Health & Safety Executive
HM Nuclear Installations Inspectorate

A Review by HM Nuclear Installations Inspectorate of the

British Energy plc's
Strategy for Decommissioning
of its Nuclear Licenced Sites

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The supplement annexed is supplied courtesy of British Energy PLC.

Foreword

This report sets out the findings of a review by HSE's Nuclear Installations Inspectorate, in consultation with the environment agencies, of the technical and some financial aspects of the strategy of British Energy Generation (UK) Limited and British Energy Generation Limited (collectively referred to as “BE” throughout this document) for decommissioning their nuclear licensed sites.

The review was undertaken in accordance with the 1995 White Paper "Review of Radioactive Waste Management Policy: Final Conclusions", Cm 2919, which stated that the Government would ask all nuclear operators to draw up strategies for the decommissioning of their redundant plant and that the Health and Safety Executive would review those strategies on a quinquennial basis in consultation with the environment agencies.

The review considers BE's strategy for the decommissioning of its seven Advanced Gas-Cooled Reactor stations at Dungeness ‘B’, Hinkley Point ‘B’, Hunterston ‘B’, Heysham 1, Hartlepool, Torness and Heysham 2, and its Pressurised Water Reactor station at Sizewell ‘B’.

The review compares BE's strategy with national and international guidance, and considers the underlying assumptions made and whether the decommissioning plans submitted are comprehensive and appropriate. The company's arrangements to identify tasks and derive associated costs are also reviewed.

A document presenting a summary of BE's strategy is attached as an appendix to this report. This document and more substantive information on BE’s decommissioning processes is available on BE’s web site.

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INDEX

1. INTRODUCTION

1. The White Paper on radioactive waste management policy (Cm 2919, reference 1, paragraph 124) states: "The Government believes that, in general, the process of decommissioning nuclear plants should be undertaken as soon as it is reasonably practicable to do so, taking account of all relevant factors. In future it will ask all nuclear operators to draw up strategies for decommissioning their redundant plant. These will need to include justification of the timetables proposed and demonstration of the adequacy of financial provision being made to implement the strategies."

2. The White Paper concludes that there are a number of potentially feasible and acceptable decommissioning strategies for nuclear power stations and other nuclear facilities available to the operator. To ensure that the operators' decommissioning strategies remain soundly based as circumstances change, the White Paper places a requirement (reference 1, paragraphs 126,127 and 183) that the Health and Safety Executive (HSE) reviews these strategies quinquennially, in consultation with the environment agencies. The HSE asked HM Nuclear Installations Inspectorate (NII) to undertake the reviews on its behalf. The NII is one of the specialist inspectorates of the HSE.

3. The White Paper records the importance of ensuring that appropriate financial arrangements are in place to cover the costs of decommissioning nuclear facilities. It concluded that segregated funds should be established for those parts of the industry that are privatised. A segregated fund has been established for British Energy plc (BE). The fund is designed to provide finance for BE's long term decommissioning liabilities. However, the fund excludes those liabilities relating to defuelling and post operational clean out of BE's nuclear facilities, as well as BE's liabilities for HLW and ILW stored on other licensees' nuclear sites. These excluded activities are financed from BE's operational funds and provisions.

4. Currently there are 40 nuclear licensed sites in the UK operated by a total of 15 licensees. The funding of liability provisioning within accounts and, where appropriate, a segregated fund is a corporate matter. Costly decommissioning tasks may need to be undertaken simultaneously on a number of licensed sites. In its statement (reference 1 paragraph 126) that "Proposals for dealing with …. (Other nuclear facilities) will need to be included within the operators' decommissioning strategies", the White Paper implies that the quinquennial review should be comprehensive. For these reasons, HSE is reviewing decommissioning strategies licensee-by-licensee rather than site-by-site.

5. This report deals with the quinquennial review of two licensees, British Energy Generation (UK) Limited (licensee for BE's Scottish sites) and British Energy Generation Limited (licensee for BE's English sites) collectively referred to as "BE" throughout this document. This report has also addressed the nuclear liabilities of these two licensees on other licensees' sites (although BE do not consider such issues to be part of their decommissioning process).

6. Licensees' plans for decommissioning are subject to regular revision as knowledge and circumstances develop. The quinquennial review process reviews each licensee's arrangements for decommissioning at a given moment in time, once every five years. This report reviews the strategy for decommissioning described by BE in a series of documents submitted on the 30 September 2000. It considers the technical adequacy of this strategy and the costs associated with its implementation which form the basis of the financial arrangements for BE's decommissioning programme.

7. This report contains a brief financial review which seeks to establish whether the process used by BE to calculate and finance liabilities not covered by the segregated fund is appropriate and reasonable. HSE has also reviewed the arrangements by which BE and the Trustees of the segregated fund will agree the adequacy of the fund.

8. Following this technical review of BE's decommissioning strategy, BE and the Trustees of the segregated fund will review the adequacy of funding to implement this strategy. A report of the review of the segregated fund by its Trustees is due to be issued in October 2001.

2. BACKGROUND TO THE REVIEW

Work required of HSE

9. The White Paper identifies two specific aspects of decommissioning for independent review to ensure that the work will be carried out. These are a "strategy" (i.e. overall approach and programme) for the work and "provisioning" (i.e. the funds available, when required to undertake the task safely). HSE was specifically given the task of reviewing the decommissioning strategies of each nuclear operator on a five-year cycle, by inference to include the arrangements for financial provisioning.

10. This review has been undertaken in consultation with the environment agencies. This was achieved by giving them access to the technical documentation provided by BE. Comments received from the agencies have been incorporated in this report. Whilst the agencies were not given access to financial information by BE for commercial reasons, where the agencies raised some issues on provisioning, NII ensured that those issues were addressed in this review.

11. Although Cm 2919 does not specifically require publication of the outcome of quinquennial reviews such as this one, the document clearly envisages that the findings would be reported.

12. The breadth, extent and detail of the review process are not specified in the White Paper. HSE has interpreted the task given as follows:

    a. consider whether the decommissioning strategy of each nuclear licensee is:

        i. appropriate;
        ii. plausible, realistic, technically practicable and appropriately timed;
        iii. comprehensive; and
        iv. appropriately costed.

    b. consider whether appropriate arrangements are in place to

        i quantify; and
        ii make available sufficient funds to undertake the work at the required time.

    c. consider whether appropriate review and revision procedures are in place.

13. In order to ensure all liability costs are addressed in this review, the term "decommissioning" is interpreted as embracing all stages of decommissioning. This includes the decontamination and dismantling of all facilities, the management after end of generation (EoG) of all nuclear material and radioactive waste until it is removed from the site and the preparation of the site to a suitable state for it to be delicensed, at which time the licensees' period of responsibility ceases.

14. Nuclear licensed sites or parts of those sites cannot be delicensed until HSE is satisfied that there is no danger from ionising radiations from anything on that part of the site (reference 2). As removal of all radioactivity from a site could be the most expensive of possible options for clearance of a site, it is appropriate that the review should consider the adequacy of BE's strategy for achieving this. As discussed in the "contaminated land" section below, alternative scenarios may develop but the regulators are not in a position to pre-empt a national decision on this question. Therefore, whilst acknowledging that other management options may ultimately be selected by Government for contaminated land, the present review has considered BE's strategy for achieving the work of fully decommissioning its sites to a state where delicensing could be achieved.

Legislative background

15. The main legislation governing the safety of nuclear installations in the UK is the Health and Safety at Work etc. Act 1974 (HSW74) (reference 3) and the associated relevant statutory provisions of the Nuclear Installations Act 1965 (as amended), (reference 2). Under the Nuclear Installations Act (NIA65), no site may be used for the purpose of installing or operating a nuclear installation unless a nuclear site licence has been granted by the HSE. The NII is that part of the HSE that is responsible for administering this licensing function and enforcing NIA65 and HSW74 on nuclear sites.

16. NIA65 provides the HSE with powers to attach conditions to the licence in respect of safety and in respect of the management of nuclear matter, which includes radioactive waste. HSW74 provides the regulatory powers to enforce these conditions. The standard licence conditions are reproduced in reference 4. An additional licence condition introduced in 1999 addresses control of a licensee's organisational change related to management of safety.

17. One licence condition requires that adequate arrangements are made and implemented for the decommissioning of any plant or process that may affect safety and that adequate arrangements are made for the production and implementation of decommissioning programmes for each plant. Furthermore, the licensee is required to provide adequate documentation to justify the safety of proposed decommissioning and, where appropriate, provide this documentation to the HSE. By these provisions, the NII has the power to require each licensee to supply it with the details and programmes of its decommissioning proposals. This information is supplied to HSE under the terms of HSW74 and hence has certain restrictions on disclosure.

18. In order for the HSE to carry out the review required by Cm 2919, additional information was required. BE expressed concern that some details of its decommissioning and waste management plans are commercially sensitive. Therefore, arrangements were made to separate the general strategy from the detailed supporting documentation, some of which contained commercially sensitive information. The full suite of supporting documentation was made available to the NII in a data room at BE's Barnwood site. The general strategy (references 10, 11 and 18) and a summary document, "Decommissioning Our Power Stations", were made generally available and the latter is reproduced as Appendix 1 to this report.

19. This review assesses both the magnitude of the task posed by the complete decommissioning of all BE's nuclear licensed sites and the arrangements to provide the necessary funding. The review includes a brief consideration of BE's proposals with respect to the discharge of its liabilities on other licensees' sites to ensure broad consistency with the quinquennial review of these licensees. The NII does not routinely examine the detailed business accounts and costings of nuclear licensees.

The extent of the information to be requested from BE for this review was decided by the NII and discussed with BE in advance.

20. The routine regulation of licensees' decommissioning work by the NII relates generally to individual plants/facilities. This is overlain on complex sites by a site wide programme that prioritises the work and ensures the maintenance of facilities on which other plants will subsequently depend for their decommissioning. Each licensee's operating arrangements are regulated by the NII and incorporate good practice. They are designed to satisfy the obligation placed on the licensees by the conditions attached by the nuclear site licence and include:

    - in the design of new facilities, taking account of the work that will be required to clean and dismantle the facility at the end of its life;

    - during the active commissioning, operational and decommissioning phases of the plant, minimising the generation of radioactive waste and contamination of plant;

    - including decommissioning plans to be developed in the safety case for each operational plant and reviewing these plans regularly with the NII;

    - prior to the end of the operational phase of the plant, preparing detailed decontamination and decommissioning plans; and

    - undertaking decommissioning work only in accordance with an adequate safety case. If NII so specifies, Consent is required before decommissioning can be started.

