilities are funded. The Nuclear Liabilities Fund (NLF) managed by independent trustees has a role in independently holding and managing funds to cover decommissioning and radioactive waste management liabilities[2].

Removal of CO_2 Gas Cooling Ducts at Berkeley

As part of the restructuring, the Government provided certain indemnities against any future shortfall in NLF funding of qualifying uncontracted liabilities and qualifying nuclear decommissioning costs[3].

British Energy has prepared life cycle plans for the management of plant decommissioning and certain radioactive waste liabilities. Subject to necessary approvals, these plans will form the strategy for the long-term management of nuclear liabilities to be funded through the NLF[4].

Each year, British Energy make payments to the NLF towards the costs of these liabilities. These include annual payments of £20 million, which will decrease as the nuclear stations reach end of operating life, and a Cash Sweep Payment of 65% of net adjusted cash flow, which amounted to £105 million in 2005/06[4].

Based on current estimates of station lives and lifetime output projections, British Energy assess that, in current prices, the likely undiscounted payments for decommissioning[5] are £8.6 billion, the equivalent sums discounted at 3% real per annum are £2.7 billion. The difference between these amounts recognises that the costs concerned will not fall due for payment for a number of years[4].

Nuclear liabilities have to be annually restated to reflect the impact of inflation and remove the effect of one year's discounting as the payment date moves one year closer. This accounting procedure is known as "revalorisation" and is presented in British Energy's profit and loss account each year.

The International Atomic Energy Authority (IAEA) Position

Article II of the IAEA Statutes on the peaceful uses of atomic energy, states that,

"the IAEA shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world...."

In fulfilling these objectives with other bodies, e.g. the Nuclear Energy Agency of the Organisation for Economic Co-operation & Development (OECD/NEA), radioactive waste management has been given a prominent status as an IAEA activity.

The IAEA creates internationally accepted standards and criteria which, in particular, reflect the needs of its Member States. It is generally agreed that a generation which undertakes certain activities should deal with the adverse aspects of these rather than leave them for future generations. The main objective of waste management is to ensure the safe handling and disposal of radioactive waste with special emphasis given to the potential consequences for future generations. A key aspect of this is the provision of adequate finance to undertake the work involved.

In 1991, because of the growing number of nuclear plants facing permanent shut down and decommissioning, the IAEA set up a programme known as RADWASS (Radioactive Waste Safety Standards). The objective was to produce a series of safety documents specifically directed at radioactive waste management and decommissioning. Such documents express an international consensus by a universal approach to the safe management of the storage and disposal of waste.

Member States have, in general, national regulations and laws which control their own nuclear energy programmes. The questions relating to the decommissioning of facilities are now being addressed in a more practical way and at an expedient level, as more and more plants are being closed, in order to secure an International consensus.

There is a growing recognition of the need to achieve safety standards which encompass all the legal and radiological requirements, allowing the general adoption of a common policy and strategy between States. Such methods must seek to provide for commonality on a range of topics including, planning, decontamination and dismantling, reduction of public and occupational exposures, as well as the recycling and/or safe disposal of materials.

European Union Overview

In general, decommissioning work is covered by Article 37 of the Euratom Treaty. The basis of the Treaty requires compliance with plans laid down to ensure no work results in the radioactive contamination of the water, soil or the atmosphere. This essentially means that decommissioning plans must be submitted to the European Commission. For the UK, the Government presents confirmation that decommissioning activities comply with Article 37 of the Euratom Treaty.

The European Council Directives 85/337/EEC and 97/11/EC require consideration of the potential environmental impacts of a reactor decommissioning project and for the decision process to involve the public and be open and transparent.

Removal of one of the sealed boiler vessels at Berkeley Power Station

Further Information

- **IET Energy related factfiles**
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- **The principles of nuclear power**
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  http://www.theiet.org/factfiles/energy/nuc-fuel-page.cfm
- **The radioactive decay of uranium^{238}**
  http://www.theiet.org/factfiles/energy/uranium238-page.cfm
- **Glossary of nuclear terms**
  http://www.theiet.org/factfiles/energy/nuc-terms-page.cfm

Further Reading

- Wood, J. **Nuclear Power** (IET Power and Energy Series 52); Institution of Engineering and Technology (2007) ISBN 0863416683
- Temple, R. (2005) **Nuclear Decommissioning: the UK Proposals**, Nuclear Future, Vol. 01, No. 5, September/October 2005.
- Taylor, F.E. and Dr J. Nettleton (2005) **Regulation of Decommissioning Power Reactor**s, Nuclear Future, Vol. 01, No. 2, March/April 2005.
- McGill, G. (2006) **Alliancing to Ensure Efficient Nuclear Decommissioning**, Nuclear Future, Vol. 02, No. 4, July/August 2006.

Useful Websites

- **Nuclear Decommissioning Authority (NDA)**
  http://www.nda.gov.uk
- **United Kingdom Atomic Energy Authority (UKAEA)**
  http://www.uk-atomic-energy.org.uk/
- **International Atomic Energy Authority (IAEA)**
  http://www.iaea.org

The IET is not responsible for the content of external websites.

End notes

1 Passive safety means immobilising radioactive waste and materials in a form that is physically and chemically stable and stored in a manner that minimises the need for control and safety systems, maintenance, monitoring and human intervention.

2 British Energy CSR Report 2004/05.

3 British Energy Group plc Annual Report and Accounts 2005/06.

4 British Energy CSR Report 2005/06.

5 Back end fuel costs are excluded from these costs.

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