21. In reviewing the decommissioning proposals presented by BE, NII would expect some gradation in the detail of proposals for specific plants. A plant not yet in operation is likely to have relatively outline plans for decommissioning. During operation of the plant the level of detail contained in the plans will be progressively increased until, nearing the end of operation, the plant will have a fully detailed decommissioning proposal. The progression described above may be represented by the status of documentation as follows:

    - decommissioning proposals as part of the pre-operational safety case;

    - production of a pre-decommissioning plan (PDP) (regularly updated);

    - presentation of a safety justification for the option chosen in the decommissioning plans;

- establishment of a pre-decommissioning safety case;
- development of an environmental study for the chosen option;
- consultation on an environmental impact statement; and
- submission of a fully developed decommissioning safety case.

22. The authorisation of discharges and disposal of radioactive waste arising from operations and decommissioning is regulated by the relevant environment agency under the terms of the Radioactive Substances Act 1993 (reference 5). The management of nuclear matter (including radioactive waste) on nuclear licensed sites is regulated by the NII. Formal administrative arrangements ensure that the NII and the environment agencies work closely together to ensure compliance with requirements.

23. The NII regulates the work of decommissioning in the same manner as all other work undertaken on the nuclear licensed site. This includes the assessment of licensees' proposals for work, and the inspection of work as it proceeds. Arrangements are in place to ensure, where appropriate, that the work is planned in phases with hold points to prevent further work being undertaken without the consent of the regulator. By this means, the NII regulates decommissioning work. The experience that the NII has gained from this regulation over many years has been used in this review.

24. In addition to these regulatory activities, and as part of the quinquennial review, the NII has examined BE's activities in three other areas:

    - first, to consider the adequacy of the long term plans for the eventual removal of all nuclear facilities from each licensed site;
    - second, to consider the arrangements for discharging the licensees' liabilities on other licensees' sites; and
    - third, to consider the arrangements for funding BE's decommissioning and liabilities discharge so that work may proceed unimpeded.

25. The Nuclear Installations Act (reference 2) places significant obligations and responsibilities on the licensee. Under current legislation, the licensee's period of responsibility (reference 2, Sections 4(6) and 5(3)) does not end until the HSE is able to declare that there is no danger from ionising radiation from anything on the licensed site. It is generally assumed that the licensee will wish to be relieved of these responsibilities and will plan the decommissioning of individual sites to achieve this.

26. The NII expects the licensees to manage their sites to achieve a systematic and progressive reduction in the hazard presented (reference 1 paragraph 125) towards a situation where no danger from ionising radiation remains on those sites and the licensee's liability ceases. That is the basis for the present review.

The Review of BE

27. This report describes the quinquennial review of the decommissioning strategy for those nuclear licensed sites operated by BE namely, Heysham 1 and Heysham 2, Torness, Hunterston ‘B’, Hinkley Point ‘B’, Hartlepool, Dungeness ‘B’ and Sizewell ‘B’.

28. Some external developments have occurred in the period since Cm 2919 was issued which have the potential to affect the company's operations and liabilities, e.g. the agreement reached at the 1998 Ministerial Meeting of the Oslo and Paris Commission (OSPAR) (references 6 and 7). Also relevant are the review by the House of Lords Select Committee on Science and Technology (reference 8) of nuclear waste management and the legislation contained in the Nuclear Reactors (Environmental Impact for Decommissioning) Regulations 1999 (reference 9). This review has been undertaken against this background of change and the regulators (NII in consultation with the environment agencies) have taken into account the evolving situation when preparing this report.

29. The report reflects the regulator’s current understanding of the totality of the potential liabilities of the licensee. BE has an annual review process that is designed to update provisions in the light of such changes. BE’s strategy for decommissioning is reviewed at less frequent intervals. Subsequent quinquennial reviews will consider the effectiveness of the BE review process in this respect.

BE Sites

Dungeness 'B'

30. The Dungeness 'B' nuclear power station is situated on the south coast of Kent, on Romney Marsh approximately 5 miles from the small town of Lydd. Construction of the station started in 1966 on a 225 acre site which already included the Magnox power station Dungeness ‘A’. Dungeness 'B' comprises twin advanced gas cooled reactors each housed in a pre-stressed concrete pressure vessel. The two reactors, gas circulators and associated plant are contained in a single building with a common charge hall. This building forms part of a main complex that also houses the turbine hall and reactor services annex. The first unit supplied electricity to the grid in April 1983, followed by the second unit in December 1985.

Hartlepool

31. Hartlepool nuclear power station is situated next to the Tees estuary in the Borough of Seaton, approximately four miles south of Hartlepool itself. Construction started in 1968 and the first unit supplied electricity to the national grid in August 1983 followed by the second unit in October 1984. The site was developed as part of a project that saw the construction of a sister station at Heysham 1. The two stations are very similar in layout and general construction. The station has two advanced gas cooled reactors each contained within a pre-stressed concrete pressure vessel. The reactors are housed in the same building and are refuelled by a single machine. The reactor building is part of a complex that also contains the turbine hall, services and shielded facilities blocks. The station's cooling ponds are located within the shielded facilities block together with the fuel handling facilities. The active effluent treatment plant, (AETP), is located in the fuel handling block basement together with the pond water treatment plant. Also within the shielded block facilities are a number of voids that are used for the disposal of miscellaneous activated used reactor fuel components

Heysham 1

32. Heysham1 nuclear power station is situated on land adjacent to Heysham harbour on the Lancashire coast. Construction of the station began in 1970 and it first supplied electricity to the grid in July 1983. The second unit became fully operational in October 1984. The station is similar in design and layout to its sister station at Hartlepool.

Hinkley Point 'B'

33. Hinkley Point 'B' nuclear power station is situated on the Somerset coast, 5 miles west of the River Parret estuary and 15 miles east of Minehead. The station was built on the same site as the Magnox power station Hinkley Point 'A'. Hinkley Point 'B' was built in the early 70's and was the first AGR nuclear power station to commence generation, in February 1976. The station comprises two reactors each housed within a pre-stressed concrete pressure vessel. The plant is laid out similarly to the Hunterston 'B' station.

Hunterston 'B'

34. Hunterston 'B' nuclear power station is situated on a headland of the Ayrshire coast in the Firth of Clyde near West Kilbride, 30 miles southwest of Glasgow. It was Scotland's first AGR power station and has two reactors and associated turbo alternators. The station was fully commissioned in 1977 and was designed along similar lines to Hinkley Point 'B'. Hunterston 'B' is the second of two power stations on the Hunterston site, the first being the Magnox type Hunterston 'A' station now undergoing decommissioning. Hunterson 'B' main block comprises the two reactors with solid waste facilities located between the two reactors. The AETP building is sited on the south side of the reactor building and to the east of the flask handling building. The cooling ponds are located south of the reactor building, adjacent to the AETP.

Torness

35. Torness nuclear power station is situated on the East Lothian coast, about 5 miles from the town of Dunbar and 30 miles east of Edinburgh. The station lies partially on reclaimed land. Construction on the site began in 1980 and the first reactor was commissioned in 1988. Torness consists of two reactors with pre-stressed concrete pressure vessels. The main building is arranged as a complex combining reactor building, reactor services annex and turbine house. Services for each reactor are grouped in an annex to the south end of the reactor building. Equipment for handling the irradiated fuel and for disposal to the cooling pond is provided in the fuel handling building which is situated between the two reactors. The cooling pond is sited to the south of the reactor buildings and adjacent to the handling facility for the irradiated fuel transport flask facility. Southwest of these facilities but still south of the reactor building is the active effluent treatment building. Solid wastes of both medium and low activity levels are handled in the active solid waste building, a separate complex to the south west of reactor building 1.

Heysham 2

36. Heysham 2 is situated on the northwest Lancashire coast adjacent and to the south of the Heysham 1 power station. Detailed design work for Heysham 2 began in 1978 along with its sister station Torness. Construction commenced in July 1980 and the first unit supplied electricity in July 1988 followed by the second unit in November 1988. The design and layout of Torness and Heysham 2 are similar, but there are differences in the design and layout of the radioactive waste facilities.

Sizewell 'B'

37. The Sizewell 'B' nuclear power station is located on the east coast near Leiston in Suffolk. The station design is based upon a Westinghouse standard four loop pressurised water system. The reactor and coolant loops are contained within a cylindrical steel lined pre-stressed concrete primary containment building with a hemispherical dome. The principal block of buildings (the power block), comprises the reactor building, the auxiliary building, the secondary containment enclosure building, the turbine hall and mechanical annex. The main outlying buildings are a diesel building, the administration and workshop buildings, the radioactive waste process and storage building, the circulating water pump house, the 400 kV substation, the reserve ultimate heat sink and the auxiliary shutdown and diesel generator building. The reactor commenced operation in 1995 and since that time has discharged used fuel into the station fuel storage ponds. No used fuel has been exported from the site.

Liabilities

38. The responsibility for safety and the liability for harm under NIA65 rests exclusively with the licensee. In the case of this review, the licensee for each of the sites described above is either British Energy Generation (UK) Limited or British Energy Generation Limited, collectively referred to in this document as BE.

39. Some licensees have liability for part of the decommissioning costs of the Sellafield site. It has been established that BE has no such liabilities. For recent commercial fuel contracts, the Government has required BNFL to charge a fee to cover the anticipated cost of future decommissioning work arising as a consequence of such contracts. Historically, BE has inherited liability for high level and intermediate level waste stored at Sellafield from past reprocessing and as a consequence of its current reprocessing contract. Additionally in the future, liabilities will arise from the final operation and defuelling of reactors prior to decommissioning. In the case of Sizewell 'B', BE has not decided upon a route for management of spent fuel. Currently, spent fuel is stored at the Sizewell site and gives rise to a future liability. For costing purposes, BE has chosen to assume that a dry store will be constructed at the Sizewell site as a longer-term storage measure. Following storage, BE will need to consider final disposal or reprocessing of the stored fuel.

NII decommissioning policy

40. HSE has prepared (reference 12) a statement of policy relating to its responsibility for the regulation of decommissioning and radioactive waste management on nuclear licensed sites. This followed the publication of Cm 2919 and incorporates the policy lines presented in that document. Although this document is not a definitive statement of government policy, it was issued following consultation with government departments. In this report, NII uses the Cm 2919 interpretation of the term "decommissioning":

"Decommissioning is the set of actions taken at the end of a facility's economic life to take it permanently out of service and subsequently make its site available for other purposes."

41. Decommissioning is not explicitly defined in the nuclear site licence. The NII/HSE interpretation quoted above is consistent with the definitions given by the International Atomic Energy Agency (IAEA) (reference 13) and the Nuclear Energy Agency (NEA/OECD) (reference 14). Hence, the adequacy of BE's decommissioning strategy has been reviewed against this definition of the decommissioning activity.

BE Submission

42. After discussion with the NII, BE supplied three documents which form the basis of this review:

- Corporate Decommissioning Strategy (reference 10);
- Decommissioning Plan - Early Safestore - Implementation of the Corporate Decommissioning Strategy (reference 11); and
- Corporate Arrangements for the Management of Decommissioning (reference 18).

43. BE also supplied a summary document, "Decommissioning Our Power Stations", to inform the public of BE's decommissioning strategy and its quinquennial review. This document is reproduced in full as appendix 1. The document summarises the company's decommissioning policy, its strategy for implementing the policy and managing radioactive wastes, the scope of the work and the general arrangements for funding the work. Linked to this document BE has set up a web site which gives more substantial information on the decommissioning process.

44. In addition to the above, information has been compiled from published sources and regulatory inspections. The corporate decommissioning strategy document is supported by station specific pre-decommissioning plans detailing the plans for each of BE's sites. These pre-decommissioning plans are supported by a large number of reports detailing each aspect of the work associated with decommissioning and waste management. Many of the reports contain BE commercial information. These reports have been lodged in a data room and made available to the NII for review purposes. They have been amplified when required either in response to written questions raised by the NII or clarified in discussions between BE and NII and in some cases by exchange of correspondence

3. THE TECHNICAL REVIEW

Guidance

45. The technical assessment has compared BE's strategy with the following policy statements and guidance:

- UK national policy: Cm 2919 (reference l);
- HSE Decommissioning and Waste Management Policy (reference 12); and
- International guidance of the IAEA (references 13, 15 and 16).

Review Process

46. The BE submission has been assessed by:

- comparison of the approach with the above policy statements and guidance;
- examination of the assumptions upon which the strategy, planning and estimation of costs are based to determine their validity and completeness;
- review of the BE methodology, to determine its overall adequacy to maintain a viable decommissioning strategy; and
- review of BE's plans to test validity against current practice in decommissioning experience.

47. Due to the intimate relationship between decommissioning and waste management, including retrieval of accumulated material, the NII reviewed BE's radioactive waste management strategy in conjunction with its decommissioning strategy.

48. The BE Corporate Decommissioning Strategy, the Corporate Arrangements for the Management of Decommissioning, the Decommissioning Plan - Early Safestore and the supporting documents together with the outcome of discussions with the licensees' technical specialists have all been taken into account in this review.

Findings

Corporate Decommissioning Strategy

49. BE's Corporate Decommissioning Strategy report (reference 10) states that the stations will be decommissioned as soon as it is reasonably practicable to do so taking into account all relevant factors. This reflects the UK national policy described in Cm2919 (reference 1 paragraphs 124 and 127). The White Paper also expects (reference 1 paragraph 125) decommissioning decisions on individual plants to be taken on a case-by-case basis and "that the hazards presented by the plant are (to be) reduced in a systematic and progressive way" (reference 1 paragraph 125). These aims are reflected in BE's Corporate Decommissioning Strategy.

50. The BE strategy, in supporting documents and in the document "Decommissioning Our Power Stations" (Appendix 1), identifies the reduction of radiological hazard as a reason for delaying final dismantling of power stations. This is particularly related to the calculated dose uptake to the workforce. For AGR stations, BE advocates a delay of "at least 85 years after the end of generation" and for its PWR station "up to 50 years after the end of generation" before final dismantling takes place.

51. One of BE's stated primary reasons for deferral of final dismantling is to reduce doses to workers by gaining benefit from radioactive decay and consequent reduction of hazard that will occur during a delay to the dismantling of the plant. Whilst delaying some parts of the decommissioning process may lead to the reduction in dose rates from radioactive decay, this may not always result in reduced doses to workers. In practice ALARP considerations would ensure that worker doses are constrained. For example, early dismantling would require greater use of remotely operated equipment, given the high dose rates that would prevail, whereas dismantling after a period of radioactive decay with less use of remotely operated equipment could result in greater doses to operators. A balance needs to be struck between undertaking decommissioning in a 'prompt' manner and taking other relevant considerations into account, including cost and government policy.

52. BE makes it clear that the technical proposals described in its pre-decommissioning plans represent just one way of meeting the 'early safestore strategy' and have not necessarily been optimised. BE recognises that other techniques and approaches to decommissioning are available and so does not regard its current pre-decommissioning plans as definitive. The pre-decommissioning plans as presented are in an early stage of evolution and represent BE's thinking circa 1996 drawing on data from the early 90s. They have become less relevant to BE's proposals as BE's thinking moves forward. During discussions with BE staff as part of the Quinquennial Review process, it became clear that BE's thinking has advanced considerably since the pre-decommissioning plans were produced. NII believes that BE needs to update these plans to reflect its current thinking which it has summarised in discussion and correspondence with the NII.

53. In the case of the AGR stations, BE has presented dose calculations based upon currently available data to support the BE conclusion on the timing of final dismantling of the reactors given the techniques and dose rate measures proposed by BE. The documentation presented is consistent with BE's view on timing of AGR reactor dismantling and is based in the main on dose rate data obtained from sampling of representative materials from each reactor. These materials were taken from materials at locations of particular interest within the reactors. Some 200 steel, 70 graphite and 14 concrete samples were taken and analysed and are supplemented by the data previously available. There is therefore some confidence that the dose rate data has some basis from measured results. However, no AGR station has entered into a post operational period which would confirm or otherwise the BE calculations on dose uptakes and BE claims its data are reported to be accurate to a factor of 4. Data also excludes dose rate resulting from activity deposition within the reactor which BE studies indicate has no significant contribution to dose rate during dismantling. BE has used occupancy data to translate the radiation levels calculated into operator dose uptake. NII would expect BE to demonstrate that it has made best and appropriate use of remote techniques to dismantle the reactor, by this means reducing the dose uptake to operators and so bringing forward the dismantling date for the reactor. BE's plans overall are not sufficiently advanced to make judgement on the adequacy of this optimisation process.

54. For the Highly Active Debris Vaults (HADVs), as a surrogate for the dismantling of the reactor buildings, BE has undertaken a comprehensive design review that has included validation of the dose implications of undertaking work on a range of timescales. The depth of study on HADV decommissioning compares favourably with the detail of analysis for the other elements of AGR station dismantling as described in the station pre-decommissioning plans. BE has explained in some detail the approach it has taken for the HADVs. As a result, NII has discussed with BE its plans for clarifying the reactor decommissioning proposals to the standard demonstrated for the HADVs and has taken this into account when formulating its findings on the BE submission.

55. In arriving at estimates for collective dose, average dose and dose to the highest dosed worker, BE has concentrated on the dose uptake received by the workforce who directly interface with the dismantling operation within the reactor building. Those activities outside the reactor location have not been subject to the dose rate modelling methodology. For these areas, BE has assumed that the plant and waste packaging shielding will be adequate to reduce the dose rate to workers whatever the timing of decommissioning. Consequently, for these locations a fixed dose rate, which has not been decayed with time, has been taken for the worker dose calculations. As activity in reactors decreases, the proportion of dose uptake in fixed dose rate locations is increased and becomes more dominant. It is NII’s view that BE's modelling in this area should be enhanced and take into account good engineering practice in the design of the non-reactor areas.

56. It is NII's view that the depth of radiological dose information upon which BE's reactor dismantling plans are based is in need of enhancement. In this area, NII considers that BE should undertake further research. Notwithstanding this, NII considers that, based upon current knowledge, a delay in the stage 3 dismantling of the reactors is likely to be justifiable. NII will be seeking further evidence from BE on justification for the timing of final dismantling in the period before the next quinquennial review. NII will monitor BE's progress in aligning its decommissioning documentation to a uniform standard and will expect BE to have completed its work in this area on an early timescale, well before the commencement of the next quinquennial review.

57. NII has noted that there may be scope for some activities related to dismantling and disposal of inactive or low active plant to be brought forward from stage 3 to a point prior to the construction of the safestore envelope. The cost of these activities will be to some extent offset by the earlier generation of scrap value. Nevertheless, there will be some minor call upon the resources of the segregated fund. Since provisioning for decommissioning AGR stations has been calculated based on a final dismantling of the reactor 70 years after the cessation of generation, there is scope for some of the non active and low active parts of the programme to be brought forward and for the reactor dismantling to be advanced from the present minimum of 85 years after cessation of generation without unduly affecting the provision within the segregated fund.

58. For the Sizewell PWR, world practice suggests that dismantling of the reactor can be undertaken well before the 50 years indicated in the BE strategy. BE has given an indication of the predicted dose rates in the reactor structure at 50 years and has stated that the dose rates at that time will require a high proportion of the reactor to be remotely dismantled. Given that earlier dismantling of the reactor would not significantly increase the proportion of work that would have to be undertaken remotely, NII believes that the case for delayed dismantling has not been demonstrated on the basis of safety. Since decommissioning funding has been calculated on the basis of dismantling 10 years after end of generation and this implies an almost continuous station decommissioning process, there is unlikely to be a significant impact on provisioning resulting from early decommissioning of the reactor.

59. The White Paper requires the application of the principle of sustainable development (reference 1 paragraphs 50 and 162) in the licensees' strategies for decommissioning. For the purposes of this review, the NII has used the definition of sustainable development given in Cm 2646 (reference 17), "development that meets the needs of the present without compromising the needs of future generations to meet their own needs". BE's company strategy does not specifically address this issue. However, the company strategy states as a principle that "prudent financial provisions for decommissioning will be made" and that "the safety of the public, staff and plant, and the protection of the environment are of paramount importance throughout the decommissioning process". Further, the strategy states that "where later stages of decommissioning are to be deferred, the initial stages will lead to a state of passive safety not requiring immediate human intervention to maintain risks below an

acceptable level" and "potentially mobile radioactive wastes will be removed and immobilised as soon as reasonably practicable…" and "radioactive waste will be disposed in conformance with UK Government Policy and regulatory requirements, making full use of available repositories for the waste arisings during decommissioning".

60. This indicates the intention to undertake decommissioning, to leave waste in a state suitable for management by future generations and to provide funds for the future work. Additional to its submission, BE has drawn NII attention to its "Safety Health and Environmental Report" (reference 19). In this document BE notes that the Company is committed to work with its stakeholders to define and extend best practice in this area.

61. The NII has some concern as to whether the proposal to leave some reactor waste in the AGR stations debris vaults aligns with these intentions. This is discussed further under 'BE's Radioactive Waste Management Strategy'.

62. Overall, research and development (R & D) in support of the decommissioning proposals is needed. BE needs to review its current programme for R & D, develop its future requirements for that R & D and commit to its implementation.

Corporate Arrangements for the Management of Decommissioning

63. BE has set out its decommissioning management proposals in its document 'Corporate Arrangements for the Management of Decommissioning' (reference 18). This document places the responsibility for compliance with Site Licence Condition 35 (decommissioning) with the Station Director as Agent Licensee. In practice, the Station Director delegates a substantial part of the duties associated with compliance to the BE central resource at its Barnwood or Peel Park offices. Thus while the formal responsibility lies with the Station Director, it is effectively discharged and managed elsewhere. NII had expected to see these arrangements reflected in the corporate management arrangements.

64. Licence Condition 35 requires the licensee to make and implement adequate arrangements for the decommissioning of any plant or process that can affect safety. Since currently no decommissioning is being undertaken by BE, those arrangements do not yet need to be detailed. The licence condition also requires the production and implementation of decommissioning programmes. These need to become more detailed as the start of decommissioning approaches. The licence condition also requires the provision of adequate documentation to justify the safety of the proposed decommissioning.

65. A sequence of documentation, which could be expected to be produced in the period before decommissioning, is given in paragraph 21. Since the production of such

documentation absorbs considerable effort and time, NII expects that it will be produced to a timetable working in reverse from the start of decommissioning. BE's corporate management arrangements do not include such a timetable, which NII would have expected to see in a generic form. This report comments elsewhere on the need to update the station pre-decommissioning plans. Given that the first of BE's stations is due to commence decommissioning in 2008, NII will expect BE to address the timing of decommissioning documentation on a generic basis in a short timescale. For those stations closest to decommissioning, a high percentage of the decommissioning documentation will need to be produced before the next quinquennial review.

Radioactive Waste Management Strategy

66. BE's waste management strategy has been developed over the years. It has led to the current situation where LLW is appropriately disposed of on an ongoing basis. This has included periodic disposal of LLW resins and sludges after conditioning and packaging in accordance with Drigg conditions for disposal. ILW waste has been accumulated at sites and, during the first phase of decommissioning, it is planned to condition package and store these wastes on the sites until a suitable repository is available. Some of these wastes will be conditioned, packaged and stored on sites prior to the end of generation if raw waste storage facilities have been filled. NII is satisfied that the plans for these wastes are acceptable.

67. BE's intention for the AGR stations is to defuel on cessation of generation and to despatch the spent fuel to Sellafield. NII is aware that BE has an ongoing commitment and liability in relation to this fuel and to the products of fuel, which have previously been sent to Sellafield for storage or reprocessing. With the exception of reprocessed uranium and plutonium, NII has briefly considered these liabilities and their discharge within the scope of this report although BE has not included them in its submission. NII has reviewed the validity of the technical assumptions made in the generation of the BE data for provisions which appear in the BE Annual Report and Accounts (reference 22) under the title " Decommissioning" and "Fuel Cycle" liabilities. The findings in this area are further discussed in the Financial Review, section 4.

68. There are major stocks of uranium and plutonium resulting from reprocessing owned by BE and stored on BNFL sites. BE has provided for storage and security of this material through arrangements with BNFL. The removal and disposal of this material before BNFL sites are closed has also been provided for by BE in its accounts as "uncontracted back end fuel liabilities". It is not considered by BE to be waste, nor is the unreprocessed fuel stored at Sellafield on BE's behalf. However it would require removal from the Sellafield Site before that site could be delicensed. NII will, in due course, expect to see further evidence of BE's strategy in this area.

69. The spent fuel derived from operation of the Sizewell 'B' reactor is currently stored in the fuel pond adjacent to the reactor building. This pond has capacity for extended

storage of large quantities of spent fuel although it does not have sufficient capacity to store the full lifetime arising of spent fuel from the station. BE has not committed itself on the future management of this spent fuel. In its Decommissioning Plan for Early Safestore document (reference 10), BE states that "for decommissioning planning and costing purposes, it is assumed that on-site storage in a separate fuel dry store is adopted". NII has not looked in detail at a proposal for a dry store at the Sizewell site as part of this review. Once BE has made firm proposals for the future management of spent Sizewell fuel, NII will expect greater detail on its chosen option to be submitted as part of a future quinquennial review. Should BE opt for a dry store at Sizewell, NII would not expect the technical feasibility of the concept for the dry store to present insurmountable problems since fuel of the type used at Sizewell is utilised elsewhere in the world and dry store arrangements are in existence.

70. BE has proposed that the ILW waste derived from AGR reactor operations and which is currently stored in Highly Active Debris Vaults (HADV) at the reactor sites should be left in-situ and recovered as part of the final phase of reactor decommissioning. The debris in these vaults is primarily from AGR fuelling operations and typically consists of:

- fuel stringer component debris;
- graphite sample stringer debris;
- fuel plug unit debris;
- redundant control rods; and
- flux measuring instruments and associated items.

71. This solid ILW waste is generally fabricated from stainless steel or graphite and its main radioactive source is induced by exposure to the reactor flux. However some radioactivity is associated with the surface of the debris resulting from deposition during the time in the reactor gas stream. This surface deposition is potentially mobile. The vaults are constructed with an installed sump area into which BE proposes to install moisture detection and therefore to have the ability to respond should water be detected in the sumps. Provision will be made for water removal and treatment. NII considers that there is potential for water ingress into the vaults from, for example, seepage through the vault walls or floors or condensation within the vault. There is therefore potential for radioactivity to pass from the surface of the vault debris into any water present and thence out into the environment through seepage through the vault walls or floors. NII does not consider the long-term storage of debris within the vaults to be fully passive.

72. BE has put forward arguments that seek to demonstrate that the likelihood and risk of any seepage into the environment from the vaults is negligible, particularly in the light of proposals for water detection, monitoring and disposal arrangements. BE has also argued that on the basis of reduced dose to operators in packaging and storing the debris, there is justification for delaying retrieval of the debris. BE has also indicated that on the timescales for which retrieval is proposed, the debris in the vaults will remain significantly radioactive such that remote retrieval will be necessary. On that basis there may be little to be gained by long term storage. BE concludes that whilst the retrieval operation is not sensitive to timing with respect to operator dose uptake, the vault access requirements, and the sorting, packaging and storage of retrieved wastes is sensitive to the timing of retrieval. BE has obtained direct dose measurement of the HADV contents to confirm its dose rate database. Therefore, on the basis of current design for the sorting, packaging and storage of recovered waste, NII is satisfied that BE has made a case for some deferral of retrieval from the HADVs. As noted earlier in this document, dose rate uptake for non - reactor operations has generally been considered as fixed. Plant design and shielding may be capable of modification to allow operations to proceed on an earlier timescale within allowable operator dose limits. NII will continue to press BE to pursue design improvements in the sorting and packaging area, which may lead to early retrieval options and will include further review of the proposals for retrieval of the debris from the HADVs during subsequent quinquennial reviews.

73. As indicated above, NII concurs with BE's view that deferral of the retrieval of debris from the HADVs is justified subject to the provisos stated below. NII will seek further evidence that BE's proposals for monitoring the HADVs and for responding to changed conditions within the HADVs is appropriate. The potential hazard from migration of the activity within the HADVs requires enhanced attention particularly during extended periods of storage. NII will enter into further discussions on the detail of BE's proposals and will expect BE to develop these details before the next quinquennial review. NII has noted that BE has a specific project in progress which seeks to define the way forward with respect to long term storage of debris in the HADVs. NII will expect that individual station design proposals are produced and that the proposals will take account of the needs of guaranteeing safe long-term storage of debris. Where additional equipment or enhanced monitoring and inspection regimes are identified, NII will expect early action to install such equipment and institute the monitoring and inspection regime. This will help to establish the effectiveness of such proposals in advance of a safestore construction.

74. BE has in part based its arguments for the deferral of decommissioning on the premise that there will be some decrease in the volume of waste generated in decommissioning commensurate with decommissioning delay. The uncertainties on the radioactive content of decommissioning waste are mirrored by the arguments in the section of this report concerning operator dose uptake. NII will be seeking further evidence from BE on justification for the timing of this aspect of the decommissioning. This issue will need to be resolved before the final repository for the waste is

sanctioned and the conditions for acceptance at and transport to the site have been finalised.

75. Overall, on radioactive waste management, BE's proposals are generally sound in that they demonstrate drive towards passivation with an emphasis on non foreclosure of treatment and disposal options. There remain issues on waste volume/deferral, contaminated ground and the timing of the future repository. The question of arrangements for the removal of the contents of the HADV will also need to be reviewed as information becomes available. NII will progress these issues as part of the regulatory process.

Structures

76. As part of the review process, NII met with BE to discuss the civil engineering aspects of their decommissioning proposals. BE has appointed a member of its Civil Design Group (CDG) to co-ordinate advice on civil engineering issues. NII views this development positively since the BE project team will benefit from the central collation of civil engineering matters through a suitably qualified and experienced person. BE is progressing the development of its civil engineering decommissioning proposals. Work remains at a preliminary stage but has revealed significant departure from the published pre-decommissioning plans. The later information suggests that BE is pursuing more realistic and plausible proposals than those outlined in the pre-decommissioning plans. This represents a welcome development of BE's original plans.

77. The condition of structures in the reactors and associated buildings (those which will form part of the proposed safe store enclosure) has been monitored by surveys undertaken in 1992. The condition surveys will be updated as part of station maintenance schedules which will be monitored and interpreted by BE's CDG. NII will monitor the results and interpretation and will expect condition surveys to continue throughout the period of safestore operation.

78. Original proposals by BE indicated that it was intended to store active components and wastes in the pond structure. BE is considering dismantling of pond related plant and removal of all active components to a facility constructed within the safestore. In some stations the pond wall adjacent to the irradiated fuel dismantling (IFD) cell will continue to function as containment for the HADVs until such time as the IFD is emptied and decontaminated.

79. The pre-stressed concrete pressure vessel (PCPV) will continue to support the reactor liner and sealed penetrations that form the principal means of containment against release of activity from the remnant core structures and components. The current proposal is to release the tendons used to keep the PCPV in compressive stress during reactor operation. This will eliminate the need to monitor pre-stress. In discussion, BE confirmed that its CDG had examined the proposal to de-tension the

tendons and their preliminary analysis has supported the de-tensioning option. The CDG has also undertaken preliminary assessment of the effect of creating access through the top reactor cap for final dismantling of the remnant core structure during final reactor dismantling. The CDG has not assessed the response of the de-tensioned PCPV to seismic hazard loads.

80. BE has revised the proposals to cast a slab of concrete over the pile cap during the safestore period. BE is now able to propose some monitoring of the pile cap area during the safestore phase. It is NII's view that this proposal is essential. NII also considers that BE needs to ensure adequate research into the effects of concrete ageing on the safestore structure and will expect to see firm proposals implemented before the next quinquennial review.

81. The CDG has conducted only very preliminary assessments associated with the role of the existing reactor building during decommissioning. BE has stated that it is no longer its intention to store dismantled plant in the charge hall. Active components will be stored in a facility within the safestore. BE is also considering the present proposal to delay the dismantling of the plant in the boiler annulus and circulator halls.

82. Turning to the structure of the HADVs, work has progressed further than the preliminary studies reported for other structures. However, it is NII's view that a considerable amount of work remains to be completed to demonstrate the continued safety of the HADVs through the care and maintenance period until final dismantling. It was noted that the assessment considers many of the relevant civil engineering issues.

83. BE proposes that the design life of the AGR safestore is 135 years plus an allowance yet to be defined, although the current strategy is for dismantling to take place not earlier than 85 years. BE states that the safestore, in line with other nuclear facilities, will be the subject of periodic safety reviews. NII considers that the design of the safestore should be treated as if it were a new structure. As such, structural integrity will be judged against current relevant safety and design standards. BE has indicated that it intends to design the structures to the relevant codes with special studies to support the use of long life materials. BE expects to gain some benefit from the experience gained during the development of the proposed “Torness Dry Store". BE considers that the research undertaken for the Torness dry store together with current industry research work will be sufficient to demonstrate the prolonged integrity of the safestore structures. NII will wish to examine BE's evidence in this area and will expect the issue to be resolved before the next quinquennial review.

84. Overall, for all ‘safestore’ structures (i.e. new, re-used or modified), NII expects to see:

- development of robust functional and integrity requirements;
- substantiation to modern safety and design standards;
- implementation of appropriate monitoring to ensure that functionality and integrity are established and maintained; and
- confirmation of expected results from that monitoring and contingency plans if the results are different from those expected, which will need to be developed as appropriate.

Decommissioning options

85. The International Atomic Energy Agency has defined what it considers to be the relevant stages in decommissioning nuclear reactor plants (reference 13):

Stage 1 - Storage with Surveillance

- reactor defuelled and fuel moved away from reactor;
- all heat transfer fluids, readily removable contaminated materials, and some highly contaminated materials removed;
- all mechanical openings (valves, piping) to the reactor blocked and sealed;
- containment building atmosphere controlled with most ventilation systems operable and operated as required;
- access controlled by physical barriers and administrative procedures;
- continuous surveillance with radiation monitoring of the containment and surrounding areas in accord with regulatory standards; and
- periodic measurements and checks to ensure the adequate operation of the contamination control systems.

Stage 2 Restricted Site Release

- reactor defuelled and fuel moved away from reactor;
- all heat transfer fluids, readily removable contaminated materials, and some highly contaminated materials removed;
- contaminated areas decontaminated or if appropriate sealed to prevent unauthorised access;
- containment features remain and augmented where necessary;
- contaminated parts that are easily dismantled are removed and transferred off site or into plant areas that are to be sealed;
- ventilation and other active services are not needed and are deactivated;
- some monitoring equipment remaining operational depending on particular circumstances;
- some parts of the site can be released for new uses or released, with constraints in accordance with appropriate radiological protection requirements, for uses not involving other radioactivity sources; and
- surveillance in accord with regulatory conditions but less extensive than stage 1, e.g. remote monitoring equipment with periodic physical checks.

Stage 3 Unrestricted Site Use

- reactor defuelled and fuel moved away from reactor;
- all heat transfer fluids removed;
- all materials, equipment and structures in which radioactivity exists above prescribed limits are removed to an approved storage or disposal site;
- in all remaining plant areas, the radioactivity levels will have been reduced to those which permit unrestricted access;
- the site and any remaining equipment and materials may be released for other purposes, without radiological protection restrictions; and

- no further surveillance, inspection or tests are necessary.

86. The IAEA document (reference 13) states that variations can exist on these three main stages, including decommissioning different parts of the same facility to different stages. The BE chosen strategy loosely follows the three stage process with some variation on stages.

87. NII has examined the optioneering process which BE has undertaken as a measure of the scope of BE's consideration of all reasonable options for decommissioning its reactors. During the process of reviewing, BE was asked to provide a number of historical documents which served to demonstrate the evolution of BE's consideration of options through its predecessor companies including the Central Electricity Generating Board (CEGB). Most of the options considered are variants of the three stage decommissioning process described in the IAEA literature on nuclear power station decommissioning. In making its final choice of strategy, BE has been mindful of the historical process which has eliminated some options which were given early consideration. The final choice has been reached using a multi-attribute decision analysis technique (MADA) which established the 'early safe store' option as the preferred strategy. The process allows any emergent decommissioning options to be compared through review and BE has stated that some variants in dismantling technique have been considered through this process. The analysis undertaken represents a variation of what may now be termed a BPEO study. The scope of the study was limited, addressing only one sample individual AGR (Heysham 2) and only one safestore duration (135 years after end of generation). The decision making process was dominated by calculated values of cost and individual risk. Whilst the option study was undertaken in the early 1990's, BE reviewed its conclusions in 1999. The review did not reveal the need for any significant variation in the chosen option. The original MADA itself provides only limited evidence that BE has selected the optimal strategy for decommissioning its stations.

88. The BE Board of Management has endorsed the AGR early safestore strategy initially with deferred stage three dismantling at 135 years and more recently at 'no less than 85 years'. BE's proposals for the timing of final dismantling are considered to be reasonable on the basis of the information presented by BE, but with the following proviso. NII will be seeking further evidence from BE on justification for the timing of final dismantling in the period before the next quinquennial review.

89 With respect to the PWR station at the Sizewell site, NII considers that the case for deferred dismantling for 50 years needs to be re-examined in the light of world experience and consideration of Sizewell plant data. Should examination of the data lead to a shortening of the deferment of stage 3 decommissioning, as NII expects, the current safestore PWR decommissioning strategy may be inappropriate.

Decommissioning experience

90. BE recognises that it needs to take account of other organisations' experience in decommissioning. It is known that BE's proposals for delays prior to final dismantling are significantly longer than those for other non-UK gas cooled reactors. The delays in the final dismantling of those reactors range from prompt decommissioning to 30 - 40 years for the French gas cooled reactors. The decommissioning of the High Temperature Reactor in Fort St Vrain in the USA begun in 1990 has been completed broadly to plan. This demonstrates that prompt final dismantling of a gas-cooled reactor is feasible. It is noted that the conditions pertaining to Fort St Vrain are considerably different to those in UK AGR reactors.

91. Given that the BE generic strategy is based predominantly on decommissioning techniques developed prior to the 1990's, work is required to show that the strategies are still based on the 'best engineering principles'. BNFL Magnox is currently decommissioning a number of its reactors. As such the techniques that are required for decommissioning are in the process of demonstration and improvements based upon experience are emerging. BE is monitoring the decommissioning experience closely. NII expects that BE will learn lessons from decommissioning at other licensees' sites world wide and that it will incorporate these lessons into the revised Pre-Decommissioning Plans which it has committed to produce. It should be noted that if experiences in decommissioning other reactors demonstrate that earlier final dismantling is reasonably practicable, there may be a consequence to the funding requirements of the segregated fund if BE's timescales are brought forward.

Climate and coastal change

92. The effects of climate change are of increasing concern, particularly when decommissioning strategies extend over the period proposed by BE. At each of its sites, BE needs to identify and address the key climate variables on which decisions about decommissioning are sensitive. The completion of climate change studies should be based upon the draft decision framework issued by the Environment Agency (reference 26). It is recommended that scenarios for sea level and rainfall are taken from UKCIP 98 (or its successors). These scenarios need to be augmented by the effects of so-called 'climate surprises' (eg reduction/reversal of the thermo-haline circulation of the North Atlantic, or the melting of the West Antarctic ice sheet).

93. BE has previously considered the effects of coastal change on the long-term viability of its sites. Coastal change has a number of potential impacts on a decommissioning strategy. These impacts need to be considered in the light of regional approaches to flood defence and developing understanding of climate change. The timescales for the proposed safestore structure are sufficiently long for coastal change to become a potential issue notably at Dungeness, Sizewell and Hartlepool. The effects of coastal change may not have a bearing on the selection of the early safestore as BE's strategy for decommissioning. Rather they are likely to have an impact on the detailed

measures required to keep the site in a satisfactory state, particularly during the care and maintenance period. Nevertheless, BE will need to be mindful of the effects of climate change on its choice of strategies. BE makes provision for the coastal management of one site currently affected by coastal change and continues to monitor the situation at its remaining sites.

94. The understanding of the nature of the problem by BE has not advanced sufficiently to make detailed predictions on individual sites. BE has commissioned work to build an understanding of the long-term morphological change at each of its affected sites. Clearly, the impact will depend upon the ongoing national policy for sea/flood defences. The cost implication related to coastal change is therefore undefined and is unable at this time to be fully reflected in the provisions made by BE into the segregated fund.

Contaminated land

95. NII is generally satisfied that BE has appropriate experience and arrangements in place to predict the nature of work to be undertaken in those facilities which BE has identified as requiring attention. However there are potential liabilities which may exist due to contamination of land or groundwater at some of BE's sites. This may be chemical or radiological contamination or both. Where such contamination is discovered, BE may propose to leave it in situ until final decommissioning. In this case BE will need to identify the means by which this could be controlled and monitored during the safestore period. In cases where the contamination is potentially mobile or its off-site migration may cause harm, remediation of the site or contaminated land needs to be undertaken without delay. As part of its plans to deal with contaminated land, BE should consider, before the next quinquennial review, its requirements for new or existing facilities to either store or dispose of soil excavated during remediation work.

96. Whilst BE has not explicitly dealt with the contaminated land issue, it has noted that it will be necessary to confirm the status of HADVs during the safestore period. This will require some monitoring of the ground conditions around the safestore. NII expects that the monitoring regime proposed in this area will, in whole or in part, serve to address the issue. Nevertheless NII will expect to see the issue more formally addressed at the next quinquennial review.

Records Management

97. BE's strategy for safestore assumes that future generations will be able to undertake the final stages of decommissioning. It is therefore incumbent upon BE to ensure that those charged with decommissioning activities will have sufficient information to enable them to carry out the operations required in full knowledge of the project. As such BE has recognised that it will be necessary to preserve selected records and that

these will require maintenance to ensure that deterioration of the records is managed and that they retain compatibility with contemporaneous technology.

98. While NII notes that BE has given some consideration to the need to keep records, NII believes that BE needs to start to address how to deal with such issues as:

- what records need to be kept;
- what minimum level of documentation is required during safestore;
- how to compile accurate historic records;
- archiving and retrieving records from archives;
- working documents and their updating;
- records for historic/potential litigation; and
- impact of future technology.

NII will expect these issues to be addressed in the period up to the next QQR and will be examining the progress as part of its normal regulatory business.

Costings

99. Although costings of decommissioning activities have been difficult to assess accurately, the procedures used by BE to generate costs are fully auditable. NII has costed some areas of the work to be undertaken from its own knowledge and has concluded that there is good agreement with the costs calculated by BE. The timing of spending has changed since the costs were generated (early 1990's) and, although the costs have been escalated, there is a need to revalidate their basis. The costing of the care and maintenance activities during the safestore period may have been underestimated but these are not a large contributor to the overall costings.

Resources

100. The site specific documentation that BE has produced, such as the pre-decommissioning plans and their source data, is out of date. There is no definition of the document process by which BE proposes to control the transition from operating plant to decommissioning plant. BE needs to propose such arrangements and, in particular, demonstrate the way in which it will comply with licence conditions, document updates, document records, document preparation and the timing of

submissions prior to the start of decommissioning. A generic programme for these matters should be generated.

101. NII considers that resources need to be increased and sustained if BE is to meet its declared timescales for decommissioning. This review suggests that until recently BE has underestimated the level of resource required to complete its programme in a timely manner. It will be necessary for BE to ensure that resources are provided, that good use is made of experienced personnel, adequate records are made and maintained and that relevant practical decommissioning experience is fed back into this process.

4. THE FINANCIAL REVIEW

Aims and objectives

102. The general aim of the financial review has been to consider whether BE has made adequate arrangements for financial provisions to meet its long term nuclear liabilities in line with Cm 2919. This report provides an overview of the NII's consideration of the process and arrangements made by BE for funding decommissioning and waste management liabilities associated with prescribed activities at its nuclear licensed sites. The report:

- explains the basis of the review and how NII has gone about it;
- describes the licensee's arrangements and process; and
- presents conclusions and recommendations

Background

103. BE funds its liabilities from two sources:

- early liabilities via provisions in its accounts; and
- long term liabilities via a segregated fund managed by independent trustees.

Topic areas reviewed

104. HSE is not responsible for carrying out work directly to satisfy itself on the adequacy of provisions and on the reliability of the internal financial and business controls. That is a matter for the BE Board, in conjunction with the company's auditors and

financial advisers. Consequently NII's assessment of the financial aspects of the licensees' decommissioning strategy is limited to an examination of whether:

- there is an adequate process for establishing the costs of decommissioning activities;
- the costs are compatible with the totality of the work that needs to be done;
- underlying technical and corporate assumptions are prudent;
- any discount rate used is appropriate;
- funding to meet the output of the above process has been allocated and is being appropriately managed;
- funding will be available when required to meet the decommissioning strategy timetable;
- there is some flexibility to cope with decommissioning on shorter timescales should this become necessary; and
- the arrangements are subject to adequate auditing.

105. BE's formal submission for the quinquennial review by NII of its decommissioning strategy consisted of three documents (see Paragraph 42 and references 10,11 & 18). Each of these documents refers to arrangements for decommissioning and provisioning, and the distinction to be made between costs to be funded by the Nuclear Decommissioning Fund (see paragraph 134), and by BE.

106 BE's submission makes a number of generalised statements about costing and provisioning for decommissioning. There is some information in the BE Group leaflet – 'Decommissioning our Power Stations' (attached) and in the Annual Report and Accounts of the BE Group for the period ended 31 March 2000 (reference 22). These sources were supplemented by documentation available in the data room and related discussions with BE personnel. Consequently this assessment has been undertaken on the basis of examination of that supporting documentation and on the related discussions with BE personnel.

Accounting standards

107. NII has also had regard to the observance of current accounting standards. The main statutory requirements on accounting for provisions and contingencies are set out in Schedules 4 and 4A of the Companies Act 1985 (reference 20). Paragraph 12(b) of Schedule 4 states the general requirement that "all liabilities and losses which have arisen or are likely to arise in respect of the financial year to which the accounts relate or a previous financial year shall be taken into account…". Provisions are one means by which this general requirement is met, and they are defined in paragraph 89 of Schedule 4 as follows:

> "References to provisions for liabilities or charges are to any amount retained as reasonably necessary for the purposes of providing for any liability or loss which is either likely to be incurred, or certain to be incurred but uncertain as to amount or as to the date on which it will arise."

108. In terms of current accounting standards, Financial Reporting Standard 12 (FRS12) requires companies to make provision to cover liabilities, which are of uncertain timing or amount, a description that encompasses nuclear decommissioning, and waste management liabilities. The need to recognise a provision will arise if:

- there is a present obligation;
- it is probable that a transfer of economic benefits will be required; and
- if a reliable estimate of the amount can be made.

If a reliable estimate cannot be made then the circumstances should be disclosed as a contingent liability.

Findings

Establishing BE's base costs/uncertainties

109. The costings for the safestore strategy for the AGR nuclear power stations are largely based on engineering cost estimates generated in the early 1990s. These comprised thorough engineering assessment and quantity surveying exercises which set out the activities required to decommission each site, identify and quantify the materials to be removed, and attach staff and other costs. BE has also been able to draw on experience from the decommissioning activities already undertaken elsewhere, e.g. at Berkeley and Trawsfynydd.

110. The engineering studies were originally undertaken to inform the development and provisioning of the 'deferred safestore' strategy, and the figures are now being deployed to underpin the current, ‘early safestore’ strategy. This is possible because the base costings relate to a detailed analysis of individual activities that are required to be completed at some stage during the whole decommissioning programme. Hence they can be used as building blocks in calculating the cash flows associated with a variety of sequences and timescales.

111. Costs for Sizewell ‘B’ decommissioning are based both on station-specific engineering studies (dating from 1995/96) and also on extrapolation of AGR studies where this is appropriate.

112. The base costings include 3% for administrative overhead costs.

Costing issues

113. The fact that some of the base costs used by BE are now approaching 10 years old gives rise for concern on two counts:

i) Although no radically new relevant technologies have been introduced since the engineering studies were undertaken, it seems likely that working methods, plant and equipment will have advanced incrementally over the period. Consequently the studies may no longer fully reflect contemporary productivity levels.

ii) The original costings are enhanced from time to time by an escalation factor in order to bring them to current prices. Whilst this is an entirely reasonable approach to updating prices over the short term it may be prone to an increasing margin of error as time elapses. This is because the repeated application of an uprating factor to an estimate, which contains an element for contingency, and then the application of a risk margin (in effect, the multiplying of assumptions) is likely to compound any relatively small errors (either favourable or adverse to the company) inevitably included in the original assumptions.

114. There is a need for the base data to be updated systematically to ensure that both the licensee and other stakeholders can have confidence in its currency. BE needs to consider what its policy should be in this regard, given that increasing amounts of information are becoming available on the actual costs of dealing with those stations already in decommissioning and that decommissioning strategies are to be reviewed quinquennially. This may be undertaken in parallel with the update of the pre-decommissioning plans noted earlier in this report.

115. One issue which has yet to be resolved is whether the surveillance period should be unmanned, as BE proposes, or whether it will be necessary to have a permanent security presence on each site. BE has recognised this risk and has assessed it as 50% technical, which is counted for in provisions, and 50% regulatory, which is not, i.e. BE has based assessment on the current regulatory system and has not attempted to 'second guess' any future changes to legislation. Figures provided by BE indicate that a risk margin of almost 46% has been applied to the base cost plus contingency for the surveillance period.

116. The strategy submission does not deal in any detail with the arrangements for ensuring that the necessary staff competencies and corporate knowledge are retained over the whole of the decommissioning programme. This is a particular concern given the extended period between the end of operations on the site and the start of stage 3 decommissioning; there will certainly need to be a significant training and development programme to ensure that decommissioning is executed safely and efficiently. These factors are reflected to some extent in the on cost for overheads, which is included in the costings, but there is not enough information to provide confidence that the scale and scope of this task is adequately recognised.

Contingency allowance and risk margin

117. Contingency is applied to base cost estimates at the activity level, to reflect the uncertainty of the cost estimates in the proposed strategy (i.e. in-model uncertainties). This allowance is intended to accommodate estimating inaccuracies, including minor omissions and undercounts, and minor unforeseen problems. Individual estimates are assigned to contingency bands to reflect the confidence that is felt in an individual cost estimate. It is the person/team responsible for producing the estimate that determines which contingency band is appropriate, since they have the greatest insight into the provenance and reliability of the estimate. Aggregate cost is then determined by adding upper bound costs together.

118. Risk margin is an allowance added to base-cost-plus-contingency values at the stage cost level to account for out of model uncertainties, for example finding unexpected radioactivity during decommissioning operations or accommodating a somewhat different solution from that originally envisaged. BE has indicated that it has undertaken a rigorous approach to the derivation of risk margins tailored to individual stage costings, according to detailed registers of risks considered.

119. It was noted that BE's values for contingency and risk margin are substantially lower than those adopted by the licensees' main comparator in costing its own liabilities. Across the aggregate costs of defuelling and decommissioning the allowances for uncertainties applied by BE appear to be less than half of the enhancements used by others. It is not clear at this stage whether these differences in corporate assumptions:

a) reflect real differences in the levels of confidence with which base costs should be viewed;

b) are due to the adoption of particularly conservative assumptions by others;

c) are due to the adoption of optimistic assumptions by BE; or

d) arise from a combination of the above.

NII believes that these differences require further examination in the period before the next quinquennial review.

Contaminated land

120. Contaminated land is a particular case in point. The licensees' commercial risk review identified unexpected radioactivity as a potential risk at all stages of the decommissioning process and assigned allowances to cover the potential liability. However, the monetary values resulting from the approach adopted by BE seem low. BE should progress its studies to achieve a better understanding of contaminated land liabilities for the next quinquennial review.

BE's corporate assumptions - station lifetimes

121. Under a condition attached to the standard nuclear site licence the operators of nuclear power plant are required to carry out periodic safety reviews (PSRs). PSRs are undertaken every 10 years and are complementary to day-to-day regulatory controls. The PSRs are assessed by NII and, depending upon the results of that assessment, the regulator may require the licensee to undertake a specified programme of safety related improvements. NII is unable to predict the operational lifetime of a station on the basis of a PSR. However, NII will indicate whether it expects a station to be able to operate safely until its next PSR, subject to continuing satisfactory results from the routine monitoring and demonstrations of safety required under the current licence conditions.

122. The prospectus for the BE share offer was issued in June 1996 (reference 21). It included a statement of the station lifetimes, which were adopted for accounting purposes. Those projected lifetimes reflected BE's contemporary assessment of potential life limiting factors and independent engineering assessments. They were a factor in formulating the arrangements for the segregated fund. Subsequently BE has extended by five years the accounting lifetimes of four of the stations, Hinkley Point 'B', Hunterston 'B', Heysham 2 and Torness. [Subsequent to the quinquennial review, BE has similarly extended the accounting lifetimes for Heysham 1 and Hartlepool]. BE has justified this on the basis of a full engineering assessment of the factors which may affect extended operation, and a financial

assessment with regard to the cost benefits, eg investing in new ancillary plant to support lifetime extension.

123. The lifetime extension engineering programme is subject to an independent technical audit by NNC and an internal audit by British Energy's Business Review and Audit Department (BRAD). The audits aim to identify whether the conclusions reached in the engineering assessment were consistent with achieving the lifetime criteria and the extent to which uncertainties or margins impacted on reaching the criteria. The independent audits were performed separately for each station subject to lifetime extension proposals, and their terms of reference were to consider whether:

- robust safety/economic issues had been assessed;
- the approach followed was sound;
- there were any omissions;
- the conclusions were supportable; and
- the conclusions would be valid for the expected future operational regime.

124. Since the assets representing these stations will be depreciated over a longer period there is an immediate positive effect on the BE Group balance sheet. In addition, in relation to decommissioning, the effect is to:

- delay the commencement of decommissioning by 5 years, with a knock on effect on the timing of later stages. Deferment of the associated cash flows means that the net present cost (NPC) of the programme will be reduced; and
- extend the period over which provisions can be accumulated.

125. The extension of accounting lifetimes is not in itself a safety issue and, given its policy on Periodic Safety Reviews, NII has not examined the basis on which the station accounting lifetimes have been extended. Consequently NII offers no opinion on this matter.

Timing of decommissioning and associated risk

126. BE's strategy for the AGRs embodies the concept of deferring dismantling of the safestore until at least 85 years after the end of generation (EoG). However BE has

recognised that it may be necessary to commence dismantling sooner, and has provisioned on the basis of a deferral period of 70 years only. Likewise for the Sizewell PWR, whilst BE's strategy is to defer dismantling for 50 years after EoG, it is actually provisioned on a 10 year deferral period.

127. It is BE's position that it is inappropriate to make any other allowance for timing risk. BE asserts that by convention of the relevant UK accounting standards it is not necessary to make any provision against possible future changes in legislation and that therefore, by analogy, it is not necessary to make provisions for any changes in nuclear regulation. Whilst legislation may change, it seems unlikely that considerations such as public perception and intergenerational equity would accommodate any relaxation in regulatory standards. However BE acknowledges that any increase in cost due to an enforced shortening of the safestore period would have to be funded by the licensees. NII also notes that the stated objectives of the segregated fund (see paragraph 135 of this report) include a target of accumulating assets with a value equal to 110% of the accrued discounted liabilities, and BE's contributions to the fund cannot be reduced until more than 220% of the target value has been accumulated. This may give rise to assets greater than liabilities, that, if achieved, might be regarded as offsetting the timing risk to some extent.

Discount rate and cash flow modelling used by the licensees

128. Discounting is the process of comparing quantities which are distributed over time by converting them to a present value. In this context the effect of using a discount rate is to reduce the value of a projected future cost or benefit to its value as seen from the present day. Since the licensees' projected cash flows include a risk margin it is appropriate for them to use a risk-free real rate of interest applying to debt with long-term maturity, e.g. a government bond rate. On this basis the licensees' chosen discount rate of 3% appears to be soundly based.

Cash flow modelling

129. The licensees provided financial information to NII in support of their current provisioning strategy. During the course of the review NII asked BE for sight of comparative data showing the effect on the net present cost of decommissioning the AGR fleet on earlier timescales. This information was not forthcoming and BE has subsequently confirmed that the licensees have done no formal modelling of other timescales. In the absence of soundly based costings BE will not have been able to evaluate properly the relative merits of the case for earlier decommissioning. To that extent the strength of the case for the chosen deferral period could be demonstrated more robustly.

Decommissioning liabilities on BNFL sites

130. The BE Sale prospectus (reference 22) noted (pages 164 and 171) that both BEGL and BEG(UK)L had contractual arrangements with BNFL which included contributions towards the cost of decommissioning certain of the latter's facilities. BE has confirmed that these arrangements remain in place and that the contracted payments will run until 2073. BE's liability is fixed.

Spent fuel management and radioactive waste management costs

131. Although the management of spent fuel and radioactive waste is outwith the scope of BE's decommissioning strategy, NII does have an interest in the extent to which, taken together, the nuclear site licensees recognise and provide for the costs of meeting the totality of the UK's decommissioning and waste management liabilities. Otherwise there is a risk that some liabilities may not be adequately funded, with potentially adverse consequences for safety, health and the environment.

132. In the run up to privatisation there was some debate about the agreed scope of the Nuclear Decommissioning Fund. It was concluded that it should exclude all fuel-related liabilities. The Department of Trade and Industry (DTI) and BE considered that these costs, and the defuelling and waste management costs related to the final charge of fuel were, or would be, largely contracted for under normal commercial arrangements and should be met out of operating resources. The directors of the company gave undertakings in the sale prospectus that they would establish appropriate provisioning and financial policies to meet these costs and that there would in due course be sufficient investments in place to provide the necessary funding.

133. The responsibility for funding the reprocessing and disposal of spent fuel and operational wastes clearly rests with BE. However there is a concern that if the licensees are unable, through insolvency, liquidation or other adverse circumstances to meet future commitments, then those commitments would have to be borne by Government. The National Audit Office (NAO) report (reference 24) on 'The Sale of British Energy' examined in some detail the DTI's decision that fuel-related liabilities should be excluded from the segregated fund. The NAO noted the risk that such liabilities could fall to the taxpayer and recommended (at paragraph 17(a)) that the department should ascertain and make clear how they intend to keep any residual risk under review….". On the basis of that report, NII understands that the Department of Trade and Industry will be reviewing these risks and it is inappropriate for NII to consider them here.

Provisioning - segregated fund

134. In the Government's "Review of Radioactive Waste Policy Cm.2919" (reference 1) it was stated that, "The Government believes that it is right that, for those parts of the industry which are privatised, segregated funds for decommissioning should be established". In response the Nuclear Generation Decommissioning Fund Limited was set up at privatisation. It is an independent company owned by the Nuclear Trust and operating within the Nuclear Decommissioning Agreement (reference 23). The Nuclear Trust is a charitable trust governed by a Trust Deed; three independent trustees are appointed by the Secretary of State for Trade and Industry and two by BE. However the licensees continue to retain full financial and operational responsibility for decommissioning their stations.

135. The objectives of the fund are to accumulate sufficient assets at least to meet the decommissioning liabilities as defined in the Nuclear Decommissioning Agreement (NDA), and to have as a target the accumulation of assets with a value equal to 110% of the accrued discounted liabilities. The Fund will make payments to meet the costs of decommissioning until such time as all the stations have been fully decommissioned. The NDA specifically excludes:

"(a) the post operational clean out of a station by the removal of fuel and radioactive materials from a reactor to the extent practicable by the operations team utilising the installed plant and equipment and

(b) undertaking Waste Management in relation thereto;"

It may, however, extend to any fuel storage activities that in future fall within the decommissioning strategy as adopted by BE's Board of Management.

136. The Fund was created in 1996 with an initial endowment. The Fund has since been receiving quarterly contributions from BE. These are adjusted each year in accordance with the Retail Prices Index but will reduce in time as each station ceases to be operational. Subject to any adjustment resulting from the Fund's prescribed quinquennial review process (see paragraph 140), these will remain payable in accordance with the terms of the NDA until 2018 in the case of BEG(UK)L and 2035 in the case of BEGL.

137. The segregated fund arrangements were thoroughly assessed at the time of privatisation (by DTI & advisers, NII & advisers, NAO & advisers, & Treasury counsel, see Part 1 NAO report 694 (reference 24)). All concluded that the arrangements were fit for purpose and robust. Given that only two years have elapsed since the publication of the NAO report, NII has concluded that it would be inappropriate to revisit that assessment as part of this quinquennial review. Instead the NII's review has been confined to assuring itself that:

- The arrangements set out in the NDA are working as intended; and

- The Fund is achieving rates of return that give confidence that the investment assumptions, underlying the calculation of the initial endowment and ongoing contributions are soundly based.

138. The initial endowment and annual contributions to the fund were derived by actuaries, taking account of the amount and timing of decommissioning costs, the period until station closures, and assumed average real, post tax rates of return for the Fund's investments. When the NAO examined the sale of British Energy it engaged a firm of actuaries to advise on the investment management aspects of the Nuclear Decommissioning Fund. The NAO's actuaries considered that for the purposes of budgeting British Energy's annual contributions and in the context of the investment strategy, the assumed rates of return were reasonable and without significant pessimism or optimism.

139. Investment policy forms part of the Decommissioning Agreement and dictates what investments may be made by the Fund. The policy may only be changed with the agreement of BE and the Fund. The investments held determine the risk profile of the fund and the expected returns and the large proportion currently held in equities takes account of the inflation risk inherent in the liability timescale. Current policy is to hold 80% of investments in equities (50% UK and 30% overseas), 10% in Index Linked Gilts and 10% in property. Investments are held in passively managed portfolios (with the exception of property) and performance is measured against appropriate market indices. Recognising that different asset classes will grow at different rates, the investment policy provides for automatic rebalancing if target holdings are out of balance. Following station closure it is assumed that the proportion held in Index Linked Gilts will be increased as liabilities fall due for payment.

140. The Trustees are required to undertake quinquennial reviews of the segregated fund to determine whether its assets will be sufficient to meet the decommissioning liabilities, in accordance with the NDA. The first of these reviews is due to be completed by 31 October 2001 and it will enable a determination to be made as to whether any change to the contributions made by the licensees is appropriate. In conducting their review the Trustees will be supported by technical and financial advisers, and they will have regard to the outcomes of HSE's assessment of the licensees' decommissioning strategy. Reviews may also be instituted outside the five-year cycle in the event of a material change in circumstances.

141. The NDA sets parameters limiting the freedom with which contribution rates may be changed. If the actuarially assessed value of the assets of the fund company is within the range of 90% to 220% of the then accrued discounted decommissioning liabilities in respect of all the BE stations no adjustment will be made to the contribution rate, other than the indexation increase. If the fund company value lies

above that range there is a mechanism for reducing the payments by the licensees and, potentially, for them to receive a refund.

142. In accounting terms a decommissioning liability is created in full at the beginning of the station's operational life. The financing option agreed at the time of privatisation, which led to the creation of the segregated fund is based on partial endowment with ongoing contributions during the anticipated reactor lifetimes. This results in a funding gap, i.e. at any given moment there is a difference between the value of the Fund's investments and the discounted decommissioning liabilities.

143. At 31 March 2000 the liabilities in the scope of the segregated fund stood at approximately double the value of the Fund. The intention underlying the NDA is that the licensees' ongoing contributions and the returns on the Fund's investment should close the funding gap by the time the last power station ceases to operate in 2035.

Liabilities not covered by the segregated fund

144. BE acknowledges that it is responsible for funding any decommissioning liabilities which lie outwith the segregated fund, for which the fund does not provide adequate cover. This obligation was reflected in the BE Share Sale prospectus and BE remains committed to it.

Audit of BE's decommissioning funds

145. BE's report and accounts for the period to 31 March 2000 (reference 22) were audited by PriceWaterhouseCoopers. The auditor’s endorsement of the accounts confirms that the audit included:

- Examination, on a test basis, of evidence related to the amounts and disclosures in the financial statements;
- Assessment of the significant estimates and judgements made by the directors in the preparation of the financial statements; and
- Assessment of whether the accounting policies were appropriate to the company's circumstances, consistently applied and adequately controlled.

The auditors concluded that the financial statements gave a true and fair reflection of the state of affairs of the company.

146. The annual report and accounts for the Nuclear Generation Decommissioning Fund Limited for the period to 31 March 2000 (reference 25) were audited by Deloitte and Touche, with the same outcome.

5. CONCLUSIONS

Technical Aspects

T1 NII regards the strategy proposed by BE for decommissioning its power stations which envisages a three stage process, to be appropriate at this time. It is consistent with both national and international guidance and is flexible enough to be able to accommodate lessons learned during decommissioning of other licensees' sites.

T2 Government policy is that, in general the process of decommissioning nuclear plant should be undertaken as soon as it is reasonably practicable to do so, taking account of all relevant factors. At this time, the technical aspects of BE's decommissioning proposals are considered to be practicable, feasible and realistic. In addition, at this time on the basis of information presented, and with the provisos stated below, the proposals for the timing of final dismantling are considered to be reasonable. However, NII will be seeking further evidence from BE on justification for the timing of final dismantling in the period before the next quinquennial review. Following this initial quinquennial review, NII will continue to take account of any developments in decommissioning experience and/or advances in technology since the previous review.

T3 BE's management plan for decommissioning and its plan for implementation need further development. Although NII would not expect these plans to be fully developed at this time, NII would expect progressively more details in the plans as the end of generation and the start of decommissioning approaches.

T4 The decommissioning proposals for the Sizewell PWR are less well developed than those for the BE AGR fleet. This is not unreasonable, as decommissioning is not planned for another 35 years. Decommissioning plans for Sizewell 'B' will be regularly monitored by NII as part of the quinquennial review process. NII notes world practice on early decommissioning of PWR reactors and that BE's provisioning is based essentially on following that practice. Should BE wish to defer dismantling beyond 10 years from end of generation, it will need to present considerably more evidence.

Financial Aspects

F1 BE has a soundly based process for establishing the cost of decommissioning but some of the base costings are now rather dated. BE has not provided comparative costs

for final dismantling on shorter timescales. NII believes that although the basis on which BE has developed the costings of its decommissioning liabilities appears reasonable, there are areas in which the financial case needs updating and developing. NII expects BE to have revised its costing base by the time of the next quinquennial review.

F2 BE has enhanced its base costings to reflect in-model and out-of-model uncertainties via the use, respectively, of contingency allowance and risk margin. NII notes that the values resulting from this process are significantly different from those employed by BE's main comparator, and believes that the reasons underlying those differences need to be examined further in the period before the next quinquennial review.

F3 The decommissioning cash flows and the opportunity to accumulate matching funds are both driven to some extent by BE's assumption on accounting lifetimes of the stations. Some of these have recently been extended and go beyond the scope of the arrangements for periodic review. NII has not examined the basis on which the station accounting lifetimes have been extended. NII will continue to review safety aspects of BE's proposals for station lifetime independently of financial matters.

F4 BE's chosen discount rate is within the bounds of NII expectations.

F5 The decommissioning programme assumes that the final dismantling of the first station will be deferred until at least 85 years after the end of generation (50 years for PWR). However, the Group has provisioned on the basis of a deferral period of only 70 years (10 years for PWR), and argue that this approach adequately deals with the issue of timing risk. Hence, its arrangements do not feature any additional risk margin to cope with decommissioning on a shorter timescale.

F6 The segregated fund arrangements were thoroughly considered at the time of privatisation by the Department of Trade and Industry and others, including the National Audit Office, and found to be robust. It would be inappropriate for NII to revisit that work and hence this assessment has been confined to examining whether the arrangements are working as intended and that the Fund is achieving rates of return which give confidence that the investment assumptions underlying the calculation of the initial endowment and ongoing contributions are soundly based. This appears to be the case at present, pending the outcome of the first of the Trustee's quinquennial reviews of the Fund.

F7 The National Audit Office report 694, (reference 25), noted that there remained a residual risk that some of BE's nuclear liabilities, particularly those relating to spent fuel management and waste management, could fall to the taxpayer in certain circumstances. On the basis of that report, NII understands that the Department of Trade and Industry will be reviewing these risks and it is inappropriate for NII to consider them here.

References

1. Department of the Environment *Review of radioactive waste management policy: Final conclusions* Cm 2919 HMSO 1995 ISBN 0 10 1291922

2. *Nuclear Installations (as amended) Act* 1965 HMSO ISBN 1 10 8502163

3. *Health and Safety at Work etc Act* 1974 HMSO 1974 ISBN 0 10 543774 3

4. Health and Safety Executive *Nuclear site licences under the Nuclear Installations Act 1965 (as amended): Notes for Applicants* HSE Books 1994 ISBN 0 7176 0795X

5. *Radioactive Substances Act* 1993 HMSO 1993 ISBN 0 10 541293 7

6. *The Sintra Statement* by environment ministers from the member countries of the OSPAR Commission for the protection of the Marine Environment in the North East Atlantic, Sintra, near Lisbon, Portugal 22 - 23 July 1998

7. OSPAR *Strategy with regard to Radioactive Substances*. Paper No 1998/17, Ministerial Meeting of the OSPAR Commission, Sintra, Portugal 22-23 July 1998

8. House of Lords Select Committee on Science and Technology *Management of nuclear waste 3rd report* HMSO 1999 ISBN 0 10 404199 4

9. *Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations* 1999 Statutory Instrument 1999 No. 2892 HMSO ISBN 0 11 085395

10. *Corporate Decommissioning Strategy* British Energy Generation Limited/British Energy Generation (UK) Limited E/REP/GEN/0004/00

11. *Decommissioning Plan - Early Safestore - Implementation of the Corporate Decommissioning Strategy.* British Energy Generation Limited/British Energy Generation (UK) Limited E/REP/GEN/0005/00

12. Bacon, M *HSE policy on decommissioning and radioactive waste management at nuclear licensed sites* Nuclear Energy 1997 36 1 13-19

13. International Atomic Energy Agency *Factors relevant to the decommissioning of land based reactor plants* Safety Series 52 IAEA1980 ISBN 92 0 623080 8

14. Nuclear Energy Agency *The Safety of the Nuclear Fuel Cycle* NEA/0ECD 1993 ISBN 92 64 13824 2

15. International Atomic Energy Agency *Principles for the safe management of radioactive waste* Safety Series 111 - F IAEA 1995 ISBN 92 0 103595 0

16. International Atomic Energy Agency *Regulatory process of the decommissioning of nuclear facilities* Safety Series 105 IAEA ISBN 92 0 123690 5

17. Department of the Environment Sustainable development the UK strategy Cm 2426 *HMSO* 1994 *ISBN 0* 10 *124262 X*

18 *Corporate Arrangements for the Management of Decommissioning* British Energy Generation Limited/British Energy Generation (UK) Limited E/REP/GEN/0035/ 00

19. *Safety Health and Environment Annual Report* 1999 British Energy Generation Limited/British Energy Generation (UK) Limited 50

20. *Companies Act 1985* HMSO 1985 ISBN 0105406856

21. *British Energy Share Offer Prospectus* British Energy 26 June 1996

22. *BE Report and Accounts for the period ended 31 March 2000*

23. *Nuclear Decommissioning Agreement – Allen & Overy London C2 : 76891.1 29 March 1996*

24. *National Audit Office Report - The Sale of British Energy* HMSO 1998 ISBN 0102954984

25. *Nuclear Generation Decommissioning Fund Limited – Report and Accounts for the period ended 31 March 2000*

26. *Climate Adaption and Risk Uncertainty*: Draft Decision Framework *Environment Agency National Centre for Risk Assessment and Options Appraisal:* Report No. 21 June 20000

GLOSSARY OF TERMS AND ABBREVIATIONS

AETP	Active Effluent Treatment Plant
AGR	Advanced Gas Cooled Reactor
ALARP	As Low As Reasonably Practical
Alpha	Ionising radiation consisting of specific particles emitted during some nuclear transformations
BE	British Energy plc
BEGL	British Energy Generation Limited (operator of BE's power stations in England)
BEG(UK)L	British Energy Generation (UK) Limited (operator of BE's power stations in Scotland)
Beta	Ionising radiation consisting of electrons emitted from an atomic nucleus
CDG	Civil Design Group: BE's internal civil engineering experts currently based at Peel Park, East Kilbride
CEGB	Central Electricity Generating Board
EoG	End of Generation
Gamma	Nuclear generated electromagnetic radiation
Gbq	A unit of radioactivity: one giga Becquerel is 10^9 disintegrations per second
HADV	Highly Active Debris Vault
HLW	High Level Waste: radioactive waste whose temperature may rise significantly as a result of its radioactive decay
HSE	Health and Safety Executive
HSW74	Health and Safety at Work Act 1974
IFD	Irradiated Fuel Dismantling: area where irradiated fuel stringers are dismantled and fuel components removed for disposal in the HADVs
IAEA	International Atomic Energy Agency
ILW	Intermediate Level Waste: waste with radioactivity greater than LLW but the heat it generates is insufficient to affect the design of storage facilities

LLW	Low Level Waste: radioactive waste inappropriate for disposal with ordinary refuse but with a specific activity not greater than 4 GBq/te alpha or 12 GBq/te beta/gamma
Magnox	Nuclear reactors with fuel clad in magnesium – aluminium alloy
MW (e)	Mega Watts (electrical): a measure of electrical power
NDA	Nuclear Decommissioning Agreement
NEA	Nuclear Energy Agency
NIA65	Nuclear Installations Act 1965 (as amended)
NII	Her Majesty's Nuclear Installations Inspectorate
OECD	Organisation for Economic Co-operation and Development
OSPAR	Oslo - Paris (OSPAR) Commission, Contracting Parties to the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic
PCPV	Pre-stressed concrete pressure vessel: reactor pressure vessel which contains tendons used to place the concrete in a compressed state
PDP	Pre-decommissioning plan
PWR	Pressurised Water Reactor
"Safestore"	Stabilisation of a reactor to facilitate an extended delay period before dismantling
Sintra	Sintra, Portugal: The location of the 1998 OSPAR Conference

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